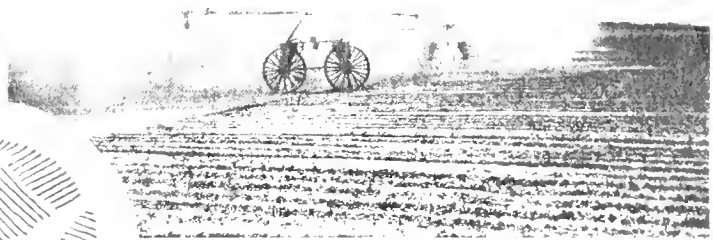
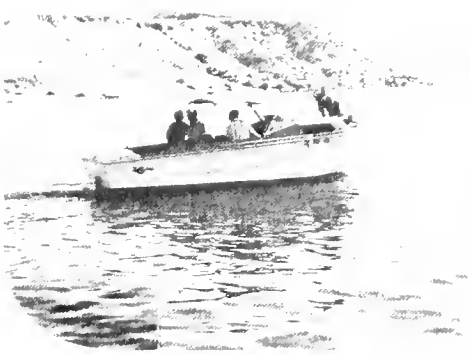
PORT

Volume 3

on the Yellowstone Basin and Adjacent Coal Area LEVEL B STUDY

Clarks Fork - Bighorn





MONTANA

Missouri River Basin Commission
May 1978

mrbc

The Missouri River Basin Commission is the principal agency for the coordination of Federal, State, interstate, local and nongovernmental plans for the development of water and related land resources in the area served by the Missouri River and its tributaries. As an independent regional commission, it also provides a forum in which States meet with Federal agencies to conduct and coordinate water and related land resources planning. The Commission's Chairman is appointed by the President; its Vice-Chairman is elected from among State members.

MRBC members are Colorado; Iowa; Kansas; Minnesota; Missouri; Montana; Nebraska; North Dakota; South Dakota; Wyoming, Department of Agriculture; Department of the Army; Department of Commerce; Department of Energy; Environmental Protection Agency; Department of Health, Education and Welfare, Department of Housing and Urban Development; Department of the Interior; Department of Transportation; Yellowstone River Compact Commission; Big Blue River Compact Administration. Canada is an observer.

General Report

YELLOWSTONE RIVER BASIN AND ADJACENT COAL AREA LEVEL B STUDY

CLARKS FORK-BIGHORN

MONTANA

Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

January 1978

CONTENTS

CHAPTER I

INTRODUCTION

PAGE

Background and Authority I-1

Purpose of the Study I-2

Scope of Study I-5

Organization of Study. I-5

Study Direction I-5

Management Group. I-6

Ad Hoc Group. I-8

State Study Teams I-8

State Involvement I-9

Public Participation. I-9

Interstate and Study Area Planning Coordination. I-10

Study Area Description I-11

Study Area Objectives. I-13

CONTENTS (Cont.)

CHAPTER II

NATURAL RESOURCE BASELINE

PAGE

Description II-1

Area History II-3

Natural Resources II-5

Physiography and Geology II-5

Climate II-8

Soils and Vegetation II-9

Mineral Resources II-11

Land Use II-12

Agricultural II-12

Non-Agricultural II-13

Land Ownership and Administration II-13

Fish and Wildlife Resources II-14

Outdoor Recreation Resources II-14

Water Resources II-15

Water Rights II-15

Yellowstone Moratorium II-16

Federal and Indian Water Rights II-17

Water Rights Litigation II-18

Yellowstone River Compact II-20

Drainage Network II-20

Historical and Depleted Flows II-22

Surface Water Quality II-27

Ground Waters II-29

CONTENTS (Cont.)

CHAPTER III

SOCIOECONOMIC CHARACTERISTICS

	PAGE
Population	III-1
Population Estimates	III-1
American Indians	III-1
Rural and Urban	III-1
Educational Attainment	III-4
Age Distribution	III-4
Income and Income Distribution for Families	III-9
Earnings by Sector and Per Capita Personal Income	III-11
Employment	III-14
Sector Employment	III-14
Unemployment	III-15
Agriculture	III-18
Farm Size and Income	III-18
Crop and Livestock Production	III-21

CONTENTS (Cont.)

CHAPTER IV

PROJECTED REQUIREMENTS

PAGE

Agriculture IV-1

Nonirrigated Cropland IV-2

Irrigated Cropland IV-2

Saline Seeps IV-8

Domestic, Industrial, Non-Energy Mineral, and Livestock Water IV-11

Domestic IV-11

Industry and Non-Energy Minerals IV-12

Livestock IV-13

Flood Control IV-13

Indian Water Requirements IV-15

Instream Flows IV-20

Energy IV-23

Outdoor Recreation IV-23

Projected Recreation Requirements IV-25

Land Conservation IV-26

Fish and Wildlife IV-28

Degradation of Habitat IV-28

Access IV-30

Increase in Resource Use IV-30

CONTENTS (Cont.)

CHAPTER V

FUTURE WITHOUT (F/WO) AND REMAINING NEEDS

Agriculture. V-1

Nonirrigated Cropland V-1

Irrigated Cropland. V-2

Saline Seeps and Irrigated Salinity. V-3

Municipal, Industrial, and Livestock Water V-4

Flood Control. V-4

Indian Water Requirements. V-5

Energy V-5

Outdoor Recreation V-8

Land Conservation. V-8

Fish and Wildlife. V-8

F/WO Impacts on Water Quantity and Quality V-12

Opportunities. V-12

Multipurpose Projects V-12

Single Purpose Projects V-12

Energy. V-13

Land Conservation V-13

Fish and Wildlife V-13

Wild, Scenic, and Recreational Rivers V-13

CONTENTS (Cont.)

CHAPTER VI

PLAN FORMULATION

PAGE

Principles and Standards VI-1

The Four-Account System VI-2

Project Formulation. VI-6

Summary--Clarks Fork-Bighorn Planning Area VI-6

THE NATIONAL ECONOMIC DEVELOPMENT PLAN VI-8

Multipurpose Projects. VI-9

Elbow Creek VI-9

Bluewater-Fivemile Creek. VI-11

Single Purpose Projects. VI-12

Wyola-Lodge Grass Canal VI-12

Long Otter and Gas Field Pump Units VI-12

Hardin Unit VI-13

Energy VI-16

Yellowtail Afterbay Powerplant. VI-16

Land Conservation. VI-17

Accelerated Land Conservation Program VI-17

THE ENVIRONMENTAL QUALITY PLAN VI-22

Fish and Wildlife. VI-23

Instream Flows. VI-23

Beartooth Wilderness Area VI-24

Land Conservation. VI-24

Accelerated Land Conservation Program VI-24

Streambank Greenbelt Program. VI-24

PAGE

Wild, Scenic, and Recreational Rivers. VI-25

Bighorn River VI-25

Clarks Fork River VI-25

CHAPTER VII

THE RECOMMENDED PLAN

PAGE

Selection of Plan Elements VII-1

Hydrology Supplement. VII-2

Display of the Plan. VII-4

CHAPTER VIII

RECOMMENDED PLAN EVALUATION

PAGE

Agriculture. VIII-1

Flood Control. VIII-2

Outdoor Recreation VIII-2

Land Conservation. VIII-3

Fish and Wildlife. VIII-3

Other Functional Areas VIII-3

Cost of the Program. VIII-3

CONTENTS (Cont.)

CHAPTER IX

IMPACTS OF THE RECOMMENDED PLAN

	PAGE
Population	IX-1
Water Consumption	IX-2
Land Use	IX-3
Environment	IX-3
Outdoor Recreation	IX-6
Economic Impacts	IX-6

CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

	PAGE
Conclusions	X-1
Recommendations	X-3
Miscellaneous	X-4
Coal Impacts	X-4
Flood Damage Reduction	X-5
Irrigation and Industrial Development	X-5
Fish and Wildlife	X-5
Domestic and Municipal Water Supply	X-6
Land Conservation	X-6
Water Quality	X-7
General Environment	X-7
Official Comments	X-8

LIST OF TABLES

TABLE		PAGE
II-1	Land and Water Areas by County Clarks Fork-Bighorn, Montana.	II-2
II-2	Division of Waters Under the Yellowstone River Compact. . . .	II-20
II-3	Wyoming's Yellowstone Compact Estimates (Acre-Feet)	II-21
II-4	Clarks Fork River at Edgar - Historical Flow.	II-23
II-5	Clarks Fork River at Edgar - 1975 Depletion Level	II-24
II-6	Bighorn River Near St. Xavier - Historical Flow	II-25
II-7	Bighorn River Near St. Xavier - 1975 Depletion Level.	II-26
III-1	Population Estimates for Clarks Fork-Bighorn, Montana	III-2
III-2	County Population Classified by Race Clarks Fork-Bighorn, Montana: 1960 and 1970.	III-3
III-3	Rural and Urban Populations for Clarks Fork-Bighorn, Montana: 1960 and 1970.	III-5
III-4	Population of Urban Centers of 1,000 or More Persons Clarks Fork-Bighorn, Montana: 1960 and 1970.	III-6
III-5	Years of School Completed by Persons 25 Years of Age and Older, Clarks Fork-Bighorn, Montana: 1970.	III-7
III-6	General Age Distribution of Inhabitants Clarks Fork-Bighorn, Montana.	III-8
III-7	Income and Income Distribution of Families in the Clarks Fork-Bighorn, Montana, and the United States - 1970. .	III-10
III-8	Personal Income and Earnings by Sector, 1970-1974 Clarks Fork-Bighorn, Montana.	III-12
III-9	Percent of Earnings by Sector, 1970-1974, Clarks Fork-Bighorn, Montana.	III-13
III-10	Employment by Type and Broad Industrial Sources Full and Part-Time Wage and Salary Employment Plus Number of Proprietors, Clarks Fork-Bighorn, Montana	III-16
III-11	Average Annual Unemployment Rates, Counties of Clarks Fork-Bighorn, Montana, 1972 through 1975	III-17

LIST OF TABLES (Cont.)

TABLE		PAGE
III-12	Farm Size, Value of Production and Farm Expenses Clarks Fork-Bighorn, Montana.	III-19
III-13	Historical Production of Irrigated and Nonirrigated Crops Clarks Fork-Bighorn, Montana.	III-22
III-14	Historical Acres of Irrigated Crops Harvested Clarks Fork-Bighorn, Montana.	III-23
III-15	Historical Acres of Nonirrigated Crops Harvested Clarks Fork-Bighorn, Montana.	III-24
III-16	Number of Head of Livestock Clarks Fork-Bighorn, Montana.	III-25
IV-1	Projected Acres of Harvested Nonirrigated Crops for 1985 and 2000, Clarks Fork-Bighorn, Montana.	IV-3
IV-2	Projected Acres of Harvested Irrigated Crops for 1985 and 2000, Clarks Fork-Bighorn, Montana.	IV-4
IV-3	Projected Livestock Production for 1985 and 2000 Clarks Fork-Bighorn, Montana.	IV-6
IV-4	Livestock Feed Units Produced and Consumed OBERS Series E and E', 1985 and 2000, Clarks Fork-Bighorn, Montana	IV-7
IV-5	Base Acres, OBERS Projections, 3E and 3E' for Irrigated Lands, Clarks Fork-Bighorn, Montana	IV-8
IV-6	Estimated Acreage Affected by Salinity Conditions Clarks Fork-Bighorn, Montana.	IV-11
IV-7	Population Projections and Associated Consumptive Water Requirements, Clarks Fork-Bighorn, Montana.	IV-12
IV-8	Industrial and Non-Energy Consumptive Water Use Clarks Fork-Bighorn, Montana.	IV-12
IV-9	Livestock Water Requirements Clarks Fork-Bighorn, Montana.	IV-14
IV-10	Evaporation from Stockwater Impoundments Clarks Fork-Bighorn, Montana.	IV-14
IV-11	Current (1975) Flood Damages Along Combined Reaches Clarks Fork-Bighorn, Montana.	IV-16
IV-12	Current (1975) and Projected Flood Damages Along Combined Reaches, Clarks Fork-Bighorn, Montana	IV-17

LIST OF TABLES (Cont.)

TABLE		PAGE
IV-13	Streambank Erosion Damages, Level B Study Area: 1975, 1985, and 2000.	IV-18
IV-14	Instream Flow Requirements in the Clarks Fork and Bighorn Rivers.	IV-22
IV-15	Demand for Surface Acres Related to Alternative Outdoor Recreation Requirements, Clarks Fork-Bighorn, Montana	IV-24
IV-16	Projected Land Conservation Requirements Clarks Fork-Bighorn, Montana.	IV-29
IV-17	Clarks Fork-Bighorn Fisheries, 1975	IV-31
V-1	Comparison of Alternative Irrigated Acreages Clarks Fork-Bighorn, Montana.	V-2
V-2	Surpluses and Remaining Needs After F/WO Developments Clarks Fork-Bighorn, Montana.	V-3
V-3	F/WO Municipal, Industrial, Non-Energy Mineral, and Livestock Consumptive Water Needs	V-4
V-4	Flood Damage Remaining Needs, Clarks Fork-Bighorn, Montana. .	V-6
V-5	Streambank Erosion Remaining Needs Clarks Fork-Bighorn, Montana.	V-7
V-6	Remaining Needs for Outdoor Recreation Clarks Fork-Bighorn, Montana.	V-9
V-7	F/WO and Remaining Land Conservation Needs on Federal and Non-Federal Lands, Clarks Fork-Bighorn, Montana	V-10
VI-1	Agricultural NED Projects, Clarks Fork-Bighorn, Montana . . .	VI-7
VI-2	Display of Beneficial and Adverse Effects, NED Plan Clarks Fork-Bighorn, Montana.	VI-18
VI-3	Display of Beneficial and Adverse Effects EQ Plan Clarks Fork-Bighorn, Montana.	VI-27
VII-1	Display of Beneficial and Adverse Effects, Recommended Plan, Clarks Fork-Bighorn, Montana.	VII-5

LIST OF TABLES (Cont.)

TABLE		PAGE
VIII-1	Capital Costs, Recommended Plan Clarks Fork-Bighorn, Montana.	VIII-4
VIII-2	Annual Costs and Benefits, Recommended Plan Clarks Fork-Bighorn, Montana.	VIII-4
VIII-3	Summary of Capital Cost by Function, Recommended Plan Clarks Fork-Bighorn, Montana.	VIII-5
IX-1	Population Changes, 1975-2000, Clarks Fork-Bighorn, Montana.	IX-2
IX-2	Additional Water Consumption by Sector, 1975-2000, Recommended Plan Plus F/WO, Clarks Fork-Bighorn, Montana. . .	IX-2
IX-3	Identified Land Use Changes Stemming from Recommended Plan, 1975-2000, Clarks Fork-Bighorn, Montana	IX-4
IX-4	Identified Environmental Impacts Stemming From the Recommended Plan, 1975-2000, Clarks Fork-Bighorn, Montana . .	IX-5
IX-5	Identified Recreation Impacts, Stemming From the Recommended Plan, 1975-2000, Clarks Fork-Bighorn, Montana . .	IX-6

LIST OF PLATES

PLATE		PAGE
IV-1	Irrigated or Irrigable Lands.	IV-9

PLATE		PAGE
V-1	Location of Proposed Projects and Programs (Opportunities). .	V-14

PLATE		PAGE
VI-1	NED Projects.	VI-21
VI-2	EQ Projects	VI-30

PLATE		PAGE
VII-1	Elements of the Recommended Plan.	VII-3

LIST OF FIGURES

FIGURE		PAGE
I-1	Example of Possible Planning Sequence for Coal Development. .	I-4
I-2	Level B Study Organization.	I-7
I-3	Composition of Level B Study Area	I-12

FIGURE		PAGE
IV-1	Formation of a Saline Condition	IV-10

FIGURE		PAGE
V-1	Land Conservation Status, Clarks Fork-Bighorn, Montana. . . .	V-11

CHAPTER I

INTRODUCTION

Background and Authority

The Missouri River Basin Comprehensive Framework Study, published by the Missouri Basin Inter-Agency Committee in December 1971, stated that the principal planning objectives for the Yellowstone Basin were: "the intensification of agricultural production and the processing of agricultural products; development of industrial processing of coal; and expansion of the recreation and tourist industry."

Shortly after completion of the Framework Study, the national energy crisis created increasing needs for careful resource planning in the Yellowstone Basin Area; this together with other recognized needs was the basis for initiation of a number of programs and studies. In general, these studies emphasized the need to follow a comprehensive plan in making resource-use decisions and recognized the need to develop an updated comprehensive/coordinated plan at the earliest possible date.

In February 1974, the Missouri River Basin Commission reacted to the need for a Yellowstone study and gave a high priority to its initiation. On April 1, 1974, a request was submitted to the Water Resources Council for funds to develop a Proposal to Study (PTS). At the May 1974, Commission meeting, a motion was approved by consensus which directed the MRBC Chairman to appoint a special Action Task Force for the Yellowstone River Basin and Adjacent Coal Area.

The Action Task Force proposed that a Level B type study be undertaken. A PTS was prepared and submitted to the Water Resources Council

in July 1974, with a request by the MRBC Chairman for funds to initiate the study in FY 1975.

Funds for initiation of the study were not made available for a FY 1975 start. Thus, the proposal was deferred, but with a priority consideration for FY 1976 funding. The Yellowstone Study was one of two new Level B starts that the President recommended in his FY 1976 budget request. Congressional approval resulted and an appropriation of funds for the Study was provided in December 1975. Work on the Level B Study was begun in early 1976.

Authority for the study is found in the Water Resources Planning Act of 1965 (P.L. 89-80, 42 U.S.C. 1962, as amended) and Section 209 amendments of the Federal Water Pollution Control Act of 1972 (P.L. 92-500, 86 Stat. 816). A Level B Study is regional or river basin in scope and involves a reconnaissance-level evaluation of water and related land resources for the selected area. The intent of a Level B Study is to: (1) resolve the complex problems identified by framework studies and assessments; (2) focus on near and midterm (10 to 25 years--base year is 1975) needs; (3) involve federal, state, and local interests in plan formulation; and (4) identify alternative plans and recommend action plans or programs to be pursued by individual federal, state, and local entities.

Purpose of the Study

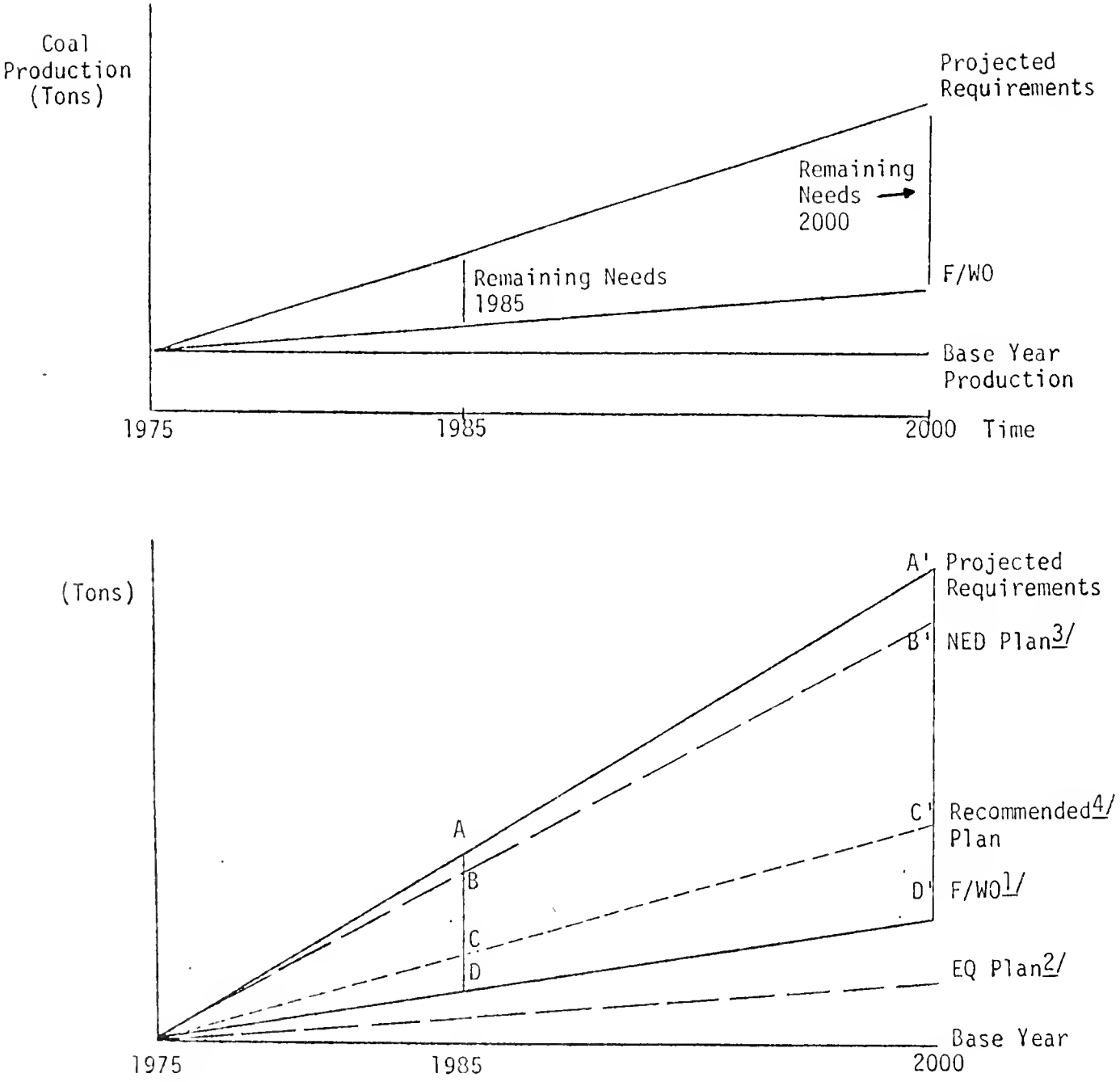
The purpose of the Level B Study is to promote the quality of life by: (1) enhancing the quality of the environment through the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems; and (2) enhancing national economic development by increasing the value

of the Nation's output of goods and services and improving national economic efficiency. The goal of enhanced environmental quality (EQ) and that of expanded national economic development (NED) are equal partners in the Level B planning process.

The planning process (see Figure I-1) includes the development of: (1) projected requirements (i.e, resources necessary to satisfy a water-related need); (2) the future "without" situation (F/WO), which describes development of an area in terms of future private endeavors and ongoing government programs in the absence of a plan; (3) the remaining needs that are not met by the F/WO (the remaining needs may be defined as the difference between the projected requirements and the F/WO, or Projected Requirements minus F/WO = Remaining Needs); (4) the NED and EQ plans which are initiated through local, State, or Federal actions to meet the remaining needs; and (5) the Recommended Plan which evolves from the combination of the EQ and NED plans. The Recommended Plan does not necessarily have to satisfy all of the remaining needs. If it is the judgment of the planning group (State Study Team, see below) that the quality of life in the planning area would not be promoted by satisfying certain remaining needs (e.g., massive coal development to satisfy the needs of other regions), then the group may choose some level of development more compatible with desires of the planning area's population.

The priorities and preferences of the various individuals affected will vary and, accordingly, there will likely not be full agreement among all affected on whether certain effects are beneficial or adverse, or on the relative trade-offs between objectives. However, when any plan is recommended from among the alternative EQ and NED plans, there is an implicit expression of what is considered to be the affected group's priorities and preferences.

Figure I-1. Example of Possible Planning Sequence for Coal Development



1/ Under the F/WO situation, remaining needs are AD, in 2000, A'D'.

2/ The EQ Plan would constrain private development to less than the F/WO.

3/ The NED Plan come nearest to satisfying remaining needs only AB and A'B' remain.

4/ The Recommended Plan satisfies only CD and C'D' and would result in the production of the amounts AC and A'C' being shifted to another coal area.

Scope of Study

Although the Level B Study is new, water and related land planning is not starting anew in the Study Area. Planning agencies at all levels of government have already produced a baseline of data from studies conducted at various investigative levels. In most respects, plan formulation for the Level B Study has involved the reconsideration, reanalysis, reformulation, and rethinking of previously studied programs and projects into alternative plans which are responsive to changing needs and to evolving state, regional, and national goals. The intent has been to complete an analysis in sufficient detail and depth only to provide a reasonable and implementable overall plan, subject to the findings of Level C studies (i.e., feasibility studies) of each element of the plan.

Organization of Study

The Missouri River Basin Commission was responsible for the conduct, supervision, and management of the study. Funding of the Federal portion of the study was through the Water Resources Council to the Missouri River Basin Commission. State participation was funded through regular channels in each State. Public participation was funded by the organizations or individuals participating, except that the mileage costs to and from meetings were paid by the Commission for those organizations or individuals that requested it.

Study Direction

The Study Manager was given full authority and responsibility by MRBC to conduct the study, serving under the general supervision and direction of the MRBC Director of Planning and Technical Services. The Study Manager developed workplans, budgets, and schedules for completion of task activities; reviewed and evaluated completed work assignments,

reports, and studies for quality control, technical adequacy, integration into overall study efforts, compliance with work plan objectives and compliance with WRC Principles and Standards; and prepared recommendation and reports on results of the study efforts. Further, the Study Manager served as Chairman of the Management Group, which advised him on overall management guidance, direction, and control for the study effort.

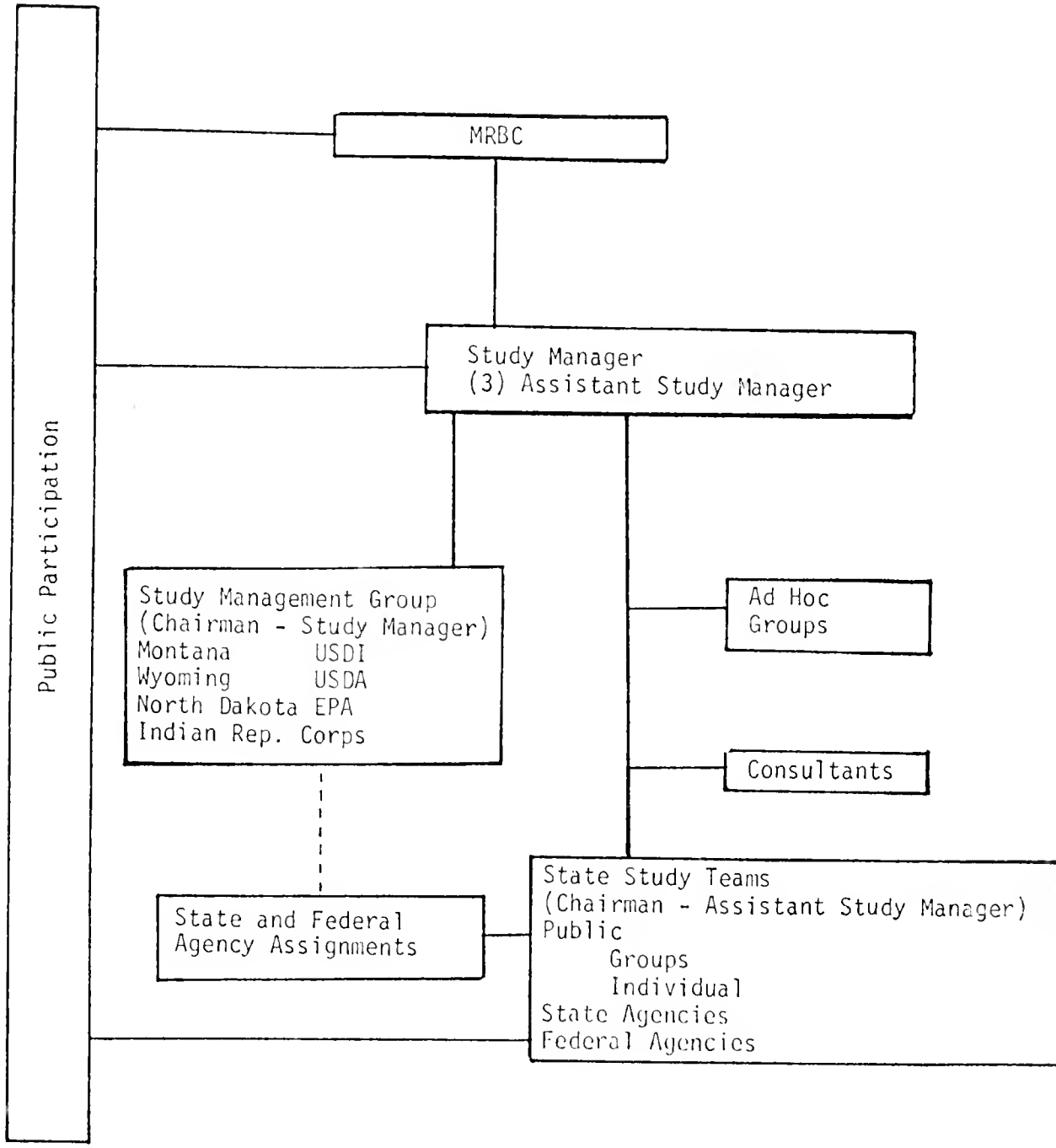
The Study Manager was assisted directly by three Assistant Study Managers. Each of these served as coordinator of planning, and of work activities of the various task groups and study participants, in the respective State of assignment. They also maintained continuing liaison with designated representatives of governmental and nongovernmental entities in their respective states for purpose of delineating and expediting study inputs and outputs.

The Manager and Study Office were located in Billings, Montana, with state offices located in Helena and Billings, Montana; Cody, Wyoming; and Bismarck, North Dakota. Figure I-2 displays the study organization.

Management Group

The Management Group established for the study was composed of the Study Manager and one representative from the Corps of Engineers, Environmental Protection Agency, U.S. Department of Agriculture, and the Federated Indian tribes, and two representatives from each State and the Department of the Interior. The primary function of the Management Group was to mold the seven area plans into a plan for the complete Study Area and provide guidance on management and direction for the study effort. In addition, it provided study performance evaluation, critique, and monitoring and control from a resource allocation context. The Group thus provided assistance to the Study Manager in policy formulation, direction, and study problem resolutions.

Figure I-2. Level B Study Organization



Ad Hoc Groups

During the early phases of the study, certain specific tasks were assigned to ad hoc groups. These groups were composed of agency representatives (Federal, State, local, etc.) with a given expertise and capability to effectively perform the task assignments. The assigned functional areas included: specification of the basic needs of agriculture, outdoor recreation, fish and wildlife, instream flows, energy, and others. Each group prepared a report defining: (1) base conditions (1975); (2) projected future requirements (1985 and 2000); (3) the portion of those requirements that may be satisfied through private initiative; and (4) the remaining needs to be met by time frame 1975-1985 and 1985-2000. Upon completion of their given assignments, the groups were disbanded.

State Study Teams

Plan development, analysis, and associated public participation were handled through State Study Teams under the direction of the Assistant Study Manager in each state. State Study Teams were composed of representatives from Federal and State agencies, interest groups, and industry--as well as private individuals.

The State Study Teams have had the most important role in the study in that they formulated the alternative and recommended plans for each planning area. A typical sequence of events for the State Study Team in an individual planning area was:

1. Preparation of a background report.

2. Development of issue papers by individual agency, group, or citizen involved in the study. Issue papers defined the future of the area without additional federal or state involvement; the problems and needs this would leave unfulfilled; necessary programs to meet those needs; and reconnaissance benefits and costs of suggested programs.

3. Development of Ad Hoc Work Group Reports. The ad hoc group presentation was primarily technical and designed to cover

the entire Study Area with a consistent description of needs in each functional area (e.g., instream flows, flood control, and agriculture). These needs were then disaggregated to individual planning areas where possible.

4. Formulation of alternative plans emphasizing National Economic Development (NED), Environmental Quality (EQ), and State-Regional Development (SRD) objectives and the development of a recommended plan, with involvement of the public. State Study Team meetings were held in the various planning areas in which the information supplied by the issue papers and ad hoc group reports was evaluated and analyzed as part of the planning process.

State Involvement

This Level B study effort has been oriented to a high degree of State agency participation, both in terms of task performance and policy guidance through service on the Study Management Group and on State Study Teams. Additionally, each of the respective states assumed a major role through its cost-sharing portion of the total study effort. In some instances, resources expended on these state-oriented efforts provided input over and above that of the Level B requirements. Similarly, efforts undertaken on the Level B study will provide added information for use in the various state plans and programs.

Public Participation

A continual emphasis on public awareness, involvement, and participation is called for in the U.S. Water Resources Council's Principles and Standards, which provided the basic guidelines for this study. Considering the large geographic size and diversity of interest in the Study Area, it was deemed inadvisable to structure a formal organizational entity such as a Citizens Advisory Committee or Citizens Task Force. Interest groups within the area (both developmental and environmental) were already fairly well organized and operationally established, and some of these organized groups sent representatives to Study Team meetings. Members of the general public also participated directly on the Study Teams.

Interstate and Study Area Planning Coordination

Planning coordination for drainage areas crossing state boundaries were coordinated in three ways: (1) the Assistant Study Mangers for the respective states maintained constant watch, directly and through the Study Manager, on the activities in their respective portions of the Study Area; (2) joint planning meetings between members of affected study teams were scheduled when conflicts were evident in planning philosophies or resource availabilities; and (3) the Assistant Study Managers were called upon by the Study Manager to report to the Management Group at appropriate times during the plan formulation process.

This process provided adequate coordination to provide overall compatability, but at the same time permitted enough freedom at the local and state levels to allow the plans to reflect local conditions and preferences.

A more difficult coordination problem revolved around the multitude of water and/or related land studies being undertaken by individual local, State, and Federal agencies. Many of these studies were related to some single objective, and had a schedule that did not correspond to that of the Level B Study. Attempts were made to coordinate activities with such programs as the "208" water quality studies; the regional coal-related EIS endeavors, and BLM and Forest Service land allocation studies. Even so, the differences in timing often made interchange of data and analytical results very difficult, though representatives of such ongoing studies attended Study Team meetings. As a result of these difficulties, it seems quite likely that the conclusions of some of these ongoing studies may not agree fully with some details of the Level B analysis. On the other hand, the coordination and interchange that has been possible has been

of great help in at least keeping basic philosophies and broad objectives identified and coordinated, so that differences in study outputs, if they occur, would be matters of detail that can be accommodated within the framework of future planning and implementation efforts.

Study Area Description

The Yellowstone Study Area encompasses the 37 counties in Montana, Wyoming, and North Dakota which are wholly or partially within the hydrologic boundary of the Yellowstone River Basin, plus 13 counties in North Dakota and two in Wyoming which are outside the hydrologic boundary but within the coal resource area associated with the Yellowstone Basin. Figure I-3 identifies the counties in each state that are involved in the study. The study does not include Yellowstone National Park, although a substantial part of the Park is drained by the Yellowstone River. The counties are shown below:

Montana

Big Horn	Fallon	Musselshell	Rosebud
Carbon	Gallatin	Park	Stillwater
Carter	Garfield	Powder River	Sweet Grass
Custer	Golden Valley	Prairie	Treasure
Dawson	McCone	Richland	Wibaux
	Meagher		Yellowstone

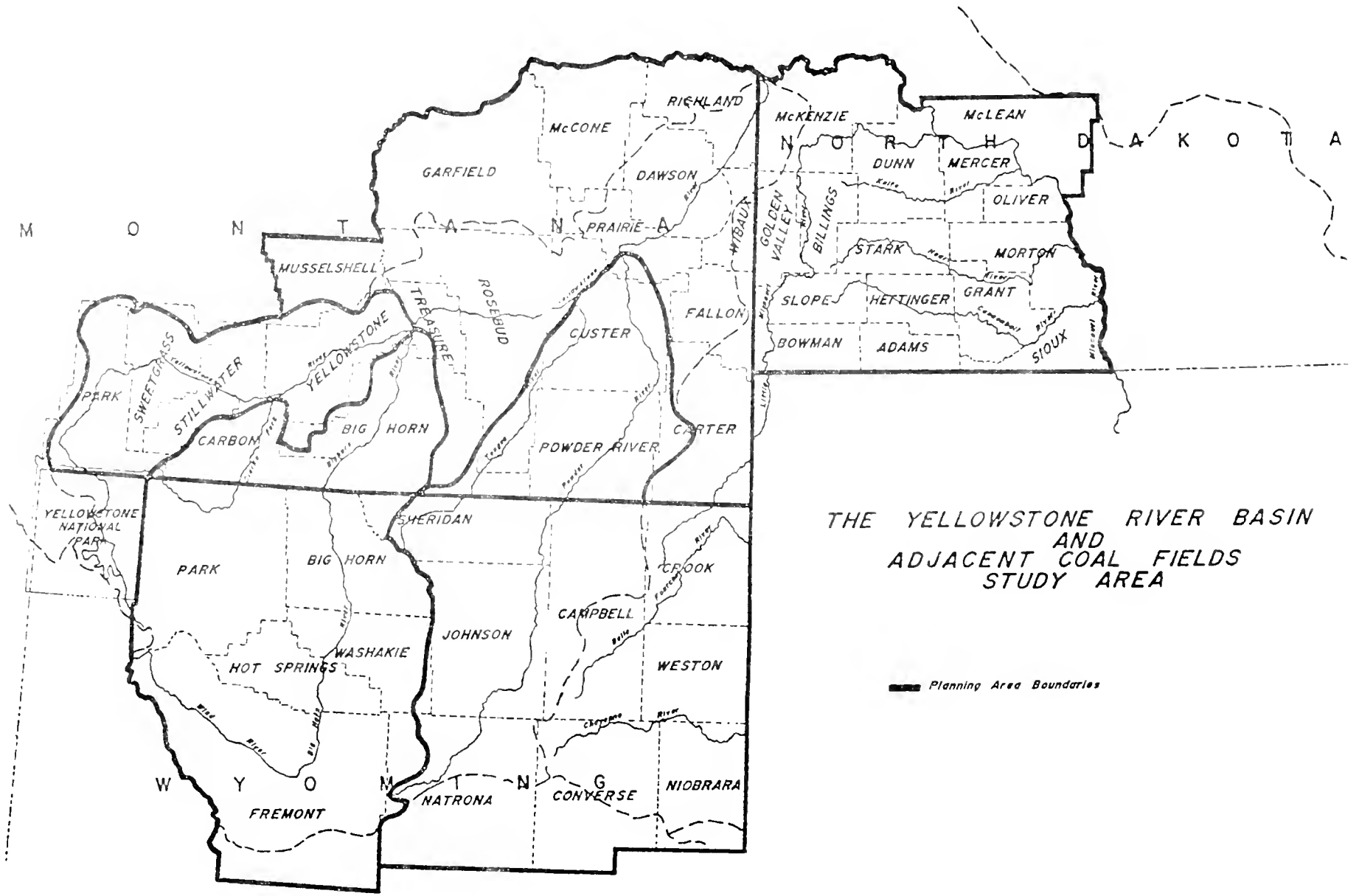
Wyoming

Big Horn	Fremont	Niobrara	Teton
Campbell	Hot Springs	Park	Washakie
Converse	Johnson	Sheridan	Weston
Crook	Natrona	Sublette	

North Dakota

Adams	Golden Valley	McLean	Sioux
Billings	Grant	Mercer	Slope
Bowman	Hettinger	Morton	Stark
Dunn	McKenzie	Oliver	

Figure I-3. Composition of Level B Study Area



For the purposes of this study, the total area, which covers about 123,375 square miles or 78,959,645 acres, has been subdivided by drainage into the seven planning areas listed below and delineated on Figure I-3.

Montana

Mainstem of Yellowstone River above the Bighorn River (Upper Yellowstone, Montana)
Mainstem of Yellowstone River below the Bighorn River, and Adjacent Coal Area (Lower Yellowstone, Montana)
Clarks Fork of Yellowstone and Lower Bighorn Rivers (Clarks Fork-Bighorn, Montana)
Tongue and Powder Rivers (Tongue-Powder, Montana)

Wyoming

Wind, Bighorn, and Clarks Fork Rivers (Northwest Wyoming)
Northeast Wyoming (Northeast Wyoming)

North Dakota

Little Missouri, Knife, Heart, Cannonball, Grand, and Yellowstone Rivers and Adjacent Coal Area (North Dakota Tributaries).

Study Area Objectives

Many of the problems and needs of the Yellowstone Study Area were documented in the Missouri River Basin Comprehensive Framework Study Report, and others have surfaced since that time.

In the main, potential conflicts are between those uses which divert water from the streams and rivers and those uses that require instream flows. Another conflict which affects all other issues is the Federal vs. the State water rights partially as manifested in the Indian and Federal reserved water rights questions.

To better define the areas of potential problems, the staff identified what appeared to be the major water related issues in the Study Area. They were the:

1) Maintenance and expansion of food and fibre production.
2) Maintenance of instream flow levels and water quality.

3) Impact of energy development upon the area's water resources.
4) Indian water resource use.

Upon the definition of these issues, the Level B staff addressed each in a paper. The papers provided guidance to the Management Group and State Study Team as how to dispose of the issues. These papers, coupled with agency and individual issue papers and the ad hoc reports, led to the analysis presented in the following chapters of this study.

CHAPTER II

NATURAL RESOURCE BASELINE

The purpose of this chapter is to acquaint the reader with the manmade and natural characteristics of the Clarks Fork-Bighorn Planning Area. The following discussion is not intended to be in-depth, but rather to survey man and his habitat as they exist in this planning area.

Description

The planning area encompasses parts of six Montana counties: Big Horn, Carbon, Park, Stillwater Treasure, and Yellowstone. However, the area consists predominantly of Big Horn and Carbon counties. Where information is not available by planning area, data from Big Horn and Carbon counties will be used to represent the entire area. Table II-1 illustrates the area's composition. Of the total 3,467,560 acres that make up the planning area, 3,267,753 or 94 percent lie within Big Horn and Carbon Counties.

The planning area was determined by combining the Clarks Fork and Bighorn River drainage areas, both of which flow into Montana from the Big Horn Basin of Wyoming.

Area History

The first white men to enter the Yellowstone Area were Pierre and Louis Verendyre and two other men in 1742; the party was searching for a route to the Pacific Ocean. If a route were to be found by the Verendryes, the French Government had promised the family a fur trade monopoly in the area.

From the party's sketchy journals it is believed that it entered the basin north of Miles City and traveled in the Yellowstone, Powder, Tongue,

Table II-1. Land and Water Areas by County, Clarks Fork-Bighorn, Montana[1/]

County	Water Area			Land Area (Acres)	Total Area (Acres)
	Over 40 Acres	Under 40 Acres	Total (Acres)		
Big Horn	13,383	457	13,840	2,100,360	2,114,200
Carbon	4,536	4,431	8,967	1,167,393	1,176,360
Park[2/]	77	87	164	39,836	40,000
Stillwater[2/]	---0---	10	10	1,990	2,000
Treasure	899	141	1,040	74,960	76,000
Yellowstone	532	17	549	58,451	59,000
TOTALS	19,427	5,143	24,570	3,442,990	3,467,560

1/ Source: Land Use Update, Land Use Ad Hoc Work Group, January, 1976.

2/ Area in Yellowstone River drainage only.

and Little Missouri River Valleys.

Larocque's expedition in 1805 was the second to enter the Yellowstone Area and was prompted by fears that the planned expedition by Lewis and Clark would interfere with fur trading activities of the Northwest Fur Company. The Company sent Larocque into the area, a year ahead of Lewis and Clark, in yet another attempt to gain a monopoly on the area's fur trade.

The third exploration and the most valuable from a scientific standpoint was the Lewis and Clark Expedition. In the latter part of June 1806, Lewis and Clark, on their return from the west coast, decided to divide their party into two groups. Part of the group traveled north with Lewis and explored the Marias River, while Clark and some of his men explored the Yellowstone. They met again at the confluence of the Yellowstone and Missouri.

Clark's party entered the valley by crossing the Bozeman pass, between Bozeman and Livingston, and arrived at the river about a mile below near the present community of Livingston. They traveled downstream for four days looking for trees suitable for making canoes. From that point, some of the party left and traveled overland to Pompeys Pillar east of Billings. They, too, were forced to fashion floating craft after losing their horses and traveled the remainder of the trip down the Yellowstone on the water.

Other explorations followed for more mercenary reasons, rather than the scientific purposes of the Lewis and Clark. At Mandan, on the return trip of Lewis and Clark, two trappers from Illinois convinced John Colter of the exploration party to join them and return to the Yellowstone country. Their partnership was short-lived for after wintering where the Clarks Fork River joins the plains, Colter left the two to go to St. Louis. At the mouth of the Platte, however, he rejoined three former Lewis and Clark party members and agreed to return to the Yellowstone with them and another man, Manual

Lisa, who wanted to establish a fur trading post. Fort Lisa was founded at a place previously designated by the Lewis and Clark Expedition as a good site for a fort at the mouth of the Bighorn River. From this fort these men and others eventually explored all of the Yellowstone Area. The Lewis and Clark and Larocque expeditions had the direct and immediate effect of opening the Rocky Mountain area to a thriving fur trade.

Few other white men saw the area until trails were blazed by Jim Bridger and John Bozeman, in 1864, that linked the North Platte River with the Three Forks of the Missouri River. The Bozeman Trail crossed the Bighorn River at Fort Smith near the mouth of the Bighorn Canyon; it proceeded to the northwest until meeting the Yellowstone near the present day site of Laurel, Montana.

The Sioux, Crow, Shoshone, and Northern Cheyenne Indians resented the incursion and the ever increasing slaughter of the buffalo. There were isolated incidents with the Indians until the Sioux went on the warpath in 1863. This warfare continued until ended by the Fort Laramie Treaty of 1868;, in which the Sioux relinquished all claims to the lands east of the Bighorn Mountains and north of the North Platte River and moved north into the Yellowstone Basin. However, the Indian wars continued and were climaxed with Custer's defeat at the Little Bighorn in June, 1876. The massacre of Custer's command brought massive U.S. Army retaliatory action and, as part of this, Fort Custer was established at the confluence of the Little Bighorn and Bighorn Rivers in 1877. During that same year, Chief Joseph and the Nez Perce made their famous retreat down the Clarks Fork in their attempt to flee to Canada.

The Fort Laramie Treaty of 1868 also set forth the original Crow Indian Reservation boundaries which included all lands in Montana lying west of the 107th degree of longitude and south of the midchannel of the Yellowstone River. The 107th Meridian is still the eastern boundary of the reservation.

In 1877 a small part of the reservation was set aside near Red Lodge for the development of coal. Mines were opened that year by the Rocky Fork Coal Company to produce coal for the Northern Pacific Railroad which had just been built along the Yellowstone River.

The opening of the coal mines and railroad development brought a flood of settlers who clamored for opening the reservation to homesteading. Through a series of treaties, the Crows ceded most of the western part of their reservation to the Federal Government which opened the area to settlement in 1892. The northern portion of the Bighorn Valley and lands along the Yellowstone River were ceded to the government in 1904 and later opened to homesteaders in 1906.

The first recorded appropriation of water in the area was made in 1881, from the Yellowstone River near the mouth of the Clarks Fork River in Yellowstone County. Development of water from streams within Big Horn County began with the Reno Unit of the Crow Indian Project in 1885. The first water appropriation in Carbon County was made in 1891, about seven miles south of Belfry on the Clarks Fork River.

Natural Resources

Physiography and Geology

The Clarks Fork-Bighorn Area is cut into thirds by the Clarks Fork and Bighorn rivers, which flow into Montana from Wyoming. This area lies in two physiographic provinces, the unglaciated Missouri Plateau and the Northern Rocky Mountains. The Beartooth Range bounds the area to the west and the Rosebud Mountains to the east. Together, the Pryor and Bighorn mountains straddle the Bighorn River near the Wyoming border. The rugged Bighorn Canyon begins near the southeastern end of the Pryor Mountains and runs almost 60 miles to Fort Smith. Until construction of the Yellowtail Dam and Reservoir

the canyon had remained almost inaccessible to man.

About one-third of the area is classified as Northern Rolling High Plains. The remaining area is part of the Northern Rocky Mountains and related foothills. A small Desertic Basin lies in the shape of a triangle within the Clarks Fork Drainage.1/

The Clarks Fork River is unregulated and can be described as a braided stream--with multiple channels and islands. The Bighorn River also was once a braided stream but, since the construction of Buffalo Bill, Boysen, and Yellowtail dams and reservoirs, the river has been stabilized and maintains a single channel. Both tributaries of the area flow northward to eventual confluence with the Yellowstone River.

The geologic history of the area is a complex record of sedimentation, uplift, igneous intrusion, folding, faulting, and erosion. In the Montana portion at least 30 separate geologic formations, ranging in age from Precambrian to Tertiary, have been identified. The formations are mostly sandstone, shale, and limestone. Some ancient schist, gneiss, and metamorphosed granitic rocks are present in an uplifted block constituting the Beartooth Plateau. There are exposures of intrusive and extrusive igneous rocks; the layered igneous ultrabasic rocks of the Stillwater Complex extend southeast along the plateau front from the West Fork Stillwater River to Fishtail Creek, and smaller intrusive dikes and sills are emplaced within and across older volcanic and sedimentary rocks.

Rocks as exposed range in age from Quaternary to some of the oldest Precambrian rocks in Montana. The young Quaternary material is unconsolidated water-laid alluvium and colluvium. Rocks here represent every geologic period except the Silurian. Except for igneous and metamorphic rocks in the Beartooth

---

1/ See Land Use Update, Land Use Ad Hoc Work Group, January, 1976.

Mountain areas are crystalline types formed by heat and pressure probably over 1,000 million years ago and also underlie sedimentary rocks in the remainder of the Basin.

Tectonic movements of the earth's crust have occurred here since the beginning of geologic time. The greatest changes have been in the mountainous areas. Structural trends are believed related to patterns established in Precambrian time, but were largely rejuvenated during the early Tertiary period, about 65 million years ago. Large-scale thrust-faulting and folding took place at this time and resulted in the present basin-and-range tectonic pattern typical of the middle Rocky Mountain region.

The greatest tectonic movement took place in the Beartooth, Pryor, and Bighorn mountain areas where an excess of four miles of vertical uplift has taken place since Cambrian time. The Flathead Sandstone of Cambrian age lies on metamorphic rocks on the Beartooth Plateau at an elevation of 12,000 feet, while north of the Beartooth Overthrust, near Red Lodge, this formation is 10,000 feet below sea level. Relatively young Wasatch and Fort Union formatons, 40-65 million years of age, outcrop on the north side of the fault.

Other prominent structures in and adjacent to the area have undergone less movement, but are important geologic features. Vertical movement has taken place along the Nye-Bowler Lineament, the Fromberg Fault Zone, the Lake Basin Fault Zone, the Reed Point Syncline, the Ashland Syncline, and the Powder River Basin. These crystal changes have developed anticlines, synclines, and faults that affect mineral, water, and other resources.

Alpine glaciation occurred in the high mountain ranges of the area during the Pleistocene Age (20 thousand to 1 million years ago). Continental glaciation did not reach as far south as the Clarks Fork-Bighorn Area.

Climate[2/]

The Clarks Fork-Bighorn area and the rest of Montana experience a continental climate characterized by hot summers and cold winters. This climate may be modified by the pattern and contours of the area's moutains, valleys, and plains.

The amount of precipitation varies across the area but the mountainous portions receive an average of 40-80 inches per year. On the other hand, a small desertic triangle formed by linking the communities of Belfry, Bridger, and Warren may receive as little as 6 inches; lying as it does in the rain shadow of the Beartooth Range. Red Lodge, only a short distance to the west (but out of the rain shadow) receives an average of over 23 inches per year. Hardin, ninety miles to the east, receives an average of over 12 inches; Crow Agency and Wyola receive nearly 15 inches during a normal year.

About 70 percent of all precipitation falls during the April-September period--the area's growing season. The length of the growing season varies from 130 days in the river valleys to 100 days at higher elevation.

Soils and Vegetation

Soils

The soil classes and types common to the area are extremely varied, a fact closely associated with the formation of soils under different conditions as related to parent material, climate, and topography. At the lower elevations the soils vary from badlands, not suitable to cultivation or grazing, to level or gently rolling bench land with a high productive capacity. A similar situation is evidenced in upland areas that are used principally for the grazing of lifestock. Some upland soils are productive of native forage

2/ The information found here and in many of the following sections of this chapter has come from the Wind-Bighorn-Clarks Fork River Basin, Type IV Survey, December, 1974.

Climate[2/]

The Clarks Fork-Bighorn area and the rest of Montana experience a continental climate characterized by hot summers and cold winters. This climate may be modified by the pattern and contours of the area's moutains, valleys, and plains.

The amount of precipitation varies across the area but the mountainous portions receive an average of 40-80 inches per year. On the other hand, a small desertic triangle formed by linking the communities of Belfry, Bridger, and Warren may receive as little as 6 inches; lying as it does in the rain shadow of the Beartooth Range. Red Lodge, only a short distance to the west (but out of the rain shadow) receives an average of over 23 inches per year. Hardin, ninety miles to the east, receives an average of over 12 inches; Crow Agency and Wyola receive nearly 15 inches during a normal year.

About 70 percent of all precipitation falls during the April-September period--the area's growing season. The length of the growing season varies from 130 days in the river valleys to 100 days at higher elevation.

Soils and Vegetation

Soils

The soil classes and types common to the area are extremely varied, a fact closely associated with the formation of soils under different conditions as related to parent material, climate, and topography. At the lower elevations the soils vary from badlands, not suitable to cultivation or grazing, to level or gently rolling bench land with a high productive capacity. A similar situation is evidenced in upland areas that are used principally for the grazing of lifestock. Some upland soils are productive of native forage

2/ The information found here and in many of the following sections of this chapter has come from the Wind-Bighorn-Clarks Fork River Basin, Type IV Survey, December, 1974.

while others can be relatively unproductive and highly susceptible to erosion.

Generally, the soils of the area can be organized into three broad groups based largely on topography, precipitation, and elevation: (1) soils of the mountains, mountain valleys, and foothills; (2) soils of the mountain foothills and desertic basins; and (3) soils of the desertic basins and uplands. Various soil associations fall with the area's three soil categories; the major soil associations are of the types: (1) Cryborolls, (2) Haplargids, (3) Ustorthents, (4) Ustiflurents, and (5) Torriorthents.

Soils associated with steep slopes in desertic regions have great potential for severe erosion, especially during high intensity storms. The upland soils are characterized by shallow, stony loams, grey-brown loams, and by Pierre Alkali clays and loams. They are residual, generally having been developed on shales, and readily distinguished by their uneven surface and shallowness. The mountain soils are mostly within the boundaries of national forests. These soils are derived from the igneous rocks of the mountain areas; made up of granite, schist, gneiss, and other intrusive rocks. They support mostly grass and timber and consist of greyish-brown loams or sandy loams and frequently are stony and shallow. Because of the greater volume of vegetative growth, these soils contain more humus than any other soil group in the area. Except for the areas of steep slopes, canyons, and dense tree growth, the mountain soils are productive of an abundance of forage, restricted to summer and fall use by deep snows and severe winter weather. Erosion problems are relatively minor on soils of this group and, when present, they are confined mainly to steep slopes and canyons having exposed surfaces.

Vegetation

A wide variety of vegetation exists in the area, as would be expected from its large size and with great variations in elevation, topography, soil,

and climate. Vegetative types vary from desert saltbush at the lower elevations to alpine associations, including conifer timber and mountain meadows in the high mountains bordering the lower foothills and slopes. The better grazing lands lie at the high elevations and near the foothills where moisture and soil conditions are most favorable. The arid or desert-type lands, however, have an important place in the year-long livestock operations since they provide a substantial portion of the range livestock feed in winter, spring, and fall.

Sagebrush and sage-grass types occupy the plains, foothills, and plateau areas. These lands generally receive a greater rainfall than do those of the saltbush types. Associates of sagebrush include western wheatgrass, bluebunch wheatgrass, grama grass, needlegrass, bluegrass, and many other grasses. Other plants in this association include Indian paintbrush and many other forbs, shrubs, half-shrubs, and annual grasses, including cheat grass, the latter occurring most abundantly on trails, sheep bed grounds, and other areas of disturbed soils.

Woodland types occur at the intermediate elevations and include juniper, mountain mahogany, and sagebrush, in addition to a sparse undergrowth of shrubs, weeds, and grasses. These types ordinarily occupy steep slopes and broken areas of the higher foothill country. Soils in woodland ares are usually rocky and shallow to the extent that a high density of vegetation generally cannot be supported. These lands are used primarily as spring-fall range, but frequently may be used during the summer season.

Timber and grassland areas occupy the highest elevations. The grasslands are usually mountain meadows having a high density of grasses, weeds, shrubs, and half-shrubs. Such areas support an association of bromegrasses, fescues, mountain timothy, pinegrass, and a large assortment of broad-leafed weeds.

Approximately two-thirds of the area is covered by grasses. Domestic

crops are cultivated on nearly 11 percent of the land and forests cover 14 percent. Commerical forests--lands capable of producing 20 cubic feet of wood fiber per acre per year--account for 57 percent of all forests. The remaining 43 percent of the forested lands is considered to be noncommercial--defined as tree covered lands incapable of yielding usable wood products on an economic basis because of adverse growing conditions.

Mineral Resources

A significant number and amount of various types of minerals can be found in the Clarks Fork-Bighorn area. The more important ones are: bentonite, coal, gypsum clay, uranium, oil and gas, sand and gravel, and limestone.

A broad band of bentonite stretches from the Warren area down the Clarks Fork Valley to Billings and back up the Bighorn drainage to the Wyoming border. These deposits are quite extensive.

Significant coal seams of good quality exist in the Red Lodge-Bridger area and have been mined previously through underground mining operations. Since underground operations are much more costly than strip mining, the only coal currently being mined in Carbon and Bighorn counties emanates from the large strippable deposits in Big Horn county outside of the hydrological boundaries of the planning area.

Gypsum deposits of good quality exist in the Pryor Mountain area. Deposits have been reported at several levels with extensive outcropping.

Good quality clay, suitable for the manufacture of bricks, can be found in the southern part of Carbon County and near Yellowtail Reservoir in Big Horn County.

Uranium depositswith the greatest potential are found on East Pryor Mountain and upper Hough Creek. It appears that the uranium deposits are found in caverns and sinkholes in limestone and are of good grade--but

small in size. Fluorite is associated with the uranium to varying degrees.

Oil and gas resources are not extensive but both are in production. Carbon County's Elk Basin field is in full production; the Hardin field in Big Horn County is producing, but is less active. Other potential fields in the area are undergoing exploration.

Deposits of sand and gravel are widespread throughout the area. Transportation is a major cost to producers; therefore, they locate and develop processing plants and pits near the site of use. As a result, there are many sand and gravel producers, each supplying the needs of a local market.

Limestone is extracted near Warren; its principal use is for sugar refining. Some limestone is cut for building stone.

Land Use

Of the total 3,467,500 acres in the Clarks Fork-Bighorn Planning Area, approximately 10 percent is used for crop and pasture production. Rangelands, forests, urban and built-up, water areas, and barren lands make up the remainder.

Agricultural

Total croplands number 287,044 acres. About 47 percent or 133,564 of the total is irrigated, while dryland croplands occupy the remaining 153,480 acres.

A total of 62,929 acres is in pasture, with 29,319 of those acres being irrigated, leaving a balance of 33,610 in dryland pasture.

Of the total acreage of irrigated land (i.e., crop and pasture), the largest use is for hay production. Corn (grain and silage) is next, with sugar beets, barley, and wheat following in that order. Dry beans and oats are also grown on irrigated lands.

The major dryland crops are: wheat, hay, barley, and oats in that order.

Rangeland accounts for slightly more than 2.7 million acres which is ten times that of total cropland and also ten times that of total forest lands.

Non-Agricultural

There are nearly 51,000 acres of barren and alpine tundra lands and almost 28,000 acres of urban or built-up lands in the area.

Land Ownership and Administration

Of the 3,467,560 surface acres that are included within the Clarks Fork-Bighorn planning area, 17 percent is federally owned and administered. There are 24,570 acres of water area within the planning area, 79 percent of that Federal. By land use, the Federal Government owns and administers: 15 percent of the area's range lands; 44 percent of the forest lands; all of the barren or tundra land; a very small portion (325 acres) of urban and built-up lands; and none of the area's agricultural lands (i.e., crop and pasture).

Subsurface ownerhsip and administration data are not available by planning area. However, Federal ownership and administration is available on a limited basis.3/ State subsurface ownership and administration thereof is described by township and range in the State Land Mineral Ownership Listing; these data have not been totaled by county.4/ No data exist by drainage basin or by the Level B planning area.

3/ U.S. Bureau of Land Management (BLM) State Office, Billings, Montana.

4/ Montana Department of State Lands, January, 1976.

Fish and Wildlife Resources

Since the Clarks Fork-Bighorn area varies from mountains and foothills to grassy plains and desertic basins, many different kinds of habitat and wildlife are found there.

Deer are well distributed and both mule and white-tailed deer are common. Small herds of elk can be found in the mountainous areas as well as moose, bighorn sheep, and Rocky Mountain goats. Antelope inhabit the lowlands although their numbers have been declining due to changes in land use which have altered or destroyed their habitat.

Furbearing mammals including the coyote, bobcat, fox, jackrabbit, marten, lynx, raccoon, beaver, muskrat, black bear, and some bison still roam on the Indian reservation.

Upland game birds that can be found include ring-necked pheasants, sage grouse, sharp-tail grouse, mountain grouse, gray partridges, chukars, and wild turkeys.

Habitat for nongame birds exists throughout the area; most nongame birds are classified as song birds by the State and are protected by law.

The alpine lakes and mountain streams provide good trout fisheries. Yellowtail Reservoir provides habitat for warm-water species, like crappie, ling, and walleye.

The grizzly bear, classified as a threatened species, is found in the mountainous portions of the planning area. Much of this mountainous area is being considered for classification as critical grizzly habitat by the U.S. Fish and Wildlife Service.

Outdoor Recreation Resources

There are ample outdoor recreation resources in the Clarks Fork-Bighorn area. Portions of the Custer National Forest lying both in the Beartooth and Pryor mountains provide backpackers, campers, hunters, and fishermen

with opportunities for recreation. The Red Lodge Mountain Ski Area lies inside the Custer National Forest near Red Lodge; the Pryor Mountains Wild Horse Range abuts the forest in Montana just north of Lovell, Wyoming.

The Bighorn Canyon National Recreation Area, administered by the U.S. National Park Service, provides opportunities for camping, fishing, and boating in the vicinity west of Yellowtail Reservoir.

The proposed Beartooth Wilderness and existing Beartooth Primitive Area occupy a large area of the Beartooth Mountains near and above timberline, and offer outstanding opportunities for wilderness experience and for viewing alpine scenery. The Beartooth Highway, which crosses a portion of the Beartooth Plateau, is a major access route to Yellowstone National Park and is one of the most outstanding scenic drives in America.

Water Resources

Water Rights[5/]

The Montana Water Use Act of 1973 provides a permit system for the appropriation and new use of surface and ground water, procedures for the determination and court adjudication of water rights existing prior to July 1, 1973, and the establishment of a centralized record system of all water rights.

Because of Montana's past lack of documentation concerning valid water use, water supply problems and implications of industrial applications, the Montana Department of Natural Resources and Conservation (DNRC) decided that the initial determination of existing water rights would be in the Yellowstone River Basin. Field investigations of water right declarations, part

---

5/ The sections discussing water rights, Federal and Indian water rights, water rights litigation, and the Yellowstone River Compact were taken from The Future of the Yellowstone River.....?, Montana Department of Natural Resources and Conservation, January, 1977.

of the process of preparing a recommendation to the district court which issues the preliminary and final decree for adjudication, have been underway since the summer of 1974 in the Powder River Basin.

The DNRC estimates that there will be a total of about 11,000 water rights recommended to the district court in the Powder River Basin. Of the 3,000 rights investigated so far, about 75 percent are use rights--rights which have never been filed. Prior to July 1, 1973, use was the only necessary requirement to establish a water right and, except on an adjudicated stream, there was no necessity to file. Under the new law, of course, a permit must be obtained for the use of water or there is no right to that water.

The adjudication of the other three interstate tributaries (Tongue, Bighorn, and Clarks Fork Yellowstone) will be completed next. In fact, preparations for the determination of existing rights have begun in the Tongue and Bighorn river basins, but orders for declarations are currently pending because of litigation in Federal court over Indian and Federal water rights. Adjudication of the mainstem of the Yellowstone River will follow.

Until the adjudication process is completed, quanitfication of water rights is not possible. Water rights usually are not adequately reflected in historical flow records.

Yellowstone Moratorium

Under the Montana Water Use Act, new water rights are established through the issuance of permits by the Department of Natural Resources and Conservation. Originally, the Yellowstone Moratorium, enacted in 1974, suspended all large applications (diversions of over 20 cfs or storage of over 14,000 af) for water use permits in the Yellowstone Basin until March 10, 1977; in addition, the Moratorium excluded reservations in the basin by Federal agencies for three years. However, since then, the Moratorium has

been extended to January 1, 1978, and Federal agencies have been allowed to file reservation requests. The Board of Natural Resources requested further extension of the Moratorium to July 1, 1978, but the Supreme Court denied the request and stayed proceedings until some unspecified date in the summer of 1978.

Six permit applications, all of which are primarily for industrial water use, were suspended. The language of the Moratorium emphasized the need for reserving water in the Yellowstone Basin for the protection of existing and future beneficial water uses; particular emphasis was given to the need for reservation of water for agricultural and municipal needs, as well as guaranteed minimum flows for the protection of existing rights, future uses, water quality, and aquatic life.

The significance of water reservations cannot be overestimated; their impacts will be felt long after the decisions are made. Because of the magnitude of the water reservation requests, the wide variety and magnitude of potential water uses, and their basinwide scope, action on these applications could establish future patterns of water use in the Yellowstone Basin.[5A/]

Federal and Indian Water Rights

Present recognition of Indian "reserved" water rights began with the United States Supreme Court's decision in the Winters case in 1908. The Winters Doctrine, as it has been developed over the years, holds that when the Indian tribes ceded their lands to the United States, reserving smaller tracts for their own use, sufficient water to fullfill their needs on the reservation was also reserved. The measure of the reserved right is in dispute, although some courts have measured the right according to the

---

5A/ From Environmental Impact Statement, Yellowstone Water Reservations.

irrigable acreage on the reservation. The reserved right does not depend upon actual use, and is therefore available for future was well as present needs. Thus, even if the quantity of the reserved right is determined, the question arises as to whether that water can be put to uses (such as coal-based industrialization) which were not contemplated when the reservation was created. Since major tributaries of the Yellowstone flow by or through both the Crow and Northern Cheyenne reservations, the Indians' reserved rights will effect other water uses.

Reserved rights attach, not only to Indian lands, but to any lands the United States has withdrawn from the public domain for Federal purposes. Upon withdrawing the lands, the United States impliedly withdrew or reserved sufficient water to satisfy the Federal purposes. Included in this category are most national forest lands, national parks, recreation areas, and wildlife refuges. The same problems of quantification seen with Indian rights apply to these Federal reserved rights. Further discussion of Indian water rights is found in Chapter IV.

Water Rights Litigation

Aside from the Indian Lawsuits (see Chapter IV), another important series of lawsuits concerning water rights in the Yellowstone River Basin involves Intake Water Company, Inc., a wholly-owned subsidiary of Tennaco, Inc., of Houston, Texas. The basis of the three separate actions to which Intake is a party is its claim to an existing right to appropriate 111.4 cfs from the Yellowstone River near Intake, Montana. In the first action, Intake has successfully defended its claim against the state of Montana in district court to a perfected appropriation for sale, rental, and distribution for irrigation, industrial, municipal, and domestic purposes. General plans have been revealed to sell water to "companies with energy generating or conversion plants within or outside the State of Montana," including its

parent corporation, Tenneco, Inc. The judgment of the District Court upholding Intake's claimed appropriation is currently under appeal by the state in the Montana Supreme Court.

A separate action instituted by Intake against the Yellowstone River Compact Commission in Federal District Court seeks a declaratory ruling that Article X of the Yellowstone River Compact is unconstitutional in that it requires unanimous consent of the three signatory states before any water can be diverted from the Yellowstone River Basin. This case is currently stayed, pending a resolution of the issues in the lawsuit mentioned in tne preceding paragraph, and none of the issues raised has yet been resolved.

In a third separate action, Intake has sued the DNRC in Montana District Court seeking a declaratory ruling that its planned diversion of 111.4 cfs from the Yellowstone River, for the purposes described above, is not subject to the Montana Major Facility Siting Act. This case is also currently pending.

The outcome of all three of these actions is important because there are several corporations with similar large claims for Yellowstone Basin water for industrial purposes. Furthermore, the action in Federal District Court is the first to interpret and challenge the Yellowstone River Compact. Thus, final resolution of these actions could determined the validity of other claimed rights from the Yellowstone and could significantly affect the future administration of the Yellowstone River Compact.

Another series of lawsuits to which Intake Water Company is a party involves competing water development projects on the Powder River between Intake and Utah International, Inc. The issues raised are complex, but generally involve the question of whether Intake or Utah International has the prior claim to water from the Powder River. The two lawsuits--one in State District Court and the other in Federal District Court--require interpretation of the Yellowstone River Compact and the water appropriation laws of the state of Montana and Wyoming. Both actions are currently pending, awaiting resolution of preliminary jurisdictional and procedural issues.

Yellowstone River Compact

The Yellowstone River Compact, executed by Montana, Wyoming, and North Dakota, and ratified by the United States Congress in 1950, was designed to allocate water of the Clarks Fork Yellowstone, Bighorn, Tongue, and Powder rivers. The compact recognizes water rights prior to 1950, those rights designated to provide supplemental water supplies to land irrigated prior to 1950, and water rights for irrigation projects started before 1950. The compact divides the remaining water according to percentages of the flow at the mouths of the streams as shown in Table II-2.

Table II-2. Division of Waters Under the Yellowstone River Compact

Stream	Wyoming	Montana
Clarks Fork Yellowstone	60%	40%
Bighorn	80%	20%
Tongue	40%	60%
Powder	42%	58%

Article X of the compact prohibits diversion of water out of the Yellowstone Basin without the unanimous consent of the signatory States. This article has recently become controversial because there are some who would like to divert water out of the basin for energy and other uses. Montana's position at this time is to withhold approval of such diversions until the states can agree on quantification within the percentages of tributary flows. Wyoming has published its estimates of these quantities, as presented in Table II-3. Montana does not necessarily agree and intends to independently calculate its compact share.

Drainage Network

The minor streams that originate with the Clarks Fork-Bighorn Planning Area are, for the most part, plains streams--high in sediment with spring

Table II-3. Wyoming's Yellowstone Compact Estimates (Acre-Feet)

Stream	Wyoming	Montana
Clarks Fork Yellowstone	429,000	285,000
Bighorn	1,800,000	400,000
Tongue	96,400	144,700
Powder	120,700	166,600
TOTAL	2,446,100	996,300

Source: Wyoming State Engineer's Office 1973.

runoff occurring in early spring rather than late spring/early summer. Historically, the Clarks Fork and Bighorn rivers have shown relatively high flows during early spring, but have peaked during a period from mid-June to mid-July, due to the late snowmelt in their major watersheds. The Bighorn River is now regulated by Yellowtail Dam and Reservoir.

Clarks Fork River

The Clarks Fork River begins in the Beartooth Mountains of Montana, then flows southward along southeastern slopes of the Beartooths into Wyoming. From Wyoming, the river flows to the north into Montana to meet the Yellowstone at Laurel. Principal tributaries of the Clarks Fork are Silver Tip Creek, Bluewater Creek, and Rock Creek.

Bighorn River

Headwaters of the Bighorn River arise in North-Central Wyoming. The river flows northward through the Big Horn Basin of Wyoming and enters Montana near Lovell, Wyoming. Since November 1965, the flow of the Bighorn River in Montana has been regulated by Yellowtail Reservoir.

The flow of the Little Bighorn usually amounts to less than 15 percent of the Bighorn's flow. Other tributaries that enter the Bighorn below the reservoir are primarily prairie streams and at times can add significant

flows to the river during the early spring. The Bighorn River itself may add significantly to the flow of the Yellowstone--particularly during low-flow periods of the Yellowstone. At times it may contribute nearly one-half of the total flow of the Yellowstone at their confluence.

Little Bighorn River

The Little Bighorn originates in the northeastern section of the Bighorn Mountains of Wyoming. It flows northeasterly, and turning northward at the confluence of Pass Creek near Wyola, Montana, finally enters the Bighorn River near Hardin. The peak flow period for the Little Bighorn occurs in June due to snow melt in its upper drainage. Aside from Pass Creek, Lodge Grass and Owl creeks are its major tributaries.

Historical and Depleted Flows

Tables II-4 through II-7 illustrate: (1) historical and (2) depleted flows of the Bighorn and Clarks Fork rivers at the 1975 level of development.6/ The flow of the Clarks Fork is measured at Edgar; the Bighorn is gaged at St. Xavier. Peak flow years of the Clarks Fork were 1943, 1971, and 1972 and its lowest flows occurred in 1931, 1940, and 1960-1961. The Bighorn River has had relatively high and stable flows since Yellowtail Reservoir went into operation in 1965; the exception was in 1966. Other significant flow years occurred in 1940 and 1961.

The primary use of surface water in the planning area is for irrigation; all other consumptive uses are not significant when compared to irrigation (see Chapter IV for a more detailed accounting). According to the Wind-Bighorn-Clarks Fork River Basin Type IV Survey, full season water is available for irrigation on the Bighorn River. The Clarks Fork provides a full season

6/ Historical flows are the flows that were actually measured at river gaging stations; they are real flows. Depleted flows are historical flows that have been adjusted to reflect some level of development (e.g., the 1975 level of development). Depleted flows illustrate what flows would have been given some level of water consumptive development.

Table II-4
Clarks Fork River at Edgar - Historical Flow

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
						UNITS - 1000 AF							
1929	25.50	23.70	15.40	13.50	13.90	20.30	20.00	96.50	211.00	144.00	32.30	27.00	643.10
1930	26.10	21.40	18.40	15.40	16.70	24.60	44.60	89.80	157.00	89.20	64.00	30.20	597.40
1931	56.80	28.20	24.90	25.00	17.80	15.90	21.80	89.20	169.00	19.90	17.40	19.30	505.20
1932	30.70	21.70	19.70	15.40	14.40	20.30	25.60	135.00	253.00	123.00	23.40	19.90	702.10
1933	24.30	24.90	21.00	19.90	15.10	26.70	17.90	61.50	327.00	55.30	21.50	32.70	647.80
1934	30.74	26.78	21.52	16.45	17.99	22.12	52.02	186.60	156.00	45.26	18.98	17.65	614.11
1935	26.05	25.60	22.68	21.39	18.39	18.92	27.15	72.35	283.90	160.90	27.70	22.30	727.33
1936	18.80	18.48	16.96	17.90	14.96	20.34	47.27	197.40	250.70	56.51	46.04	27.84	733.28
1937	32.04	29.72	13.35	13.39	16.36	22.94	21.86	145.50	213.30	85.49	13.10	14.47	621.52
1938	27.46	20.56	21.82	22.99	22.56	17.52	28.05	104.00	300.10	126.80	27.36	24.64	743.86
1939	29.29	33.09	25.20	23.42	15.95	26.12	35.96	163.80	165.40	91.09	22.20	15.11	646.63
1940	22.39	19.77	17.06	13.61	17.18	19.59	26.58	146.00	188.90	45.68	6.25	18.99	542.00
1941	34.42	25.40	25.34	20.47	16.85	16.49	22.58	120.70	171.20	62.76	40.51	83.02	639.74
1942	62.12	37.65	29.25	23.31	18.16	23.14	42.30	99.45	195.40	143.10	23.80	23.46	721.14
1943	30.67	31.56	29.64	23.23	22.31	34.04	83.17	128.00	326.60	293.40	80.19	45.38	1128.19
1944	32.35	31.92	26.25	22.12	20.03	20.02	20.02	104.20	239.30	147.10	29.66	35.04	728.02
1945	30.37	27.15	22.68	23.23	18.70	22.58	20.99	75.11	243.90	226.10	66.10	35.61	812.52
1946	35.37	32.68	26.33	28.17	21.28	24.62	56.85	96.00	212.40	111.00	28.51	26.80	700.01
1947	33.11	29.44	26.03	20.06	20.10	32.68	28.79	167.40	200.70	152.40	45.46	25.27	781.46
1948	35.31	31.57	26.90	23.94	26.90	24.60	26.22	157.80	297.30	87.98	32.04	20.31	790.87
1949	22.37	23.86	20.32	17.06	16.51	27.62	36.52	162.30	239.10	94.48	20.28	27.58	708.02
1950	33.56	28.98	28.74	22.95	21.10	23.01	28.20	71.31	271.20	237.50	63.66	47.06	877.27
1951	55.08	43.31	35.84	28.96	28.52	30.60	34.17	163.90	203.50	227.00	94.76	43.08	988.72
1952	45.57	36.61	25.36	28.01	27.61	24.92	50.34	150.50	236.90	100.20	51.28	23.80	801.10
1953	22.92	25.30	28.15	28.40	19.42	20.35	25.46	53.08	248.30	140.40	40.55	20.59	672.92
1954	18.70	27.20	27.11	24.63	22.88	22.10	29.24	167.60	184.00	180.10	34.91	23.19	761.66
1955	24.12	24.51	26.03	25.66	22.63	24.83	27.62	68.03	197.70	91.18	23.45	14.05	569.81
1956	18.32	25.97	27.89	21.46	22.00	31.56	38.73	183.40	348.60	127.60	47.47	27.63	920.59
1957	21.69	31.49	25.22	21.10	27.00	25.14	24.76	154.70	350.50	175.70	39.85	39.08	936.23
1958	36.70	35.51	29.90	26.24	20.79	20.91	24.26	190.70	204.20	56.21	33.40	25.25	704.07
1959	20.44	29.19	29.75	23.76	21.23	24.28	30.46	56.31	350.80	151.30	38.14	25.02	800.64
1960	41.40	34.95	27.25	19.34	18.84	28.22	30.37	62.20	220.70	42.17	24.52	11.45	561.41
1961	20.70	26.25	23.31	22.37	18.91	18.31	7.34	87.34	242.80	41.11	13.56	56.64	578.64
1962	49.90	34.33	25.66	19.49	22.20	21.90	53.09	108.80	291.50	131.70	55.93	36.95	851.45
1963	33.28	29.34	29.16	20.67	32.41	22.45	25.74	141.20	289.60	102.60	19.83	37.82	784.10
1964	25.17	28.16	23.57	18.60	17.95	19.31	29.93	118.40	263.50	191.20	29.37	18.53	783.69
1965	22.28	30.69	28.13	27.31	23.40	19.57	35.39	94.77	342.40	211.50	76.35	49.56	961.35
1966	45.80	33.72	30.01	23.96	18.76	22.99	24.97	114.20	170.50	69.54	24.54	25.90	604.89
1967	28.91	28.55	26.05	26.02	21.11	21.48	21.23	112.30	379.60	243.90	50.81	29.47	989.43
1968	42.84	35.79	27.81	25.75	23.79	25.65	22.08	46.55	282.60	132.30	82.69	47.55	795.40
1969	38.03	30.66	25.06	24.08	21.72	21.88	40.52	140.10	196.40	103.00	21.50	17.69	680.64
1970	30.45	29.60	26.90	23.66	22.18	21.42	20.89	139.00	309.20	127.70	26.96	40.09	818.05
1971	38.29	30.28	27.24	23.57	24.84	24.68	29.66	128.10	362.50	190.30	64.30	57.78	1001.54
1972	51.27	37.11	30.25	28.76	28.37	36.63	28.35	113.70	381.20	145.90	77.02	56.73	1015.29
1973	58.42	39.81	28.70	27.71	25.45	24.27	33.61	102.60	189.60	95.05	30.05	52.77	708.04
1974	36.41	36.17	24.64	30.11	21.91	24.71	38.96	99.24	396.10	190.80	62.52	36.92	998.49
1975	29.98	33.23	27.01	17.92	19.42	31.66	30.52	100.50	255.50	344.60	69.51	31.63	991.48
AVG	33.12	29.61	25.22	22.39	20.78	23.70	31.75	118.45	254.69	132.17	40.08	31.68	763.64

Table II-5
Clarks Fork River at Edgar - 1975 Depletion Level

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
						UNITS - 1000AF							
1929	25.34	24.19	16.22	13.55	13.97	20.37	19.76	94.24	208.36	139.01	29.88	25.83	630.71
1930	25.94	21.89	19.22	15.45	16.77	24.67	44.36	87.44	154.26	84.21	61.58	29.03	584.81
1931	56.64	28.69	25.72	25.05	17.87	15.97	21.56	86.84	166.26	14.91	14.98	18.13	492.61
1932	30.54	22.19	20.52	15.45	14.47	20.37	25.36	132.74	250.36	118.01	20.98	18.73	689.71
1933	24.14	25.39	21.82	19.95	15.17	26.77	17.66	59.24	324.36	50.31	19.08	31.53	635.41
1934	30.58	27.27	22.34	18.50	18.06	22.19	51.78	184.24	153.26	40.27	16.56	16.48	601.52
1935	25.99	26.09	23.50	21.44	18.46	18.99	26.91	70.29	281.26	155.91	25.28	21.23	715.34
1936	18.64	18.97	17.78	18.03	15.03	20.41	47.13	195.34	248.06	51.52	43.62	26.77	721.29
1937	31.88	30.21	14.17	13.44	16.43	23.01	21.72	143.44	210.66	80.50	10.68	13.50	609.63
1938	27.40	21.15	22.54	23.04	22.63	17.59	27.91	101.94	297.46	121.81	24.94	23.57	731.97
1939	29.23	33.68	25.92	23.47	16.02	26.19	35.82	161.74	162.76	86.10	19.78	14.04	634.74
1940	22.33	20.36	17.78	13.66	17.25	19.66	26.44	143.74	186.16	40.69	3.83	17.92	529.81
1941	34.36	25.99	25.96	20.56	16.92	16.56	22.44	118.64	168.56	57.77	38.09	81.95	627.75
1942	62.06	38.14	29.97	23.36	18.23	23.21	42.16	97.49	192.76	138.11	21.38	22.49	709.35
1943	30.71	32.15	30.26	23.28	22.38	34.11	83.13	125.94	324.06	288.51	77.77	44.41	1116.70
1944	32.39	32.41	26.98	22.17	20.10	20.09	19.78	102.14	236.66	142.11	27.24	33.97	716.03
1945	30.41	27.74	23.40	23.26	18.77	22.65	20.85	73.05	241.36	221.21	63.68	34.54	800.93
1946	35.41	33.27	26.95	28.36	21.35	24.69	56.61	93.94	209.86	106.01	26.09	25.73	688.22
1947	33.15	29.93	26.65	20.23	20.17	32.75	28.55	165.34	198.16	147.41	43.04	24.20	769.57
1948	35.35	32.16	27.52	23.94	26.97	24.67	25.98	155.74	294.76	82.99	29.52	19.24	778.88
1949	22.41	24.45	20.94	17.23	16.58	27.69	36.28	160.24	236.56	89.49	17.86	26.51	696.23
1950	33.60	29.57	29.36	23.10	21.17	23.08	28.06	69.25	268.76	232.51	61.24	45.99	865.68
1951	55.12	43.90	36.46	29.11	28.59	30.67	34.03	161.84	201.06	222.01	92.34	42.01	977.13
1952	45.61	37.20	26.08	28.16	27.68	24.99	50.00	148.44	234.26	95.21	48.86	22.73	789.21
1953	22.96	25.89	28.87	28.55	19.49	20.42	25.22	51.02	245.66	135.41	38.03	19.52	661.03
1954	18.74	27.79	27.73	24.78	22.95	22.27	28.90	165.54	181.36	175.11	32.29	22.12	749.57
1955	24.16	25.10	26.65	25.91	22.70	25.00	27.28	65.77	194.96	86.19	20.83	12.98	557.52
1956	18.36	26.56	28.51	21.57	22.07	31.83	38.49	181.24	345.96	122.61	44.95	26.46	908.60
1957	21.73	32.08	25.84	21.25	27.07	25.31	24.62	152.54	347.76	170.71	37.33	38.01	924.24
1958	36.74	36.10	30.52	26.34	20.86	21.08	24.02	188.54	201.46	51.12	30.78	24.18	691.78
1959	20.48	29.78	30.37	23.87	21.30	24.45	30.22	54.15	348.16	146.31	35.52	23.85	788.45
1960	41.44	35.54	27.77	19.49	18.91	28.39	30.03	60.14	218.16	37.08	21.90	10.38	549.22
1961	20.74	26.84	23.83	22.62	18.98	18.48	7.00	85.18	240.26	36.02	11.04	55.47	566.45
1962	49.94	34.82	26.18	19.74	22.27	22.07	52.75	106.74	289.06	126.61	53.31	35.88	839.36
1963	33.32	29.83	29.68	20.92	32.48	22.62	25.40	139.04	286.96	97.61	17.21	36.65	771.71
1964	25.21	28.75	24.09	18.85	18.02	19.38	29.59	116.24	260.86	186.21	26.85	17.26	771.30
1965	22.32	31.28	28.55	27.56	23.57	19.64	35.05	92.61	339.76	206.51	73.63	48.39	948.86
1966	45.34	33.91	30.13	24.11	18.83	23.06	24.63	112.94	169.06	67.35	22.72	25.03	597.10
1967	28.45	28.84	26.17	26.07	21.18	21.55	20.79	111.04	378.16	241.71	48.99	28.60	981.54
1968	42.38	36.08	27.93	25.90	23.86	25.62	21.64	45.39	281.16	130.11	80.87	46.68	787.61
1969	37.57	30.95	25.28	24.23	21.79	21.95	40.08	138.74	195.06	100.81	19.68	16.82	672.95
1970	29.99	29.89	27.12	23.81	22.25	21.49	20.45	137.64	307.76	125.51	25.14	39.22	810.26
1971	37.93	30.57	27.46	23.72	24.91	24.75	29.22	126.74	361.06	188.11	62.48	56.91	993.85
1972	50.98	37.34	30.43	28.88	28.43	36.69	28.00	112.61	380.04	144.15	75.56	56.03	1009.13
1973	58.20	39.99	28.83	27.80	25.50	24.32	33.35	101.78	188.73	93.73	28.95	52.25	703.41
1974	36.26	36.29	24.73	30.17	21.94	24.74	38.78	98.69	395.52	189.92	61.79	36.57	995.39
1975	29.91	33.29	27.05	17.95	19.44	31.68	30.43	100.22	255.20	344.15	69.14	31.46	989.92
AVG	33.03	30.10	25.78	22.50	20.85	23.79	31.50	116.55	252.38	127.86	37.81	30.66	752.82

Table II-6
Bighorn River Near St. Xavier - Historical Flow

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
						UNITS - 1000 AF							
1935	96.60	80.80	67.30	67.10	70.50	85.90	96.90	172.80	1065.00	462.40	96.80	82.20	2444.30
1936	102.10	98.20	81.50	73.70	51.10	123.10	125.90	280.50	726.30	225.60	185.80	79.10	2152.90
1937	136.40	123.80	85.40	78.40	68.20	124.70	132.40	326.90	759.30	564.50	84.90	107.20	2592.10
1938	124.20	93.10	75.40	78.60	74.20	124.60	110.70	279.50	711.00	469.10	118.60	157.30	2416.30
1939	159.10	128.30	98.40	92.80	67.70	171.70	121.80	269.30	416.20	169.10	134.80	114.20	1943.40
1940	133.40	178.00	116.50	72.30	79.30	105.50	88.10	138.30	236.50	121.10	80.10	112.70	1461.80
1941	209.20	146.00	167.80	97.70	88.20	123.70	132.00	350.90	484.30	173.10	282.40	234.10	2489.40
1942	247.60	185.00	136.50	100.70	106.00	209.80	285.50	489.60	741.80	328.90	95.50	132.30	3059.20
1943	146.50	142.50	113.70	97.10	151.40	219.30	247.00	306.50	961.90	860.60	202.40	144.00	3592.90
1944	132.50	147.00	106.50	91.60	99.40	140.20	187.80	532.20	1053.00	554.70	99.80	114.00	3258.70
1945	136.00	133.30	87.90	118.50	112.10	167.40	142.30	282.40	684.40	617.30	213.50	231.80	2926.90
1946	197.00	150.80	129.70	128.30	117.50	186.00	199.30	258.40	608.20	326.40	113.30	202.30	2617.20
1947	179.70	141.60	124.60	99.00	105.50	178.80	167.70	537.60	909.70	839.10	233.40	145.90	3662.60
1948	185.60	167.10	133.20	124.80	176.00	255.60	187.70	302.90	833.50	301.90	116.70	146.00	2931.00
1949	142.50	135.80	105.00	119.30	115.90	233.00	147.50	335.40	621.00	258.70	89.90	149.50	2453.50
1950	196.70	169.70	129.20	142.80	152.40	170.80	150.40	210.10	588.10	536.50	196.80	215.40	2858.90
1951	239.60	190.70	171.20	133.60	149.60	175.30	201.30	384.30	688.00	607.80	306.80	176.40	3424.60
1952	173.00	151.00	121.80	135.90	119.50	134.30	172.70	325.40	322.50	176.20	152.50	137.00	2121.80
1953	170.90	144.00	140.70	151.90	148.50	152.30	145.70	154.30	313.90	121.30	125.60	123.40	1892.50
1954	155.50	174.70	161.20	119.60	95.50	99.70	121.80	242.60	234.70	253.50	130.90	132.20	1921.90
1955	162.40	162.40	165.20	139.40	105.50	167.60	206.80	228.80	315.80	141.70	109.40	113.30	2018.30
1956	132.30	133.70	161.50	173.90	172.10	196.30	144.20	240.60	383.10	185.80	129.70	167.60	2220.80
1957	195.90	208.30	172.70	128.30	127.00	148.20	126.30	288.70	723.70	655.10	164.80	168.10	3107.10
1958	243.20	238.10	197.50	214.90	205.40	190.00	128.90	251.00	296.00	112.20	248.40	230.70	2556.30
1959	242.70	220.30	203.80	171.10	91.80	127.60	124.90	135.10	285.90	163.50	110.30	125.10	2002.10
1960	187.80	150.90	149.80	128.20	128.10	174.90	101.20	100.40	181.90	70.30	100.50	117.80	1591.80
1961	109.40	83.00	73.70	71.30	87.00	86.90	73.30	131.80	163.60	82.80	82.10	190.30	1235.20
1962	172.20	162.40	132.30	110.30	208.60	279.10	246.20	255.80	450.30	329.90	187.10	187.70	2721.90
1963	199.90	173.90	155.30	115.30	151.90	139.50	128.70	204.60	759.00	353.30	126.90	167.00	2675.30
1964	198.50	193.30	187.10	188.10	123.70	157.50	217.70	340.40	555.80	460.10	161.20	159.50	2942.90
1965	183.40	167.10	155.30	168.60	178.70	213.50	225.40	237.70	703.10	870.60	276.00	205.80	3585.20
1966	269.00	51.00	172.40	156.30	77.50	20.10	40.30	55.30	64.10	85.30	77.50	63.90	1132.70
1967	83.80	104.50	149.80	117.00	123.00	162.30	138.40	145.60	417.70	1161.00	259.90	179.80	3042.80
1968	193.10	214.00	307.40	323.90	235.40	267.70	215.50	258.80	499.10	177.30	142.70	224.20	3059.10
1969	218.70	245.70	242.20	222.40	210.10	262.30	129.80	102.50	184.70	293.70	220.00	193.40	2525.50
1970	208.60	183.70	236.00	244.00	210.40	128.40	68.10	146.20	321.90	416.30	155.00	117.30	2435.90
1971	158.10	188.00	246.80	234.50	196.50	280.00	329.70	429.50	473.80	367.40	205.80	154.40	3264.50
1972	316.20	301.90	260.50	245.90	230.10	283.80	397.20	310.90	365.00	241.80	198.30	187.10	3338.70
1973	249.00	300.40	217.20	222.40	196.60	202.70	153.00	291.80	343.00	158.70	189.00	270.40	2794.20
1974	269.20	301.90	171.00	174.00	222.10	294.90	322.00	264.20	377.40	438.70	180.20	174.70	3190.30
1975	225.20	213.70	229.00	234.80	208.00	206.20	202.30	320.10	415.10	502.90	351.60	232.00	3340.90
AVG	182.50	167.80	154.63	144.10	137.51	174.91	167.91	266.33	518.03	371.61	164.31	160.17	2609.84

Table II-7
Bighorn River Near St. Xavier - 1975 Depletion Level

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
						UNITS - 1000AF							
1935	133.90	140.56	125.86	152.46	152.26	152.45	131.47	134.02	156.28	268.42	124.19	127.65	1799.55
1936	139.20	141.37	119.86	200.96	200.76	200.95	126.87	122.12	141.58	55.82	125.09	128.55	1703.15
1937	138.20	140.27	119.46	232.06	231.86	232.05	152.07	155.72	182.18	333.42	130.79	134.25	2182.35
1938	139.60	140.67	124.26	212.46	212.26	212.45	134.67	137.32	160.18	252.22	134.19	137.75	1998.05
1939	140.20	141.17	133.56	228.88	228.66	228.85	126.57	108.92	110.28	0.00	114.39	121.15	1682.63
1940	140.90	142.97	120.56	167.78	167.56	167.75	126.97	110.42	111.38	0.00	114.49	122.15	1492.93
1941	140.80	142.17	120.56	196.66	196.46	196.65	127.27	109.22	123.08	70.22	171.89	175.25	1770.25
1942	170.20	178.67	177.86	268.06	267.86	268.05	251.47	260.02	309.58	173.62	130.09	133.55	2589.05
1943	139.60	140.67	122.46	260.16	259.96	260.15	265.27	274.52	327.88	666.12	137.79	141.25	2995.45
1944	139.70	143.37	142.56	261.58	261.36	261.55	355.67	369.42	443.78	318.92	121.49	124.95	2944.05
1945	137.60	139.97	119.46	207.58	207.36	207.55	141.57	165.62	194.78	422.62	130.39	183.85	2327.75
1946	178.90	187.37	166.46	261.36	261.16	261.35	160.17	164.22	192.28	150.42	150.39	153.85	2307.95
1947	148.90	157.47	156.66	262.86	262.66	262.85	296.07	306.92	365.68	634.02	167.19	170.55	3192.85
1948	165.60	174.27	173.36	307.16	306.96	307.15	222.57	220.72	272.68	137.22	122.29	125.75	2544.75
1949	137.30	139.67	119.26	238.86	238.66	238.85	174.37	184.52	220.58	112.82	131.79	135.25	2089.95
1950	139.40	140.87	127.26	261.56	261.36	261.55	251.87	254.62	186.78	384.72	178.79	182.35	2409.65
1951	177.40	185.97	185.16	284.16	283.96	284.15	202.87	209.62	247.38	577.62	183.89	187.25	3008.85
1952	182.20	190.67	189.76	271.26	271.06	271.25	204.17	211.52	326.08	107.32	119.89	123.25	2620.65
1953	139.40	141.47	119.96	215.65	215.47	215.65	126.97	127.92	148.48	50.72	118.79	122.25	1727.65
1954	139.30	141.07	119.76	208.28	208.06	208.25	126.87	111.62	109.88	131.22	117.59	121.05	1739.95
1955	139.10	141.07	119.76	183.89	173.67	173.85	126.97	118.92	137.28	80.42	111.99	119.15	1616.35
1956	138.30	141.2	120.66	196.49	196.27	196.45	145.87	254.12	303.08	139.12	116.99	120.45	2169.05
1957	138.90	141.27	119.96	229.48	229.26	229.45	207.47	318.92	382.48	461.62	164.09	167.65	2890.55
1958	162.70	171.37	170.76	248.26	248.07	248.25	154.47	158.22	184.88	33.02	122.39	125.75	2028.15
1959	138.10	140.47	119.66	214.09	213.86	214.05	126.57	109.02	110.28	90.52	132.59	136.05	1753.25
1960	139.60	140.87	129.36	212.49	212.27	212.45	126.47	110.82	112.18	0.00	120.49	128.15	1645.13
1961	148.60	155.07	134.66	122.99	124.07	133.35	137.07	118.22	115.88	0.00	133.79	141.85	1464.93
1962	172.50	180.57	162.56	155.59	135.77	187.05	191.37	187.02	232.08	276.22	140.89	144.35	2006.75
1963	139.30	147.87	146.96	247.68	247.47	247.65	262.17	271.32	324.28	183.22	140.59	144.05	2507.55
1964	148.70	157.67	146.76	240.49	240.26	240.45	267.07	276.42	330.18	432.62	137.89	141.35	2749.85
1965	147.30	144.27	143.36	261.19	260.97	261.15	326.67	339.02	407.18	754.12	133.59	196.95	3435.75
1966	201.50	200.36	199.36	201.69	201.47	201.65	326.37	309.62	111.38	0.00	117.89	124.95	1796.23
1967	154.50	147.07	129.36	179.69	179.47	179.63	352.27	365.82	442.08	762.22	162.79	166.25	3219.15
1968	170.90	169.77	168.96	261.19	260.97	261.15	245.97	254.22	307.48	165.52	194.89	198.25	2655.25
1969	202.80	201.77	200.86	259.19	258.97	259.15	184.37	183.52	223.18	164.52	132.89	136.25	2413.45
1970	148.00	146.37	141.46	233.99	233.77	233.95	244.57	252.82	301.68	231.92	155.29	158.75	2466.45
1971	163.40	162.67	161.66	283.79	283.57	283.75	318.17	330.12	395.68	468.82	219.59	223.05	3294.25
1972	227.50	225.67	225.77	346.09	345.87	346.05	231.29	239.56	286.14	231.41	201.27	203.70	3111.25
1973	206.80	205.98	205.18	251.79	251.58	251.77	152.22	157.37	185.71	197.33	218.37	220.05	2504.19
1974	222.06	221.09	220.28	260.59	260.39	260.58	247.35	258.02	310.07	467.62	177.65	178.30	3083.99
1975	179.18	178.39	177.79	254.00	253.89	253.99	247.37	260.96	314.04	777.11	116.92	118.25	3131.89
AVG	157.48	158.93	148.27	231.95	231.77	232.20	202.98	205.03	240.17	262.85	146.05	149.89	2367.58

supply for its irrigators only 50 percent of the time, or 5 out of every 10 years.

There are three reservoirs in the area with a capacity of over 5,000 acre-feet (af): (1) Yellowtail (Bighorn River--1,375,000 af); (2) Cooney (Red Lodge Creek--24,190 af); and (3) Willow Creek (Lodge Grass Creek--23,000 af).

Surface Water Quality[7/]

Clarks Fork River

The Clarks Fork Basin is somewhat unique for the upper reaches of the Yellowstone because of its relatively poor quality water. Three qualities can be discerned: (1) good to excellent water quality in the Rock Creek drainage; (2) a poor to fair quality in the mainstem of the Clarks Fork; and (3) generally poor quality in all other tributaries. With the exception of the Rock Creek drainage, surface waters in this basin are characterized by having relatively high concentrations of dissolved solids, high specific conductance, and large amounts of suspended sediment.

In the upper reaches of the mainstem of the Clarks Fork, temperatures, dissolved oxygen saturations, and pH are suitable for the propagation of salmonids (trout and whitefish). In the lower mainstem, temperature maximums and suspended sediments increase to an extent where the river becomes suitable only for the marginal propagation of salmonid fishes.

There is a distinct downstream increase in various dissolved solids as well as suspended sediments from the river's entry into Montana and its confluence with the Yellowstone. Increases in both of these concentrations

7/ Information found in this section has been taken from one or more of the Water Quality Inventory and Management Plans by the Water Quality Bureau of the Montana Department of Health and Environmental Sciences. Additional information regarding point and nonpoint sources of pollution are also available in these publications or may be found in the "208" Mid-Yellowstone Water Quality Plan of the Mid-Yellowstone Areawide Planning Organization that will be available in the spring of 1978.

are due at least in part to the inflow of inferior water from the tributaries that arise on the dry plains. In general, the major factor detracting from water quality in the Clarks Fork of the Yellowstone is the sediment load which can approach and exceed 27,000 tons per day at high flows. For the most part, the sediment appears to stem from natural causes and the normal geological erosion found in a desertic basin.

Bighorn River

The water quality characteristics of the Bighorn River have been substantially altered since the construction of Yellowtail Reservoir . Previously, the Bighorn transported a great deal of sediment as it entered Montana from Wyoming, but,with the advent of the dam and reservoir,sediment which emanates in Wyoming now settles in the reservoir. Therefore, the quality of the water below the reservoir has improved significantly.

A characteristically high sulfate concentration is present in the Bighorn; relatively high chloride concentrations are also present. The data for any one station on the river shows very little variation in concentration of dissolved solids with changes in flow. This is because flow variations are relatively small and water discharged from the reservoir is not taken from the surface but from approximately 150 feet below the surface of the reservoir. The lack of variation also indicates that tributary streams do not add dissolved solids to the mainstem in any significant amounts.

There appears to be a period in the early spring when runoff from the prairie portion of the drainage causes a slight and temporary increase in the sediment concentration in the Bighorn River at Bighorn. However, maximum mean monthly concentrations in the Bighorn River apparently occur when tributary streams from mountainous drainages have their peak runoff (May and June). Peak sediment loads occur in March on the Little Bighorn and are associated with prairie runoff.

Ground Waters[8/]

The Bighorn and Clarks Fork rivers drain geologically complex areas. Ground water resources vary greatly throughout the area, but large quantities of good quality water are available locally from late Paleozoic, Mesozoic, and Tertiary bedrock aquifers. Unconsolidated Quaternary deposits along the major streams locally produce important quantities of good quality water.

The Madison Group, Amsden Group, and Tensleep Sandstone are the most important Paleozoic aquifers in the area. Water from the Madison, Amsden, and Tensleep is generally a calcium sulfate type that contains about 700 to 2,300, 2,500, and 1,000 to 8,000 milligrams per liter dissolved solids, respectively.

Most of the wells tapping the Paleozoic aquifers were drilled as oil tests. Individual wells have produced artesian flows of more than 3,700 gallons per minute. The water is of suitable quality for trout rearing and irrigation at Bluewater Spring in Carbon County.

Mesozoic sandstones of the Lakota, Fall River, Eagle, Judith River, and Lennop formations are important sources of water and locally can yield as much as 1,000 gallons per minute. Most of the water is a sodium bicarbonate type with dissolved solids ranging from about 300 to 2,400 milligrams per liter.

The Tertiary Fort Union Formation occurs near the eastern drainage divide of the Big Horn River basin and in the vicinity of Red Lodge. Sandstone units in the Fort Union provide water for numerous low-yield (less than 50 gallons per minute) wells. Dissolved solids average about 700 milligrams per liter in the Big Horn basin and about 640 milligrams per liter near Red Lodge.

Quaternary alluvial and terrace deposits of major importance occur along the larger rivers and creeks. Well yields as much as 1,000 gallons per minute

8/ The technical parts of this section were prepared by Rickard Hutchinson of the U.S. Geological Survey, Billings, Montana.

have been obtained from the deposits, but they are unusual. Dissolved solids range from about 80 to 7,700 milligrams per liter. The lower value was for water from a city well near Red Lodge where as the higher value was from a shallow well near the Little Big Horn River near Garryowen. High water table and waterlogging of land is a problem in the Big Horn basin. The condition can degrade ground water quality by evaporation-concentration of the dissolved salts.

Ground water is used throughout the areas as a source of municipal and rural (including domestic uses) supply; other uses include irrigation and for livestock water. However the total amount of ground water consumed is slight when compared to the amount of surface water consumed in the area.

CHAPTER III

SOCIOECONOMIC CHARACTERISTICS

Population

Population Estimates

The populations of Carbon and Bighorn Counties are shown by Table III-1. From 1960 to 1970, the population in Big Horn County increased slightly, while in Carbon County it decreased dramatically. However, there appears to have been an out-migration of working-age people, in both counties, that was directly related to declining agricultural employment in the two counties.

The slight increase shown in the population of Big Horn County during the past decade is misleading. Big Horn County includes all of the Crow Indian Reservation and a portion of the Northern Cheyenne Reservation; while non-Indians tend to migrate in response to existing economic conditions or inability to obtain employment, Indians appear to have a much stronger attachment to their place of origin. The population increase in Big Horn County from 1960 to 1970 stems from the Indians remaining on the Reservation. The resulting racial mix of Big Horn County inhabitants is illustrated by Table III-2.

American Indians

In addition to a reluctance to leave the reservation, the Indian population showed a large increase in population and the two outweighed the decline in the non-Indian population (Table III-2). The 1970 Indian population increased by roughly 600 individuals from the 1960 totals; it is now estimated that the Indian population in Big Horn County had risen to approximately 4,600 by 1975.

Rural and Urban

The planning area population has a much greater percentage of rural

Table III-1. Population Estimates for
Clarks Fork-Bighorn, Montana

County	1960[1/]	1970[1/]	1975[2/]	Percent Change 1960-70	Percent Change 1970-75
Big Horn	10,007	10,057	10,900	+0.5	+8.4
Carbon	8,317	7,080	7,700	-14.9	+8.8
Total	18,314	17,137	18,600	-6.4	+7.7
State	674,767	694,409	748,000	+2.9	+7.7
% of State	2.7	2.5	2.5	-	-

1/ U.S. Bureau of Census, 1970 Census of Population.
2/ U.S. Bureau of Census, Estimates of the Population of Montana Counties and Metropolitan Areas, July 1, 1974 and 1975, Series P-26, No. 75-26, June 1976.

Table III-2. County Population Classified by Race
Clarks Fork-Bighorn, Montana: 1960 and 1970[1/]

County	Year	White		Indian		Other Nonwhite	
		Number	% of Total	Number	% of Total	Number	% of Total
Big Horn	1960	6,584	65.8	3,334	33.3	89	0.9
	1970	6,018	59.9	3,917	39.0	113	1.1
Carbon	1960	8,300	99.8	5	0.1	12	0.1
	1970	7,022	99.2	29	0.4	29	0.4
Montana	1960	650,538	96.4	21,181	3.1	3,048	0.5
	1970	663,043	95.5	26,385	3.8	4,981	0.7
United States	1960	158,837,679	88.6	523,591	0.3	19,964,405	11.1
	1970	178,119,221	87.6	763,594	0.4	24,327,343	12.0

1/ U.S. Bureau of Census, 1960 and 1970 Census of Population.

inhabitants than Montana as a whole (Table III-3). Roughly 85 percent of the counties' population are rural compared to nearly 50 percent for the rest of Montana.

Rural nonfarm inhabitants have increased in the planning area, while in the rest of the State there has been a slight decline. Rural farm people have declined in the planning area and the State at about the same rate.

Hardin and Red Lodge are the largest communities in the planning area (Table III-4). Both of these communities have shown a loss in population from 1960 to 1970; however coal development in Big Horn County and urban spillover and demands for recreation that focus on Carbon County have been responsible for a reversal of that trend by 1975.

Educational Attainment

Table III-5 shows the years of formal schooling attained by persons 25 years of age or older in the planning area and the rest of the State and Nation. In general, area residents have not received as much high school or college education as the remainder of Montana or the Nation. Usually residents of rural areas have lower levels of formal educational attainment.

Age Distribution

A knowledge of the size of an area's age groups can be useful because service and recreational needs vary among people due to age as well as other things. For example, certain age groups are more likely to be participants in the labor force. In addition, attitudes of an area may also be influenced by the relative age of its people. Table III-6 shows the age distribution in the planning area as a whole, but there are significant differences between the two counties not shown in the Table.

Upon closer examination the effects of out-migration of the young can vividly be seen in Carbon County where the median age in 1970 was 39.8 years old and 44 percent of the total population was at least 45 years of age.

Table III-3. Rural and Urban Populations for Clarks Fork-Bighorn, Montana: 1960 and 1970[1/]

Population	Clarks Fork and Bighorn				State of Montana			
	1960		1970		1960		1970	
	No.	%	No.	%	No.	%	No.	%
Urban[2/]	2,789	15.2	2,733	15.9	338,457	50.2	372,344	53.6
Rural	15,535	84.8	14,420	84.1	336,310	49.8	322,245	46.4
Farm[3/]	6,128	33.5	4,967	29.0	105,598	15.6	88,640	12.8
Nonfarm[4/]	9,407	51.3	9,453	55.1	230,712	34.2	233,605	33.6
Totals	18,324	100.0	17,153	100.0	674,767	100.0	694,589	100.0

1/ U.S. Census of Population: 1960 and 1970.
2/ Urban inhabitants are defined as persons living in places of 2,500 inhabitants or more.
3/ Rural farm inhabitants are defined as persons living on 10 or more acres with farm sales of $50 or more in the preceding calendar year or on places of less than 10 acres with farm product sales of $250 or more in the preceding calendar year.
4/ Rural nonfarm are persons not meeting the urban or rural farm definitions.

Table III-4. Population of Urban Centers of 1,000 or More Persons, Clarks Fork-Bighorn, Montana: 1960 and 1970[1/]

Location	1960	1970
Hardin	2,789	2,733
Red Lodge	2,278	1,844

1/ U.S. Bureau of Census, 1960 and 1970 Census of Population.

Table III-5. Years of School Completed by Persons 25 years of Age and Older, Clarks Fork-Bighorn, Montana: 1970[1/]

Level	Clarks Fork and Bighorn		Montana	United States	Urban	
					Montana	United States
	No.	%	%	%	%	%
Elementary						
0 to 8 years	1,278	13.8	8.9	15.5	7.9	14.2
8 years	1,850	20.1	16.2	12.7	13.8	11.4
High School						
Less than 4 years	1,727	18.8	15.7	19.4	14.6	19.2
4 years	2,633	28.6	34.1	31.1	34.2	31.6
College						
Less than 4 years	956	10.4	14.1	10.6	15.9	11.5
4 years or more	768	8.3	11.0	10.7	13.6	12.1

1/ U.S. Bureau of Census, 1970 Census of Population.

Table III-6. General Age Distribution of Inhabitants, Clarks Fork-Bighorn, Montana[1/]

Level	Bighorn-Clarks Fork		Montana		United States	
	1960	1970	1960	1970	1960	1970
			Percent			
Under 18 years	40.1	37.5	38.6	36.5	35.9	34.3
18 to 64 years	49.0	51.3	51.7	53.6	55.1	55.8
65 years and older	10.9	11.2	9.7	9.9	9.0	9.9
			Years			
Median age	28.6	30.2	27.6	27.1	29.5	28.5

1/ U.S. Bureau of Census, 1960 and 1970 Census of Population.

The median age of Big Horn County residents in 1970 was 23.4, and is attributed to the influence of the high fertility rate among Indian women.

Income and Income Distribution for Families

It appears that one of the beliefs of our society is that "more" means "better". Consequently, an individual's income has been viewed as one of the major determinants of how "well off" that individual is. However, other factors may be considered in determining whether or not one group is "better off" than another. Unfortunately, methods do not exist for expressing some of these other factors in comparable and measurable terms (e.g., a preference for living in a small town versus a large city). On the other hand, information concerning income levels is readily available, but it must be viewed in its proper perspective. Income is only one factor that may give an insight into an area's overall well-being.

The distribution of families by income class and the average and median incomes are shown in Table III-7. Both counties lie below the state and national average. The lower family incomes are influenced by the rural nature of the planning area. As can be observed in Table III-7, the income distribution for rural families is skewed towards the lower brackets when compared to urban families. In other words, family incomes within the planning area are not uniformly distributed--there tends to be a much greater number of people receiving lower incomes than higher incomes.

An example of the above not shown by the Table is the situation in Big Horn County in 1970. At that time, 29 percent of all families in Big Horn County had incomes of poverty level or less. This is more than twice that of the rest of the State and Nation. The high proportion of families at or below the poverty level can be attributed to the presence of the depressed economies of Crow and Northern Cheyenne Indians.

Table III-7. Income and Income Distribution of Families in Clarks Fork-Bighorn, Montana, and the United States - 1970[1/]

Family Yearly Income[2/]	Clarks Fork-Bighorn	Montana	United States			
	All Families	All Families	Total	Urban	Rural Nonfarm	Rural Farm
Dollars			Percent			
Less than 2,000	9.9	5.5	5.9	4.9	8.1	10.4
2,000 to 3,999	16.1	10.6	9.3	8.1	11.9	14.8
4,000 to 5,999	16.7	13.1	10.8	9.8	13.0	15.3
6,000 to 7,999	16.4	16.5	12.8	12.1	15.1	14.3
8,000 to 9,999	13.2	15.9	13.9	13.6	14.9	12.6
10,000 to 14,999	18.1	24.7	26.6	28.0	23.8	19.2
15,000 to 24,999	6.5	10.7	16.0	18.0	10.7	9.9
25,000 and over	3.2	3.0	4.6	5.3	2.6	3.3
Average Income ($)	8,574	9,662	10,799	11,674	9,251	8,795
Median Income ($)	6,961	8,512	9,590	10,196	8,248	7,296

1/ U.S. Bureau of Census, 1970, "General Social and Economic Characteristics".
2/ Income is the sum of wages or salary income, nonfarm net self-employment income, farm net self-employment income, Social Security or railroad retirement, welfare income, and all "other" income which includes income from interest, dividends, rentals, public and private pensions, etc.

Earnings by Sector and Per Capita Personal Income

Certain sectors of an economy are defined to be basic and others non-basic. Basic sectors are those whose output exceeds local needs which results in exports to outside areas. The non-basic sectors depend on income generated by the basic sectors for their support. Sales by the retail sector to farmers in the area are examples of non-basic sales but retail sales to nonlocal tourists would be basic sales. A farmer selling his wheat overseas would be making a basic sale. Most economies have both basic and nonbasic sectors. Formal techniques exist for estimating whether or not a given sector is basic but the use of these techniques is beyond the scope of this report.

Agriculture is the main basic industry in the area. Mining and manufacturing are the other primarily basic sectors. Without these basic sectors, many of the other sectors would not be able to sustain their current levels of output.

Examination of Tables III-8 and III-9 provides a useful insight into the area's economy. For each of the five years shown, farm earnings were the most important of all sectors.1/ Mining is a basic sector that is increasing in importance. The figures shown in Table III-8 are in constant 1975 dollars which means that values have been increased to reflect the general inflation level of 1975. The changes in total earnings, therefore, are mainly due to changes in real (physical) output of the economy rather than just general inflation. Some of the fluctuation, however, is caused by fluctuating prices. One must remember that price changes may occur

1/ Earnings are the sum of wages and salaries, other labor income and proprietor's incomes in each industry (U.S. Water Resources Council, 1972 OBERS Projections, Series E, Population, Vol. 1, p. 21). These are estimated by place of work.

Table III-8. Personal Income and Earnings by Sector, 1970-1974
Clarks Fork-Bighorn, Montana[1/]

	1970	1971	1972	1973	1974
Total Personal Income (1975 $1,000)	75,704	72,075	83,528	87,953	76,459
Per Capita Income (1975 $)	4,395	4,187	4,692	4,912	4,162
Per Capita Income Relative (U.S.=1)	.83	.77	.82	.82	.71
		Thousands of 1975 Dollars			
Total Earnings	58,226	53,232	64,806	65,236	53,051
Farm	24,793	18,049	29,222	27,398	13,647
Mining	D[3/]	D	D	D	3,994
Contract Construction	1,213	2,458	3,862	3,356	3,283
Manufacturing	3,667	2,228	1,978	1,574	1,518
Transportation, Communication and Public Utilities	2,153	2,172	2,236	2,330	2,333
Wholesale and Retail Trade	5,601	5,929	5,820	6,628	6,699
Finance, Insurance and Real Estate	1,224	1,350	1,301	1,337	1,372
Services	6,008	5,448	4,045	4,598	4,419
Federal Civilian Government	4,814	5,299	5,662	5,875	6,105
State and Local Government	6,767	7,303	7,900	8,407	8,552
Armed Forces	323	346	399	405	389
Other and Unaccounted For[2/]	1,663	2,650	2,381	3,328	740

1/ U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economics Information System, August 5, 1976.
2/ Due to disclosure problems of confidential data, earnings for some sectors for some counties could not be included in the proper sector, but it is included in the total. Consequently, some of those earnings belong to one or more of the other sectors, but there is no way of knowing which sector and how much.
3/ Figure suppressed to avoid disclosure of confidential information.

Table III-9. Percent of Earnings by Sector, 1970-1974
Clarks Fork-Bighorn, Montana[1/]

Source	Percent of Total Earnings				
	1970	1971	1972	1973	1974
Farm	42.6	33.9	45.1	42.0	25.7
Mining	D[2/]	D	D	D	7.5
Contract Construction	2.1	4.6	6.0	5.1	6.2
Manufacturing	6.3	4.2	3.1	2.4	2.9
Transportation, Communication and Public Utilities	3.7	4.1	3.5	3.6	4.4
Wholesale and Retail Trade	9.6	11.1	9.0	10.2	12.6
Finance, Insurance and Real Estate	2.1	2.5	2.0	2.1	2.6
Services	10.3	10.2	6.2	7.1	8.3
Federal Civilian Government	8.3	10.0	8.7	9.0	11.5
State and Local Government	11.6	13.7	12.2	12.9	16.1
Armed Forces	0.6	0.7	0.6	0.6	0.7
Other and Unaccounted For	2.9	5.0	3.7	5.1	1.5

1/ Based on Table III-9.
2/ Figure suppressed to avoid disclosure of confidential information.

for reasons other than inflation. For example, rising agricultural prices may be caused due to changes in supply and/or demand. These changes are also reflected in the 1975 base figures.

Total earnings in 1972 increased by $11.5 million over 1971. Direct earnings in the agricultural sector alone accounted for $11.2 million or 97 percent of the increase. In 1974 total earnings fell by $12.2 million from those of 1973. The decline of earnings in the farm sector alone amounted to $13.8 million. The reasons for these large changes in farm earnings will be examined later. Increased earnings in other sectors helped offset some of the impact of the reduced agricultural earnings.

Total personal income and per capita income are greatly affected by farm sector earnings.[2/] In 1972 and 1973 per capita income in the planning area had risen relative to 1971. With reduced agricultural earnings in 1974 came a decline in per capita income. In general, the area's per capita income has always been below that of the Nation. The strong dependence of the economy on agriculture accounts for the weak relative position.

Employment

Sector Employment

Another way of viewing the importance of various sectors is to look at employment. Employment numbers provide a picture of the various sectors that may be different from that provided by earnings.

2/ Personal income "consists of wages and salaries (in cash and in kind, including tips and bonuses as well as contractual compensation), various types of supplementary earnings termed other labor income (the largest item being employer contributions to private pension, health and welfare funds), the net incomes of owners of unincorporated businesses (farms and nonfarm with the latter including the incomes of independent professionals), net rental income, dividends, interest, and government and business transfer payments (consisting in general of disbursements to persons for which no services are rendered currently, such as unemployment benefits, Social Security payments and welfare and relief payments)." U.S. Water Resources Council, 1972 OBERS Projections, p. 20.

Examination of sector employment gives some indication of each sector's temporal growth. While employment does not directly reflect output, it does give one an indication of a level of output that is not masked by price changes. In most nonagricultural sectors, output tends to increase along with employment. However, productivity can color the picture provided by employment. For example, since productivity has continued to increase in the farm sector, output has gone up while employment has actually gone down; consequently, it is possible that employment figures could give a distorted view of the farm sector.

Total employment increased slowly from 1970-1974 (Table III-10). Most of the growth was in the nonfarm sector but total farm employment (proprietors plus wage and salary employment) also grew slightly. The nondisclosure policies of BEA make it somewhat difficult to tell which sectors actually experienced employment growth. It appears that mining and construction have experienced the highest percentage rates of growth since 1970, while the trade sector had the largest increase in absolute numbers of employees. Government employment also has gone up; most of the increase has been at the state and local levels. Manufacturing has fallen sharply since 1970.

Only recently, coal mining has become an important source of basic jobs in Big Horn County.3/ Carbon County, with large underground coal reserves, has not had a large scale mining operation for twenty years.

Unemployment

The unemployment rate of the planning area is shown to be higher (see Table III-11) than that of both the State and Nation until 1975, when the State and national rates rose sharply. Big Horn County exhibits a persistantly high unemployment rate which is probably due to presence of its large Indian population. Few Indian youths leave the Reservation to seek work elsewhere

3/ Includes data for the Decker operation which lies in the Tongue-Powder Planning Area.

Table III-10. Employment by Type and Broad Industrial Sources
Full and Part-Time Wage and Salary Employment Plus
Number of Proprietors, Clarks Fork-Bighorn, Montana[1/]

	1970	1971	1972	1973	1974
Total Employment	6,813	6,921	6,795	6,884	7,132
Number of Proprietors	2,194	2,203	2,214	2,192	2,169
Farm Proprietors	1,397	1,377	1,352	1,331	1,307
Nonfarm Proprietors	797	826	862	860	862
Wage and Salary Employment	4,619	4,718	4,551	4,692	4,963
Farm	670	728	731	730	792
Nonfarm	3,949	3,990	3,820	3,962	4,171
Government	1,421	1,478	1,504	1,549	1,647
Total Federal	406	408	423	415	482
Federal Civilian	406	408	423	415	482
Military	-	-	-	-	-
State and Local	1,015	1,070	1,081	1,134	1,165
Private Nonfarm	2,528	2,512	2,316	2,413	2,524
Manufacturing	422	271	238	208	80[D]
Mining	D[2/]	D	D	D	D
Construction	87	210	164	225	230
Trans., Comm. & Public Utilities	172	168	164	176	183
Trade	773	752	771	849	853
Fin., Ins. & Real Estate	105	121	121	139	152
Services	273	809	617	650	673
Other	D	D	D	D	D

1/ Compiled by Department of Natural Resources & Conservation, State of Montana. Data from U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economics Information System.
2/ A "D" indicates that data for one or more counties is not included due to nondisclosure policies of BEA. Total for private nonfarm is correct.

Table III-11. Average Annual Unemployment Rates
Counties of Clarks Fork-Bighorn, Montana
1972 Through 1975[1/]

County	1972	1973	1974	1975
		Percent		
Bighorn	7.5	8.5	9.8	9.1
Carbon	8.1	6.4	6.4	7.8
Planning Area	7.9	7.5	8.3	8.5
State of Montana	6.1	6.2	6.7	8.1
United States	5.6	4.9	5.6	8.5

1/ State and local data from Employment Security Division, State of Montana, Department of Labor & Industry; U.S. data from Council of Economic Advisors, Economic Indicators, September 1976.

as they appear to have a strong attachment to their place of origin and the predominantly agricultural economy cannot assimilate them.

Agriculture

At the present time agriculture is by far the most important sector in the area economy. Expenditures by the farm sector for the purchase of its inputs (e.g., machinery, fuel, fertilizer) are crucial to the output of other sectors. If agriculture were to disappear many other businesses would also disappear. Undoubtedly the economy will change over time, but it does not appear that agriculture will ever become unimportant.

Farm Size and Income

The number of farms and ranches in the planning area has declined by about 40 percent since 1949 (Table III-12). Total land in farms and ranches has changed very little over the same period of time; consequently, the average farm size has increased by about 49 percent from just about 2,000 acres to over 2,800 acres.

It is instructive to examine the value of agricultural products sold shown in Table III-12. Part of the increase shown is due to increased production. However, a large part of the increase, particularly between 1969 and 1974, was due to price. In 1969 the food grain index (wheat is a food grain) had sagged to 87 (price in 1967 = 100); by 1974 price increases had raised the index to 299.[4/] Feed grain prices (e.g., barley) followed a similar but less spectacular pattern. The index for meat animals was 165 in 1974, compared to 119 in 1969.[5/] The value of all agricultural production doubled in five years; food grain prices more than tripled

4/ U.S. Department of Agriculture, Agricultural Statistics 1975, p. 453.

5/ Ibid.

Table III-12. Farm Size, Value of Production and Farm Expenses
Clarks Fork-Bighorn, Montana[1/]

Source	1949	1954	1959	1964	1969	1974
Number of Farms (#)	1,860	1,711	1,432	1,337	1,214	1,177
Land in Farms (Acres)	3,598,377	3,339,264	3,858,602	3,081,205	3,473,038	3,399,879
Average Farm Size	1,935	1,952	2,695	2,305	2,861	2,889
Total Value of All Ag. Products Sold ($1,000)	16,134	17,431	19,643	18,926	31,314	57,492
Value of Crops Sold (Includes Nursery & Hay) ($1,000)	6,146	7,360	6,752	7,430	8,902	23,750
Percent of Total	38.1	42.2	34.4	39.3	28.4	41.3
Value of Livestock, Poultry & Their Products Sold ($1,000)	9,943	10,066	12,889	11,481	22,412	33,703
Percent of Total	61.6	57.7	65.6	60.7	71.6	58.6
Value of Forest Products Sold ($1,000)	45	6	2	2	-	38
Percent of Total	0.3	0.0	0.0	0.0	0.0	0.1
Farm Production Expenses[2/] ($1,000)	NA	NA	NA	NA	26,268	46,627

1/ U.S. Bureau of Census, Census of Agriculture for all farms.
2/ Not available for all farms until 1969.

in contrast to meat animal prices which increased by only 39 percent.

The reader may recall that farm earnings (Table III-8) dropped sharply in 1974 from 1973, after having increased substantially between 1972 and 1973. Agricultural price indexes help explain that event. The price indexes for the years 1972, 1973, and 1974 were 109, 214, and 299 respectively for food grains; 105, 162, and 242 respectively for feed grains; and 147, 198, and 165 respectively for meat animals. In short, both grains and meat animal prices increased substantially between 1972 and 1973. Between 1973 and 1974 grain prices continued up, but meat animal prices fell. Since the Clarks Fork-Bighorn is primarily a livestock producing area, agricultural income was more severely affected. While the value of agricultural products fell between 1973 and 1974, agricultural expenses increased across the nation by about 12 percent.6/ It is reasonable to assume that expenses in the study area went up in a similar manner. These changes combined to substantially reduce farm earnings of 1974 from those of 1973.

One often overlooked aspect of agriculture is the expenditures made by that sector for other items.

Farmers and ranchers tend to purchase many of their items locally, and in doing so they generate large amounts of business for local merchants. Even when earnings and net income are down for farmers and ranchers, they still have to make about the same amount of expenditures; consequently, short term income variations are probably not felt very strongly by the supplying sectors. If farm income was depressed over several years, the supplying sectors would also feel the crunch. The likelihood of such an event is probably higher due to weather than due to market conditions.

6/ Ibid., p. 465.

Crop and Livestock Production

In the past, wheat has been the largest crop produced in the area (Tables III-13, 14, and 15). More wheat is now grown on fewer acres than in 1949 due to increases in productivity. These increases in productivity reflect improved technology and better management.

Hay and feed grain production has also increased steadily since 1949. A large part of the production of hay and feed grains is used locally to produce livestock. As a consequence, the value of crops sold (Table III-12) does not fully reflect the true level of production; the value of roughage and feed grain crops is realized indirectly through sales of livestock.

Beef cattle and calves are the most numerous type of livestock produced in the area (Table III-16). The number of cattle and calves has almost doubled since 1949. Sheep and lamb numbers increased from 1949 to 1954 but have fallen by more than 50 percent since then. Milk cow numbers have declined steadily since 1949.

Table III-13. Historical Production of Irrigated and Nonirrigated Crops
Clarks Fork-Bighorn, Montana[1/]

Crop	Unit	1949	1954	1959	1964	1969	Base
Wheat	Bu.	1,695,938	1,954,635	1,929,377	2,254,925	2,186,942	2,572,067
Rye	Bu.	2,280	---	3,650	536	3,000	3,000[2/]
Corn for Grain	Bu.	10,438	3,035	1,770	3,410	65,900	257,267
Silage	Tons	---	9,087	32,519	40,476	24,250	178,100
Oats	Bu.	398,024	426,870	539,820	410,695	477,762	227,667
Barley	Bu.	456,594	537,429	795,806	1,117,300	1,596,053	1,195,033
Hay	Tons	114,553	157,866	165,513	195,622	179,027	292,822
Flaxseed	Bu.	9,255	---	1,750	---	---	---
Sugar Beets	Tons	60,100	153,144	174,762	203,139	313,942	125,423
Irish Potatoes	Cwt.	8,347	5,118	7,425	7,297	9,778	0
Dry Beans	Cwt.	133,154	88,025	66,236	78,619	33,694	43,200

1/ Source of data is U.S. Agricultural Census for years 1949 through 1969. The base is an average of SRS data for years 1972 through 1974 unless noted otherwise.
2/ 1969 Agricultural Census.

Table III-14. Historical Acres of Irrigated Crops Harvested
Clarks Fork-Bighorn, Montana[1/]

Crop	Unit	1949	1954	1959	1964	1969	Base
Wheat	Ac.	19,309	13,421	12,602	8,829	7,077	6,000
Corn for Grain	Ac.	267	88	37	59	1,000	3,367
Silage	Ac.	646	822	2,310	2,746	1,500	10,066
Oats	Ac.	7,790	6,898	8,043	4,681	3,980	2,033
Barley	Ac.	7,905	6,209	8,987	6,498	8,088	6,133
Hay	Ac.	41,704	52,040	49,450	47,287	53,169	78,633
Sugar Beets	Ac.	2,380	11,862	11,382	15,333	18,547	7,137
Irish Potatoes	Ac.	73	42	39	45	39	0
Dry Beans	Ac.	9,946	5,438	6,105	4,862	2,182	2,467

1/ Source of data is U.S. Agricultural Census for years 1949 through 1969. The base is an average of SRS data for years 1972 through 1974 unless noted otherwise.

Table III-15. Historical Acres of Nonirrigated Crops Harvested
Clarks Fork-Bighorn, Montana[1/]

Crop	Unit	1949	1954	1959	1964	1969	Base
Wheat	Ac.	94,252	76,120	59,304	72,687	65,594	75,667
Rye	Ac.	137	---	218	53	70	70[2/]
Corn for Grain	Ac.	119	25	17	0	4	0
Silage	Ac.	332	278	549	226	40	0
Oats	Ac.	3,371	4,869	4,098	3,564	4,329	2,133
Barley	Ac.	13,541	20,209	25,041	27,920	32,129	26,767
Hay	Ac.	49,891	51,099	50,733	55,998	42,261	57,300
Sugar Beets	Ac.	---	24	---	---	---	0
Irish Potatoes	Ac.	47	21	5	---	---	0
Dry Beans	Ac.	225	224	1	---	---	0

1/ Source of data is U.S. Agricultural Census for years 1949 through 1969. The base is an average of SRS data for years 1972 through 1974 unless noted otherwise.
2/ 1969 Agricultural Census.

Table III-16. Number of Head of Livestock
Clarks Fork-Bighorn, Montana 1/

Livestock	Unit	1949	1954	1959	1964	1969	Base
All Cattle & Calves	#	110,355	157,957	144,825	189,329	186,812	211,200
Milk Cows	#	6,708	6,093	4,189	2,977	1,521	800
All Sheep & Lambs	#	66,389	110,800	94,988	72,298	66,426	34,500
All Hogs & Pigs	#	9,258	8,129	12,567	14,207	15,743	16,750 2/
Chickens 4 Months & Older	#	76,273	84,130	59,495	40,418	26,812	12,550 2/
Horses & Ponies	#	---	5,530	4,217	---	4,117	3,098 3/

1/ Source of data is U.S. Agricultural Census for years 1949 through 1969. The base is 1974 data from SRS unless noted otherwise.
2/ 1972 and 1973 average.
3/ State of Montana, Report of State Department of Revenue - 1974. This estimate is used since Agricultural Census estimates exclude horses not on farms.

CHAPTER IV

PROJECTED REQUIREMENTS

The source of the information presented in this chapter is a collection of several Ad Hoc Group reports done specifically for this Level B Study. The reader is referred to the individual reports for more detailed explanations of the methodology used for each of the topics that follow.

Agriculture

The base figures shown above (Tables III-13 through III-16) in the discussion of the agricultural sector are also included in the following tables which present the OBERS projections for comparison. Since crop and livestock production and the amount of land used in that production tend to fluctuate from year to year, no one year is truly representative of the agricultural situation. To provide an accurate representation of the base condition, production data from 1972, 1973, and 1974 were averaged to represent the base year of 1975. Actual 1975 data was not used because it was not available at the time this work was undertaken.

The OBERS projections stemmed from work performed by the Office of Business Economics (OBE) and the Economic Research Service (ERS); OBERS is the acronym which combines the abbreviations of the two agencies.

The OBERS program arose from a need for a comparable data base that could serve the entire nation and its regions in a consistant and uniform manner. Although the OBERS projections are used in this planning effort, they in no way have restricted the use of other projections in the planning process.

Population growth, per capita income levels, crop and livestock prices, and foreign demand for commodities are a few of the more important variables used to formulate the OBERS projections at the national level. By assuming changes in the action of the variables, different sets of national demands can be projected. This report deals with two sets, the OBERS series E and E' projections.1/

The OBERS E' projections are more recent than the E projections, and reflect increased grain exports and increased agricultural productivity.

Once national projections were made, they were disaggregated to the various states; from there, they were disaggregated to the individual planning areas by the Agricultural Ad Hoc Group.2/

Nonirrigated Cropland

Table IV-1 illustrates the differences in the OBERS projections under E and E'. The series E projections show a decline of nearly 22,600 acres by the year 2000 due to a decline in the production of wheat. On the other hand the series E' projections shown an increase in the number of harvested acres by 2000--nearly 26,500 acres. The increase is due to an increase in production of feed grains and hay over current levels.

Irrigated Cropland

Total irrigated acres in the Clarks Fork-Bighorn are projected to decline by OBERS (Table IV-2). Therefore, it appears that there is no need to expand irrigation in the planning area over the next 25 years--given the projections in Table IV-2.

1/ The Department of Commerce, Bureau of Census, had made several series of population projections which they label as C, D, E, etc. Series E assumes a birth rate which will eventually result in no further population growth in the United States--except for immigration.

2/ See Agricultural Projections and Supporting Data, Agricultural Ad Hoc Work Group Report, February 1977.

Table IV-1. Projected Acres of Harvested Nonirrigated Crops for 1985 and 2000
Clarks Fork-Bighorn, Montana

Crop	Unit	Base[1/]	Series E		Series E'	
			1985	2000	1985	2000
Wheat	Ac.	75,667	56,639	51,780	65,576	64,519
Rye	Ac.	70[2/]	83	60	110	100
Silage	Ac.	0	7,886	9,761	9,698	13,267
Grain Sorghum	Ac.	170[2/]				
Oats	Ac.	2,133	3,917	3,420	4,464	5,188
Barley	Ac.	26,767	32,029	34,696	35,673	40,491
Vegetables	Ac.	1[2/]				
Hay	Ac.	57,390	37,459	39,810	52,832	64,871
Total	Ac.	162,108	138,013	139,527	168,353	188,436

1/ 1972-1974 average unless noted otherwise.
2/ 1969 Agricultural Census.

Table IV-2. Projected Acres of Harvested Irrigated Crops for 1985 and 2000
Clarks Fork-Bighorn, Montana

Crop	Unit	Base[1/]	Series E		Series E'	
			1985	2000	1985	2000
Wheat	Ac.	6,000	6,631	6,217	6,538	6,128
Corn for Grain	Ac.	3,367	2,015	377	1,560	435
Silage	Ac.	10,066	6,442	6,960	6,351	6,860
Oats	Ac.	2,033	3,694	3,704	3,642	3,650
Barley	Ac.	6,133	6,098	5,606	6,012	5,525
Vegetables	Ac.	637[2/]				
Hay	Ac.	78,633	63,950	64,526	63,054	63,599
Sugar Beets	Ac.	7,137	8,709	10,946	12,425	15,217
Dry Beans	Ac.	2,467	2,616	1,919	2,302	1,624
Total	Ac.	116,512	100,154	100,255	101,884	103,038

1/ 1972-1974 average unless noted otherwise.
2/ 1969 Agricultural Census.

However, Table IV-3 presents an OBERS forecast of increased cattle production in the planning area under both E and E'. This appears to be in direct conflict with the feed grain and roughage projections found in Table IV-2.

The Agricultural Ad Hoc Group felt that OBERS had fallen far short in relating its forecasted red meat production to the amount of grain and roughage needed to sustain that level of production. To more accurately reflect the effects of increased red meat production on demand for future irrigation, the group devised a means to modify the OBERS projections--so the "third projections" (3E and 3E') were evolved.

The best interpretation that can be given to the third projection is that it represents a high level of demand. That level assumes: (1) the OBERS livestock projections are about right; (2) the historical method of production (i.e., cow-calf rather than feeder operations) of cattle will continue in the future; and (3) there will not be a major shift in crop production away from cash crops such as wheat and sugar beets. Table IV-4 demonstrates needed future production (measured in feed units) of roughage and grain to meet the OBERS livestock projections.3/

Assuming that enough alfalfa is grown to remove the total deficit and to satisfy livestock demand for additional feed units in the Clarks Fork-Bighorn Planning Area (alfalfa contains 1100 feed units per ton), then an additional 32,000 to 34,500 new irrigated acres must be added by the year 2000. Another assumption here is that none of the additional demand for roughage is met by expanding nonirrigated acres. If this is the case, then the roughage demand for new irrigated acres would be that presented in Table IV-5.

3/ One feed unit is the food value of one pound of No. 2 corn. Agricultural Projections and Supporting Data, Part III, February, 1977.

Table IV-3. Projected Livestock Production for 1985 and 2000
Clarks Fork-Bighorn, Montana

Livestock	Unit	Base[1/]	Series E		Series E'	
			1985	2000	1985	2000
			Thousands			
Beef and Veal	Lbs.	64,120	85,218	97,762.2	85,039	105,093.7
Pork	Lbs.	3,720	5,966.7	6,837.9	5,689.6	6,856.4
Lamb and Mutton	Lbs.	1,636	2,335.3	2,056.0	886.5	721.3
Chickens	Lbs.	52	35.8	17.6	39.5	19.5
Eggs	Doz.	227	209.8	128.9	195.9	129.4
Milk	Lbs.	5,098.8[2/]	4,534	3,268	4,956	3,324

1/ 1974 data unless noted otherwise.

2/ Montana State Department of Business Regulation, Milk Price Control Board.

Table IV-4. Livestock Feed Units Produced and Consumed
OBERS Series E and E', 1985 and 2000,
Clarks Fork-Bighorn, Montana

Series	Feed Units Produced		Feed Units Required		Excess or Deficit Feed Units		
	Roughage	Grains	Roughage	Grains	Roughage	Grains	Total
E (1985)	896,183	129,498	1,093,771	118,576	-197,588	10,922	-186,666
E' (1985)	936,934	140,115	1,077,231	115,507	-140,297	24,608	-115,689
E (2000)	1,046,011	140,770	1,247,529	133-928	-201,518	6,842	-194,676
E' (2000)	1,120,499	164,809	1,325,961	140,174	-205,462	24,635	-180,827

Source: Agricultural Projections and Supporting Data, Agricultural Ad Hoc Group, February, 1977

Table IV-5. Base Acres, OBERS Projections, 3E, and 3E' for Irrigated Lands Clarks Fork-Bighorn, Montana

Projections	Acres	
	1985	2000
Base Year	116,512	116,512
OBERS E	100,154	100,255
OBERS E'	101,884	103,038
3E	156,719	151,044
3E'	136,941	148,701

In using these projections for planning purposes, it must be kept in mind that the 3E and 3E' forecasts indicate a high level of future demand while OBERS E and E' indicate a low level of future demand. Actual demand for agricultural products and related irrigated acres in the future lie somewhere in between.

Plate IV-1 locates existing irrigated lands and irrigable lands; there are approximately 304,921 irrigable acres in the planning area but only a small percentage is feasible for actual irrigation.

Saline Seeps

In recent years, the saline seep problem has been identified as a major threat to agricultural productivity throughout Central and Eastern Montana. According to a recent publication by the Montana Department of Health another less recognized, but equally important, problem is the long-term impact of saline waters on hydrologic systems (i.e., rural and domestic stock wells, ponds, reservoirs, springs, streams, and municipal water supplies).4/

4/ See Investigation of Salinity in Hydrological Systems in Montana, Water Quality Bureau--Department of Health and Environmental Sciences, July, 1975.

PLATE IV-1 IRRIGATED AND
IRRIGABLE LANDS

Legend

Irrigated Lands

Irrigable Lands

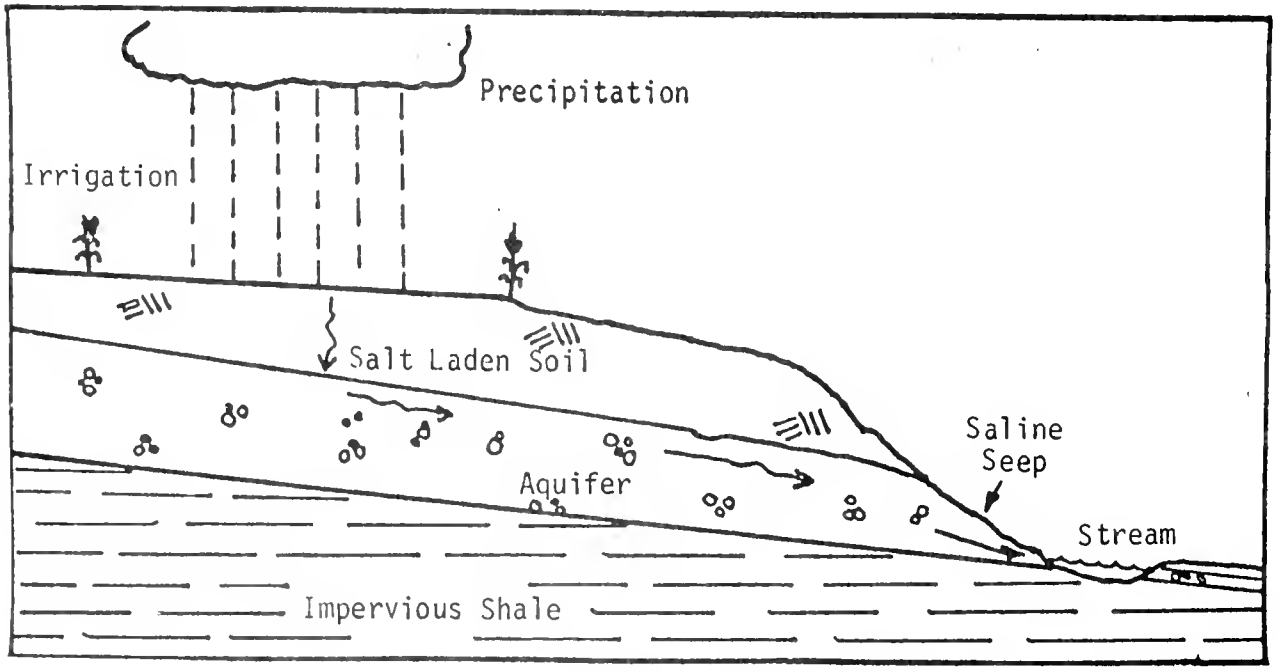
Drainage Boundary

YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY
MISSOURI RIVER BASIN COMMISSION

The portions of the Yellowstone Basin that have been affected by saline seeps are usually underlain by a thin aquifer which, in turn, lies over some thick, impervious shale or dense clay strata. The potential exists for many of these shallow aquifers to become polluted by saline waters given some impetus by man's farming activities. Shallow ground water represents a particularly valuable resource in Eastern Montana, where it serves as the primary source of water for man and animal alike; there are few alternative sources of water so pollution of the groundwater with salts would cause a real economic hardship in areas so affected.

Figure IV-1 Illustrates the dynamics of a saline seep. Water infiltrates a salt-laden solution. Naturally occurring salts, found in the soil, go into solution and move with the water through the soil into the aquifer. At this point, the saline water moves laterally through the aquifer above the impervious shale to a discharge area (i.e., a spring, seep, or stream).

Figure IV-1. Formation of a Saline Condition



In dryland farming areas, saline seeps appear to be directly related to farming methods that leave the land fallow. During wet years the moisture content of the soil will increase to the point where excess moisture percolates through the ground to an extent that a seep condition develops. Salts originating from overuse of water on irrigated lands may also cause seep conditions, and is also a growing problem in Montana.

Table IV-6 shows the number of acres affected by saline seeps and irrigation salinity in the Clarks Fork-Bighorn Planning Area.

Table IV-6. Estimated Acreage Affected by Salinity Conditions Clarks Fork-Bighorn, Montana[1/]

Planning Area	County	Acres	
		Saline Seep	Irrigation Salinity
Clarks Fork-Bighorn	Carbon	-	8,350
	Big Horn	1,000	9,000

1/ Source: Investigation of Salinity in Hydrological Systems - Water Quality Bureau, July 1975.

Domestic, Industrial, Non-Energy Mineral, and Livestock Water

Domestic

Table IV-7 shows projected population increases for the Clarks Fork-Bighorn Planning Area which relates to possible levels of energy (coal) development in Eastern Montana.[5/] Associated with each population figure is the amount of water consumed by that population. The consumptive use is roughly 35 percent of 185 gallons per person-day.[6/] Approximately 65 percent returns to the water ways as waste-water.

5/ See Current and Projected Population, Income and Earnings, Ad Hoc Group on Projections.

6/ Ad Hoc Work Group on Unit Water Requirements.

Table IV-7. Population Projections and Associated Consumptive Water Requirements Clarks Fork-Bighorn, Montana

Projection	Base Year	1985	2000
Current	18,600	-	-
af/y	1,074	-	-
Low	-	19,200	21,700
af/y	-	1,109	1,253
Most Probable[1/]	-	21,530	25,635
af/y	-	1,243	1,480
Extensive	-	21,460	26,590
af/y	-	1,239	1,535

1/ The "most probable" level represents the "future-without" situation in Montana.

At the present time, public and private wells serve 70 percent of the area's population while public surface sources serve the remaining 30 percent. Some residents are served by both.

Industry and Non-Energy Minerals

Within the industry category is included the manufacture of (1) petroleum, (2) food and kindred products, and (3) other.[7/] Non-energy minerals include: (1) stone, (2) sand and gravel, and (3) lime.[8/] Table IV-8 shows estimates of base and future consumptive water use by these sectors.

Table IV-8. Industrial and Non-Energy Consumptive Water Use Clarks Fork-Bighorn, Montana

Sector	af/y		
	1975	1985	2000
Industrial	-0-	-0-	-0-
Non-Energy Minerals	5	6	11
Totals	5	6	11

7/ U.S. Department of Commerce, Special Report Series: Water Use in Manufacturing, 1975.

Livestock

Water is consumed in two ways in its use by livestock--first through its actual physical consumption and second, through evaporation from stock ponds. Evaporation is significantly greater than actual animal consumption.

According to the OBERS projections the demand for red meat is expected to increase over the next 25 years. Tables IV-9 and IV-10 illustrate actual and evaporative consumption based on these projections.

Flood Control

The Corps of Engineers (COE) and the Soil Conservation Service (SCS) were given the task of describing flood damages and streambank erosion damages in the base year of 1975 and projecting those damages for the years 1985 and 2000.9/

The COE was given the responsibility for the main stem reaches having at least 400 square miles of drainage area. Complementing this, the SCS was given the tributary streams having less than 400 square miles of drainage area.

Both the COE and the SCS made their estimates and projections based on the Missouri Basin Framework Study and the National Streambank Erosion Assessment. In developing their data, they assumed that (1) current trends toward increased flood plain regulation would continue into the future; and (2) no additional structural measures (past 1975) would be added in the study area.

8/ See Non-Energy Mineral Industry Water Needs, Yellowstone River Basin Study Area, 1985 and Year 2000, Ad Hoc Group on Updating Minerals Data, May, 1977.

9/ See Flood Damages and Streambank Erosion Damages Along Main Stem Reaches, Corps of Engineers, December, 1976, and Flood Control and Streambank Erosion Needs: Drainage Areas Less than 400 Square Miles, Soil Conservation Service, November, 1976.

Table IV-9. Livestock Water Requirements
Clarks Fork-Bighorn, Montana[1/]

Animal Type	Water Requirements: Livestock af/y				
	Base Year	1985		2000	
		E	E'	E	E'
Beef	2,261	3,007	3,007	3,436	3,708
Milk Cow	21	19	20	13	14
Sheep	78	112	42	98	34
Hogs	60	96	92	110	110
Poultry		1	1	1	1
Horses	41	41	41	41	41
Totals	2,462	3,276	3,203	3,699	3,908

1/ Exclusive of evaporation from stockwater impoundments--See Table IV-10.

Table IV-10. Evaporation from Stockwater Impoundments
Clarks Fork-Bighorn, Montana.

Ownership	Number			Evaporation af/y[2/]		
	1975	1985	2000	Base	1985	2000
Private	1,132[1/]	1,279	1,358	9,056	10,232	10,864
Federal	13	15	15	104	120	120
Totals	1,145	1,294	1,373	9,160	10,352	10,984

1/ Estimate based on SCS data.

2/ Assume average of 2 acre feet in size and 4 af/y per acre evaporation.

Table VI-11 shows current flood damages in the Lower Yellowstone Planning Area by category: (1) crop and pasture, (2) other rural, and (3) urban. The SCS data on tributaries is shown in script. Table IV-12 displays current and projected flood damages for 1985 and 2000. Both tables indicate that damages from flooding of the tributaries is greater than that of the main stem reaches.

Existing data regarding streambank erosion damages could not be disaggregated to fit the Level B planning area. Therefore, streambank erosion damages for the Level B Study were developed by state as done in the National Streambank Erosion Assessment. Table IV-13 shows estimated streambank erosion damages for the years 1975, 1985, and 2000 for all of the basin's major rivers and their small tributaries. Streambank erosion may be caused by: the abrasive action of ice jams; banks caving during (and following) flood occurrences; and undercutting which may take place throughout the range of streamflows. Streambank erosion may be critical in local areas where it affects facilities such as highways, bridges, irrigation structures, or water plant intakes.

Indian Water Requirements

To understand the situation surrounding Indian water rights in Montana, one must first examine the "Federal reservation system or doctrine." In its simplest form, the reservation doctrine means that if the United States Government reserves a portion of the public domain for a Federal use which will ultimately require water, and intends to reserve unappropriated water for that purpose, then sufficient amounts of water for that use are reserved from appropriation by private users.

The effect of the doctrine is twofold: (1) when the water is eventually put to use, the water right of the United States will be superior to private

Table IV-11. Current (1975) Flood Damages Along Combined Reaches, Clarks Fork-Bighorn, Montana[1/]

Stream and Reach	Crop and Pasture	Other Rural	Urban	Total
		($1,000)		
Clarks Fork River				
Wyoming Line to Mouth	12	40	1	53
Bighorn River				
Wyoming Line to Mouth	10	13	0	23
Little Bighorn River				
Grass Creek to Mouth	25	30	1	56
Clarks Fork Tributaries	*49*	*10*	*41*	*100*
Bighorn Tributaries	*28*	*0*	*0*	*28*

1/ The table combines COE and SCS data. The SCS figures are shown in script.

Table IV-12. Current (1975) and Projected Flood Damages Along Combined Reaches, Clarks Fork-Bighorn, Montana[1/]

Stream and Reach	Area Subject To Flooding	Flood Damages		
		1975	1985	2000
	(1,000 acres)	($1,000)		
Clarks Fork River				
Wyoming Line to Mouth	10.5	53	56	60
Bighorn River				
Wyoming Line to Mouth	9.1	23	24	26
Little Bighorn River				
Grass Creek to Mouth	6.0	56	59	63
Clarks Fork Tributaries	*5.6*	*100*	*120*	*170*
Bighorn Tributaries	*17.5*	*28*	*34*	*48*

1/ The table combines SOE and SCS data. The SCS figures are shown in script.

Table IV-13. Streambank Erosion Damages, Level B Study Area: 1975, 1985, and 2000

Main Stems	Annual Damages 1975	1985	2000
		($1,000)	
Upper and Lower Yellowstone Planning Areas			
Yellowstone River	217	338	382
Main Tributaries[1/]	85	133	150
Upper and Lower Clarks Fork and Bighorn Planning Areas			
Clarks Fork River	32	49	56
Bighorn River	291	453	511
Upper and Lower Tongue and Powder Planning Areas			
Tongue River	55	85	96
Powder River	140	217	245
Montana Tributaries[2/]			
Yellowstone, Clarks Fork, Bighorn, Tongue, & Powder Rivers	61.5	95.7	108.1
Little Missouri River	7.8	12.1	13.6
Totals	69.3	107.8	121.7

1/ Drainages of more than 400 square miles.

2/ Drainages of less than 400 square miles.

water rights which were acquired after the date of the reservation; and (2) the federal use is not subject to state laws regulating the appropriation and use of water. The origin of the doctrine was set forth by the U.S. Supreme Court in the case of United States vs. Rio Grande Dam and Irrigation Company, 174 U.S. 680 (1899).

The cornerstone of the Indian water right issue is found in Winters vs. United States, 207 U.S. 564 (1908) which stated that when the Federal Government created the Fort Belknap Indian Reservation (Montana), it reserved not only the land, but also the use of enough water to irrigate the irrigable portions of those lands. This was based on the supposition that the Indians could not support themselves on the Reservation land without irrigation and that the Government had intended for the Indians to be self-supporting. Subsequent to this decision, other court cases have been added to this to become the body of law that is now known as the Winters Doctrine.

A significant case, United States vs. Ahtanum Irrigation District, 236 F. 2d 231, (CCA-9) (1956), aspects of which were litigated as late as 1964 330 F. 2d 889 (CA-9) (1964), resolved at least three important issues: (1) it was established that rights reserved by treaties are not subject to appropriation under State law; (2) alleged rights to water are not subject to the defense of laches or estoppel (the Indians did not lose their right to the use of the water because of their failure to make timely development); and (3) transferees, of fee patented Indian Allotments, acquired a vested interest in and right to distribution of the water.

Another benchmark case, Arizona vs. California, 373 U.S. 601, 835 Ct. 1498, 10 L. Ed. 578 (1963) held that Indian water could be used for industrial purposes and other uses not contemplated at the time of the treaty, and that the principles underlying the reservation of water rights for Indian Reservations are equally applicable to other Federal establishments.

Tweedy vs. Texas Company (C. 2738) U.S. District C. Montana (June 14, 1968) held that ground water was also included in the Indian Water right.

Litigation concerning Indian water rights in Montana's portion of the study area is currently pending in Federal District Court in Billings. Three lawsuits are pending; two of the actions were brought by the United States on its own behalf and on the behalf of the Crow and Northern Cheyenne tribes. The purpose of the suits is to have the water rights adjudicated in the Tongue and Bighorn River drainages. The third suit was brought by the Northern Cheyenne tribe on its own behalf to adjudicate the water rights in the Tongue River and Rosebud Creek. There are a few thousand private water users and several State agencies named as defendants in the three lawsuits.

Given the complexity and magnitude of the Indian water rights issue, the Yellowstone Level B Study has elected to treat water related developments on the Crow and Northern Cheyenne Indian Reservations in the same manner off-reservation development is being treated. At this time there are potential irrigation projects as well as energy related potentials that exist on Indian lands; the Hardin Bench unit is the most significant potential irrigation project lying across Indian lands (see Clarks Fork-Bighorn Chapter VI for a discussion of this project).

Instream Flows

The instream flow requirements for the Clarks Fork-Bighorn Planning Area were developed by the Montana Department of Fish and Game.[10/] The requirements found in this section are identical to those used by the Department in its water reservation request to the Montana Board of Natural Resources.[11/]

10/ See Instream Flow Needs Ad Hoc Work Group, Series of Memorandums from Liter Spence.

11/ See Legal Constraints on Resource Development in the Yellowstone River Basin, June, 1977.

Recommendations for the Clarks Fork are instream flows described as the monthly mean flows equaled or exceeded 60 percent of the time, over the period of record, from measurements at the USGS gages near Belfry and Rockvale.

Recommendations for the Bighorn River are based on records from 1968-1975 (post Yellowtail Dam). Since the Bighorn River accounts for about 30 percent of the flow of the Yellowstone at Miles City, recommendations were derived by comparing the occurrence of recommended flows of the Yellowstone at Miles City with the corresponsidng discharges from the Bighorn (considering the two-day travel time). In addition, the mean monthly discharge from Yellowtail Dam was compared to the discharges just described and the lower of the two figures was taken as the recommendation.

The instream flow requirements as presented in Table IV-14 will assure maintenance of the existing environment in and adjacent to the river. These requirements for the two rivers are based on physical/biological needs as follows:

Clarks Fork River: The area of most concern for fisheries is from the state line to Belfry, Montana. The entire river is important to riparian wildlife, waterfowl, and birds of prey.

Bighorn River: Flows are necessary to maintain the existing growth of aquatic plant and insect population needed to sustain the important trout fishery found from the afterbay dam to the mouth of the Little Bighorn River. Below the Little Bighorn, flows are necessary to maintain existing populations of channel catfish, sauger, and ling, and for potential paddlefish spawning. These flows are also needed to pass migratory species over the Manning and Kemph diversion dams during spring and fall months. March, April, and early May flows are necessary for protection of goose nests from flooding and predation.

Table IV-14. Instream Flow Requirements in the Clarks Fork and Bighorn Rivers.[2/]

Time Period	Sec. 1--Clarks Fork: MT-WY Line to Bluewater Creek		Sec. 2--Clarks Fork-Bluewater Creek to Mouth		Sec. 3--Bighorn River, Yellowtail Afterbay Dam to Mouth[3/]	
	CFS	Acre Feet	CFS	Acre Feet	CFS	Acre Feet
January	160	9,830	250	15,371	3,300	202,950
February	150	8,330	240	13,329	3,200	179,263
March	150	9,223	240	14,757	4,000	245,950
April	200	11,900	390	23,207	3,600	214,200
May 1-20	--	--	--	--	3,800	150,708
May 21-31	1,100[2/]	67,636	1,070[2/]	65,792	3,800	75,354
June 1-7	--	--	--	--	5,200	72,181
June 8-30	2,900[2/]	172,561	2,900[2/]	172,562	5,200	237,167
July 1-20	--	--	--	--	3,800	150,708
July 21-31	1,400[2/]	86,082	1,400[2/]	86,083	3,200	63,456
August	450	27,669	470	28,899	2,800	172,200
September	250	14,876	400	23,802	2,600	154,700
October	200	12,297	400	24,595	2,700	166,050
November	200	11,900	330	19,636	3,100	184,450
December	175	10,760	260	15,987	3,200	196,800
Totals		443,064		504,020		2,466,137

1/ Source: Instream Flow Ad Hoc Group

2/ Flow for the entire month

3/ Flow reflect operation of Yellowtail Dam

Energy

Although nearly 60 percent of Montana's total coal production currently takes place in Big Horn County, none of it lies within the Clarks Fork-Bighorn Planning Area.12/ The mining areas of Big Horn County do not lie within the drainage of the Bighorn River but within the lower reach of the Yellowstone and the upper reach of the Tongue River. Therefore, the reader is referred to the reports prepared for the Lower Yellowstone and the Tongue-Powder Planning Areas for information concerning coal-related energy developments. The reader should note, however, that the possible impact on this area from coal development (e.g., population) are considered in this report.

Outdoor Recreation

Water oriented activities are the major form of outdoor recreation in the area. The Forest Service, Park Service, and the State Department of Fish and Game provide camping and picnic sites associated with water bodies.

Bighorn Lake and portions of its adjoining land area have been designated a National Recreation Area, which is administered by the National Park Service. The Bighorn River below Yellowtail Dam is fast becoming known for its trout fishing and waterfowl hunting. Fishing on reservation land is presently restricted by the Crows for Indian use only.

Cooney Reservoir, in the Clarks Fork drainage, provides the public with fishing, water skiing, and boating opportunities. However, despite the apparent adequacy of water-oriented recreation in the area (Table IV-15), Cooney Reservoir is actually overcrowded which is due to heavy use made of the reservoir by recreationists from Billings.

12/ Western Coal Development Monitoring System, Federal Energy Administration, August, 1977.

Table IV-15. Demand for Surface Acres Related to Alternative Outdoor Recreation Requirements Clarks Fork-Bighorn, Montana[1/]

Activity	LOW			MOST PROBABLE		HIGH	
	1975	1985	2000	1985	2000	1985	2000
Swimming (Beach)	+1 WSA[3/] +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA
Water Skiing	-152 WSA -1 LSA	-208 LSA -1 LSA	-287 WSA -1 LSA	-287 WSA -1 LSA	-495 WSA - 2 LSA	-280 WSA -1 LSA	-521 WSA -2 LSA
Fishing[2/]							
Picnicking	+51 A	+50 A	+49 A	+49 A	+45 A	+49 A	+45 A
Nature Walks	-16 A	-19 A	-22 A	-22 A	-30 A	-21 A	-31 A
Boating/Canoeing	+401 WSA +8 LSA	+337 WSA +6 LSA	+277 WSA +5 LSA	+281 WSA +5 LSA	+72 WSA +2 LSA	+282 WSA +5 LSA	+50 WSA +1 LSA
Hunting[2/]							
Camping	+122 A	+120 A	+118 A	+118 A	+110 A	+118 A	+109 A
Hiking	-12 A	-14 A	-15 A	-15 A	-21 A	-15 A	-22 A
Playing Games/Sports	-6 A	-7 A	-8 A	-8 A	-11 A	-8 A	-11 A
Winter Sports	-1 ISA -2 SSA	-1 ISA -2 SSA	-1 ISA -2 SSA	-1 ISA -2 SSA	-1 ISA -3 SSA	-1 ISA -2 SSA	-1 ISA -5 SSA

1/ + indicates a surplus, - indicates a need.

2/ Data not provided.

3/ Numbers followed by abreviation "A" indicate Land Surface acres.
LS = Land Surface. WS + Water Surface. IS = Ice Surface. SS + Snow Surface. A = Acres.

Source: Bureau of Outdoor Recreation.

The Custer National Forest offers visitors camping and picnic areas. In addition, sightseers may visit caves on Forest lands in the Pryor Mountains and have tours provided by Forest Service personnel. The Beartooth highway, which crosses Forest lands, provides one of the most scenic drives in America and gives access to the beautiful alpine lakes on the Beartooth Plateau.

Although water-oriented recreation opportunities are great in the area, access points along the rivers are limited. If recreation opportunities are to be taken advantage of, then better access must be obtained for the public--especially in the face of a population influx from coal-related development in adjacent areas.

Projected Recreation Requirements

The methodology for deriving demand figures for activities in the area is a function of current and future population estimates.[13/] Participation rates were multiplied by the current and future population estimates for 1985 and 2000, producing estimated activity occasions. By using design load factors and standards for recreation activities, the total number of acres needed to support those activities was obtained. Acreage estimates needed to satisfy demand were developed by utilizing both land and water standards in the case of swimming, water skiing, and boating/canoeing. Winter sports were divided into the two categories of ice skating and snow skiing. The activities of driving and sightseeing were omitted because no standards were provided.

Table IV-15 shows needs for surface acres related to most types of outdoor recreation both in 1975 and in the future.[14/] From examination of

13/ See Outdoor Recreation Update, Recreation Ad Hoc Work Group, May, 1977.

14/ Since recreation estimates are tied to population estimates based on forecasted levels of coal-related development, the analysis shows requirements under the "low", "most probable", and "high" Harza scenarios.

the table, there appears to be a surplus of water-related recreational opportunities that exist in the Clarks Fork-Bighorn area. However, the "surplus" is severely limited by four major considerations: (1) the closure of the Bighorn River within the boundaries of the reservation to nontribal members by the Crow Tribe; (2) private landowners closing their lands to the public; (3) potential/possible impacts from increased population growth related to coal development; and (4) the large demand for water-related recreation from the Billings area.

Land Conservation

An acute awareness of the need for conservation of our basic resources--soil and water--has led the development and implementation of many conservation programs since 1940. Paramount among these programs are conservation farming techniques and improved forest and range management practices. The Multiple Use-Sustained Act of 1960 for National Forest Lands and the Federal Land Policy and Management Act of 1976 for the Public Domain Lands have added impetus to land conservation by ensuring that conservation values would not be sacrificed to exploit other sources.

Land conservation measures preserve and improve the land, water, and plant resources. Measures specifically designed to control wind and water erosion will also contribute to the reduction of flood hazards in rural and urban areas, improve water disposal in needed areas, and generally enhance recreational and fish and wildlife values. While measures may vary from one area to another, the long-term result common to nearly all measures is that of sustained or increased production. Land conservation measures, such as improved irrigation systems, would decrease water diversion requirements.

It has been estimated that stream sedimentation could be expected to

decrease by 7 percent for each 10 percent of additional land protected by adequate conservation measures. The draft report of the National Commission on Water Quality estimates that if land conservation measures are applied to all of the Nation's farmland, a 50 percent reduction in stream sediment loads could be achieved--as well as a related reduction in pesticides and nutrients that cling to the soil particles and are carried into the water-ways.

Soil and land conservation is an ongoing process; and many problems reoccur as time passes. Old conservation methods may be replaced by new ones; new problems replace old problems due to natural or manmade changes and as structural controls wear out or become obsolete. Erosion, from any cause, is a dynamic process and requires constant surveillance and corrective action.

The land conservation status, for 1975, on non-Federal land was developed by the Soil Conservation Service (SCS). The 1967 Conservation Needs Inventory was updated to provide a better understanding of current conservation needs and problems. The land conservation status for 1975 on most Federal land was developed by the Bureau of Land Management (BLM) and the Forest Service (FS). In addition, each of the two agencies estimated the 1985 and 2000 land conservation needs by analyzing trends from ongoing land conservation programs.15/

Land conservation measures were separated into two categories: (1) management only, and (2) management--vegetative and mechanical. Management practices that are needed on irrigated land include the proper application of irrigation water, crop-residue management, proper cropping systems, and maintenance of fertility. Some or all of these practices are needed on the remaining portion of the irrigated land. In addition, mechanical

15/ See Land Conservation Measures, Ad Hoc Work Group on Updating Land Conservation, May, 1977.

measures such as land leveling and smoothing, the installation of drainage ditches, and the improvement of on-farm distribution systems are needed on some lands. A more recent measure is the conversion from flood to sprinkler irrigation which improves water conservation. Costs were developed by the SCS for non-Federal lands and by BLM and FS for Federal lands.

Currently, 2,085,200 acres (60 percent) of total lands are adequately treated in the planning area.16/ This includes 494,200 acres of Federal lands and 1,591,000 acres of non-Federal lands.

Table IV-16 illustrates the need for increased land conservation measures on Federal and non-Federal lands in the Clarks Fork-Bighorn Planning Area. A significant need for land conservation is tied to private croplands (irrigated as well as non-irrigated). Non-Federal and Federal rangeland also would appear to benefit from increased conservation measures.

In determining the projected requirements for land conservation, it has been assumed that they include all land not now classified as adequately treated. For this reason, the projected requirements are the same for both 1985 and 2000. As of 1975, it is estimated that there were 1,371,220 acres that still needed the application of some land conservation measures before they could be considered as adequately treated. The total estimated cost to install this treatment is $29,554,000.

Fish and Wildlife

Degradation of Habitat

Settlement of the area by the white man began the degradation and destruction of wildlife habitat. Damage in this area has not been as severe

16/ Land on which the conservation measures essential to its sustained use have been applied.

Table IV-16. Projected Land Conservation Requirements
Clarks Fork-Bighorn, Montana

Land Use and Ownership	Acres	Dollars[1]/
Non-irrigated Cropland	75,000	4,125,000
Federal	0	0
Non-Federal	75,000	4,125,000
Irrigated Cropland	117,000	19,260,000
Federal	0	0
Non-Federal	117,000	19,260,000
Non-irrigated Pasture	9,000	270,000
Federal	0	0
Non-Federal	9,000	270,000
Irrigated Pasture	4,000	130,000
Federal	0	0
Non-Federal	4,000	130,000
Range	1,122,000	5,032,000
Federal	95,100	1,078,000
Non-Federal	1,027,000	3,954,000
Forest-Commercial	15,100	633,000
Federal	100	18,000
Non-Federal	15,000	615,000
Forest-Non-Commercial	29,020	104,000
Federal	2,020	36,000
Non-Federal	27,000	68,000
Other	0	0
Federal	0	0
Non-Federal	0	0
Total	1,371,220	29,554,000
Federal	97,220	1,132,000
Non-Federal	1,274,000	28,422,000

1/ Based on 1975 costs.

as in others because of the nature of an agricultural economy and the small human population.

However, potentials for coal and other mineral development exist and, if developed, may have a very large impact on the area's wildlife populations. In addition, the area is growing more attractive to urban dwellers for development for second home and suburban dwellings. Various agricultural practices, such as clean farming or use of pesticides that tend to be detrimental to fish and wildlife, will probably continue into the future.

Access

Many waters in the area are on or abut Indian or other private lands--making access a definite problem.

Closure of private lands happens often and has been an increasing trend over the last several years. About half of the area is covered by the Crow Indian Reservation on which non-Indian residents are not allowed hunting or fishing privileges.

Increase in Resource Use

Thirty-six species of fish inhabit the area's waters. A small number of fishing licenses is sold annually which reflects the small size of the population as well as the large number of Native Americans who are not required to have a license on reservation lands.

A few lakes and stream segments receive very heavy fishing pressure from people living outside the planning area--especially from Billings. This pressure has resulted in about 50 miles of stream segments receiving 80 to 100 percent of the use that they are capable of sustaining. These segments include (1) the Bighorn River from Saint Xavier to Yellowtail Dam--18.4 miles 17/; (2) Sage Creek--4.3 miles; and (3) Rock Creek

17/ Prior to Crow Indian Tribe restrictions.

from Roberts to above Red Lodge--26.9 miles.

Table IV-17 shows the area's fisheries and their use in 1975. The Montana Department of Fish and Game expects the numbers of sportsmen in the area to more than double in the period by the year 2020.

Table IV-17. Clarks Fork-Bighorn Fisheries, 1975

Water Type	Quantity	Fishermen Days Supply	Resident Fishermen	Non-Resident Fishermen
Salmonid Streams	370.7 miles	51,870[1/]	2,805[2/]	1,895[2/]
Non-salmonid Streams	73.7 miles	3,685[3/]		
Lakes and Reservoirs	9,912 acres	51,485[4/]	____	____
Totals		107,040	2,805	1,895

1/ Based on average catch rate of one trout per day.
2/ Estimated 3-year average of people buying fishing licenses in the planning area.
3/ Average of 50 man-days per mile of stream.
4/ Range of 20 to 50 man-days per acre.

CHAPTER V

FUTURE WITHOUT (F/WO) AND REMAINING NEEDS

The future "without" a plan (F/WO) is the level of assumed development that is expected to be initiated and carried through by the private sector, or by ongoing public programs. No new State and/or federally assisted developments are included when determining the F/WO.

The F/WO gives the State Study Team a place to begin its planning effort. If the F/WO meets all of the projected needs, then there is no need to plan for further development. On the other hand, if there are remaining needs beyond the F/WO, the Study Team may want to support development by recommending additional State and/or Federal projects designed to satisfy or mitigate the remaining needs.

The objectives above also apply to environmental needs (e.g., the need to maintain or enhance flows)--the process is identical.

Agriculture

Nonirrigated Cropland

In examining trends in nonirrigated cropland, the Agricultural Ad Hoc Work Group summed historical harvested acres and performed a correlation analysis on the data to see if a significant trend existed over time. None of the planning areas in Montana exhibited statistically significant increasing trends for nonirrigated harvested croplands.1/ Based on that analysis, the group projected that the number of nonirrigated acres would hold constant at their base value.

1/ See Agricultural Projections and Supporting Data, Agricultural Ad Hoc Work Group, February, 1977.

From the above analysis and assumptions, it appears that nonirrigated agriculture will be able to supply (through increases in productivity) a small portion of the roughage called for by the Ad Hoc Group's "third" projections (see Chapter IV). Most of the future agricultural production needed to mitigate or satisfy the projected requirements shown in Chapter IV will have to come from increases in roughage production on existing or new irrigated cropland.

Irrigated Cropland

The Montana State Study Team has set the F/WO increase in irrigated acreage in the Clarks Fork-Bighorn Planning Area at the rate of 300 acres per year--through the year 2000.2/ Table V-1 compares base year irrigated acreages with the F/WO, the OBERS projections (E and E'), and the "third" projections (3E and 3E').

Table V-1. Comparison of Alternative Irrigated Acreages, Clarks Fork-Bighorn, Montana

Situation	Acres	
	1985	2000
OBERS E	100,154	100,255
OBERS E'	101,884	103,038
Base Year	116,512	116,512
F/WO	119,512	124,012
3E	156,719	151,044
3E'	136,941	148,701

Differences between the F/WO and the OBERS and "third" projections are shown in Table V-2. The differences are shown in terms of surpluses (+) and shortages (-) in needed irrigated acres and defined as remaining needs.

The entries given in Table V-2 show the differences between the OBERS projections and the "third" projections (see the section of Irrigated Cropland in Chapter IV). Surplus acres occur when comparing the F/WO with

2/ Montana State Study Team Minutes, July 26-27, 1977.

Table V-2. Surpluses and Remaining Needs After F/WO Developments, Clarks Fork-Bighorn, Montana

Situation	Acres	
	1985	2000
OBERS E	+19,000	+24,000
OBERS E'	+18,000	+21,000
3E	-37,000	-27,000
3E'	-17,000	-25,000

the OBERS projections; they simply mean that according to OBERS the Lower Yellowstone will be producing on more acres than needed under the F/WO assumptions. However, when the OBERS forecasts of increases in beef cattle production (3E and 3E' projections) are used, there is a remaining need for new irrigated acres; as shown by the negative values in the table, they reflect the need for additional roughage that is not required under the E and E' analyses. At best, the values shown in Table V-2 may be considered merely to be indicators of the limits of future needs, suggesting the need for continuing and careful planning to keep production and need in a reasonable balance.

Saline Seeps and Irrigated Salinity

Areas of saline seep associated with nonirrigated croplands and irrigation salinity appear to have been increasing over the past several years (see Chapter IV for additional information). However, the F/WO status of saline lands cannot be determined because no data exist that accurately show the trend toward increasing amounts of saline lands; one estimate of the rate of increase in these lands has been 10 percent per year, which seems inordinantly high. The greatest problem is the emergence of saline seeps; however salinity problems associated with irrigation are now being documented and appear to be increasing.

Municipal, Industrial, and Livestock Water

It is assumed that all of the water needed for municipal, industrial, non-energy mineral, and livestock uses will be developed in the without situation. In other words, no matter what the level of development that is forecast for these users, the nature of that development is such that no SRD or NED projects will be needed to support it. The need for water by these users is relatively small, and they will be able to appropriate their own water at any foreseeable level of development. Therefore, there are no remaining needs beyond the F/WO. Table V-3 illustrates projected water consumption by such users in the Clarks Fork-Bighorn Planning Area.

Table V-3. F/WO Municipal, Industrial, Non-Energy Mineral, and Livestock Consumptive Water Needs

	af/y		
	Base	1985	2000
Municipal[1/]	1,074	1,243	1,480
Industrial[2/]	0	0	0
Non-Energy Minerals[3/]	5	6	11
Livestock[4/]	11,700	13,200	14,000
Totals	12,779	14,449	15,491

1/ Based on most probable level of energy development. See F/WO energy section in the Tongue-Powder or Lower Yellowstone Reports.

2/ Based on Bureau of Domestic Commerce Data.

3/ See Non-Energy Mineral Water Needs, Ad Hoc Group on Updating Minerals Data, May, 1977.

4/ Derived from F/WO Livestock Projections.

Flood Control

The Flood Control Ad Hoc Group, in updating flood damages, assumed that current trends toward increased flood plain regulation would continue

into the future. The group assumed also that no additional structural measures would be added to mitigate flood damages. Therefore, the F/WO is represented by the projected requirements shown in the section on flood control in Chapter IV (see Table IV-12). Table V-4 re-introduces the projected requirements as remaining needs, given no structural F/WO solutions for the Lower Yellowstone Planning Area.

Table V-5 depicts the remaining needs for the control of streambank erosion; again, no structural solutions are taken into account. The table re-introduces Table IV-13 of Chapter IV.

Indian Water Requirements

At the present time, the water requirements of the Crow and Northern Cheyenne Indian Tribes are unknown. The tribes have been advised not to participate in the Level B Study so as not to prejudice existing and pending litigation concerning the use of water on and adjacent to the two Indian reservations.

However, rather than ignore Indian resources and potentials on tribal lands, the Level B Study considered tribal resources and potential projects (e.g., the Hardin Unit) that were known and treated them in the same manner as those that are found off of the reservations. On this basis no separate F/WO was formulated to account for or estimate Indian Water requirements.

Energy

Since coal-related energy development takes place only in adjacent drainages (Lower Yellowstone and Tongue), no F/WO situation (aside from population impacts) pertaining to coal was developed for the Clarks Fork-Bighorn Planning Area. The reader is referred to this section in the Lower Yellowstone and Tongue-Powder Planning Area Reports for the F/WO situation and remaining needs related to coal development in Eastern Montana.

Table V-4. Flood Damage Remaining Needs
Clarks Fork-Bighorn, Montana1/

Stream and Reach	Area Subject To Flooding	Flood Damages		
		1975	1985	2000
	(1,000 acres)	($1,000)		
Clarks Fork River				
Wyoming Line to Mouth	10.5	53	56	60
Bighorn River				
Wyoming Line to Mouth	9.1	23	24	26
Little Bighorn River				
Grass Creek to Mouth	6.0	56	59	63
Clarks Fork Tributaries	*5.6*	*100*	*120*	*170*
Bighorn Tributaries	*17.5*	*28*	*34*	*48*

1/ The table combines COE and SCS data. The SCS figures are shown in script.

Table V-5. Streambank Erosion Remaining Needs
Clarks Fork-Bighorn, Montana

Main Stems	Annual Damages 1975	1985	2000
		($1,000)	
Upper and Lower Yellowstone Planning Areas			
Yellowstone River	217	338	382
Main Tributaries[1/]	85	133	150
Upper and Lower Clarks Fork and Bighorn Planning Areas			
Clarks Fork River	32	49	56
Bighorn River	291	453	511
Upper and Lower Tongue and Powder Planning Areas			
Tongue River	55	85	96
Powder River	140	217	245
Montana Tributaries[2/]			
Yellowstone, Clarks Fork, Bighorn, Tongue, & Powder Rivers	61.5	95.7	108.1
Little Missouri River	7.8	12.1	13.6
Totals	69.3	107.8	121.7

1/ Drainages of more than 400 square miles.

2/ Drainages of less than 400 square miles.

Outdoor Recreation

Although private enterprise can (and does) provide some measure of water-based outdoor recreation in the Yellowstone Basin, the extent of the industry, which is known to be minor, has not been specifically identified. For purposes of this study, it has been assumed that the projected requirements for outdoor recreation also represent the remaining needs. The needs are tied directly to population. Table V-6 shows the needs based on the "high" and "most probable" levels of development of the coal industry. The "most probable" is included because it represents the F/WO situation of coal-related development.

Land Conservation

It is reasonable to assume that land conservation measures will continue to be implemented in the F/WO situation through ongoing Federal programs. Table V-7 shows the F/WO and the remaining needs for the Clarks Fork-Bighorn Planning Area, given continuation implementation of existing and ongoing land conservation programs.

Figure V-1 further explains Table V-7 by illustrating land conservation status over time and by ownership and use. Private range and nonirrigated cropland appear to have the greatest need for land conservation treatment.

Fish and Wildlife

According to a draft of the Montana Department of Fish and Game's Strategic Plan, a surplus of salmonid, non-salmonid, and waterfowl populations will exist throughout the Yellowstone Basin at least to the year 1982; projections of supply and demand beyond this point do not exist. However

Table V-6. Remaining Needs for Outdoor Recreation
Clarks Fork-Bighorn, Montana[1]/

Activity[3]/	MOST PROBABLE		HIGH	
	1985	2000	1985	2000
Swimming (Beach	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA	+1 WSA +2 LSA
Water Skiing	-282 WSA -1 LSA	-495 WSA -2 LSA	-280 WSA -1 LSA	-521 WSA -2 LSA
Picnicking	+49 A	+45 A	+49 A	+45 A
Nature Walks	-22 A	-30 A	-21 A	-31 A
Boating/Canoeing	+281 WSA +5 LSA	+72 WSA +2 LSA	+282 WSA +5 LSA	+50 WSA +1 LSA
Camping	+118 A	+110 A	+118 A	+109 A
Hiking	-15 A	-21 A	-15 A	-22 A
Playing Games/Sports	-8 A	-11 A	-8 A	-11 A
Winter Sports	-1 ISA -2 SSA	-1 ISA -3 SSA	-1 ISA -2 SSA	-1 ISA -5 SSA
Hunting[2]/				
Fishing[2]/				

1/ Estimates of outdoor recreation needs were obtained by subtracting supply from demand. For further explanation see Outdoor Recreation Update, Clarks Fork-Bighorn Planning Area, Recreation Ad Hoc Work Group, May, 1977.

2/ Data furnished for the entire Level B Study, but not disaggregated to planning areas.

3/ + indicates a surplus. - indicates a need.

LS = Land Surface
WS = Water Surface
A = Acres
IS = Ice Surface
SS = Snow Surface

Table V-7. F/WO and Remaining Land Conservation Needs on Federal and Non-Federal Lands, Clarks Fork-Bighorn, Montana[1/]

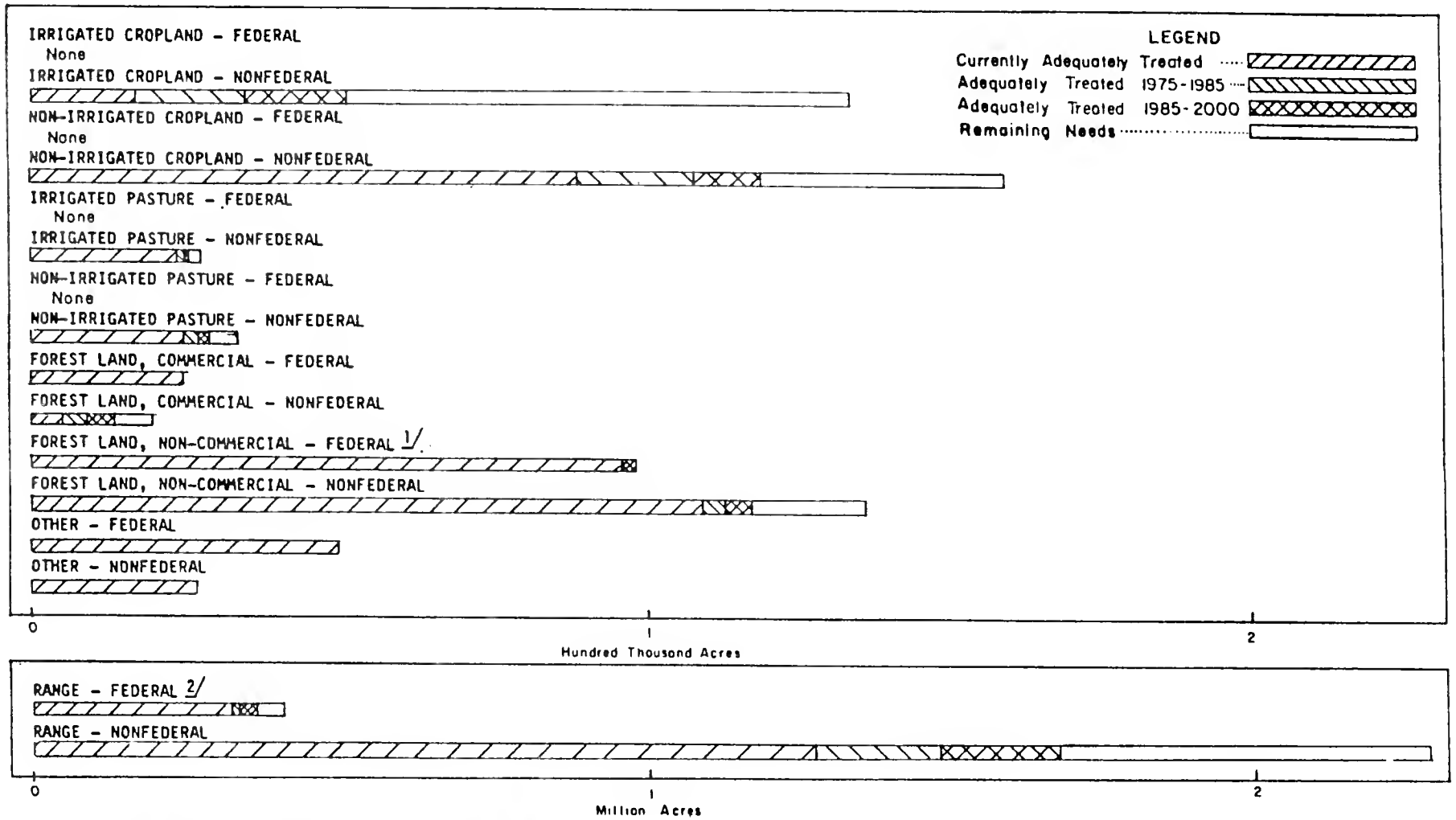
Situation	Acres		
	1975	1985	2000
Adequately Treated:			
Non-Federal	1,591,000	1,844,000	2,094,000
Federal	494,200	512,360	540,420
Total Adequately Treated	2,085,200	2,356,360	2,634,420
Remaining Needs:			
Non-Federal	1,274,000	1,021,000	771,000
Federal	97,220	79,060	51,000
Total Remaining Needs	1,371,220	1,100,060	822,000

1/ Estimates for Federal Lands were made by the Bureau of Land Management and Forest Service. The Soil Conservation Service developed the estimates for non-Federal lands. Each agency developed the 1985 and 2000 F/WO projections by analyzing the trends from ongoing conservation programs.

it is probably safe to say that, due to probable degradation of habitat in the future, the supply of harvestable wildlife will not increase enough to meet increased future demands by hunters and fishermen.

In general, the F/WO is affected by four factors: (1) continuing degradation and loss of habitat; (2) lack of access; (3) a fixed supply; and (4) increasing demand. It is unlikely that the private sector will enter the fish and wildlife business (e.g., big game ranches, private waterfowl and fishing developments) until shortages become apparent and encourage profitable entry. Therefore, until 1982 the remaining needs may be measured as a surplus and private entry into the fish and wildlife industry is not expected. However, the loss and degradation of habitat, as well as limited access to sportsmen, have to be accounted for in a different manner; thus the remaining needs related to habitat and access must be recognized as a shortage.

Figure V-1. Land Conservation Status
Clarks Fork-Bighorn, Montana



1/ Includes all BLM forest land as non-commercial
2/ Barren land and tundra are included in range

F/WO Impacts on Water Quantity and Quality

The impact of F/WO development on the area's water resources is shown in the Hydrology Supplement which is appended to the report. The Hydrology Supplement is discussed in greater detail in Chapter VII.

Opportunities

In order to meet the remaining needs as they were presented earlier in this chapter, various State and Federal agencies proposed various projects and programs to the State Study Team for consideration. These projects and programs comprised the total set of elements that were considered for the National Economic Development (NED) plan, the Environmental Quality (EQ) plan, and the State/Regional Development (SRD) that follow in Chapter VI, and later in the Recommended Plan of Chapter VII. Some of the following projects and programs were not accepted by the Study Team and were eliminated from further consideration for reasons shown in the footnotes.

Multipurpose Projects

	Source	New Irrigated Acres	Supplemental Irrigated Acres
1. Elbow Creek	SCS	1,800	5,000
2. Blue Water - Five Mile Creeks	SCS	--0--	5,350
3. Little Bighorn and Dunmore[3/]	USBR	24,900	10,300

Single Purpose Projects

	Source	New Irrigated Acres	Supplemental Irrigated Acres
1. Wyola - Lodge Grass Canal	SCS	2,900	--0--

3/ This project was rejected by the State Study Team because it could not meet either National Economic Development or State/Regional Development economic criteria (i.e., in this case a benefit/cost ratio of .85). Additional information about this project may be obtained from the U.S. Bureau of Reclamation, Billings, Montana.

Single Purpose Projects (continued)

	Source	New Irrigated Acres	Supplemental Irrigated Acres
2. Long Otter Pumping and Gas Field Pumping	SCS	2,170	--0--
3. Hardin Unit	USBR	42,800	950

Energy

	Source	Capacity
Yellowtail Afterbay Power Plant	USBR	10 MW

Land Conservation

	Source	Protected Acres
1. Accelerated Land Conservation Program	BLM and SCS	410,500
2. Streambank Greenbelt Program	State Study Team	Not Available

Fish and Wildlife

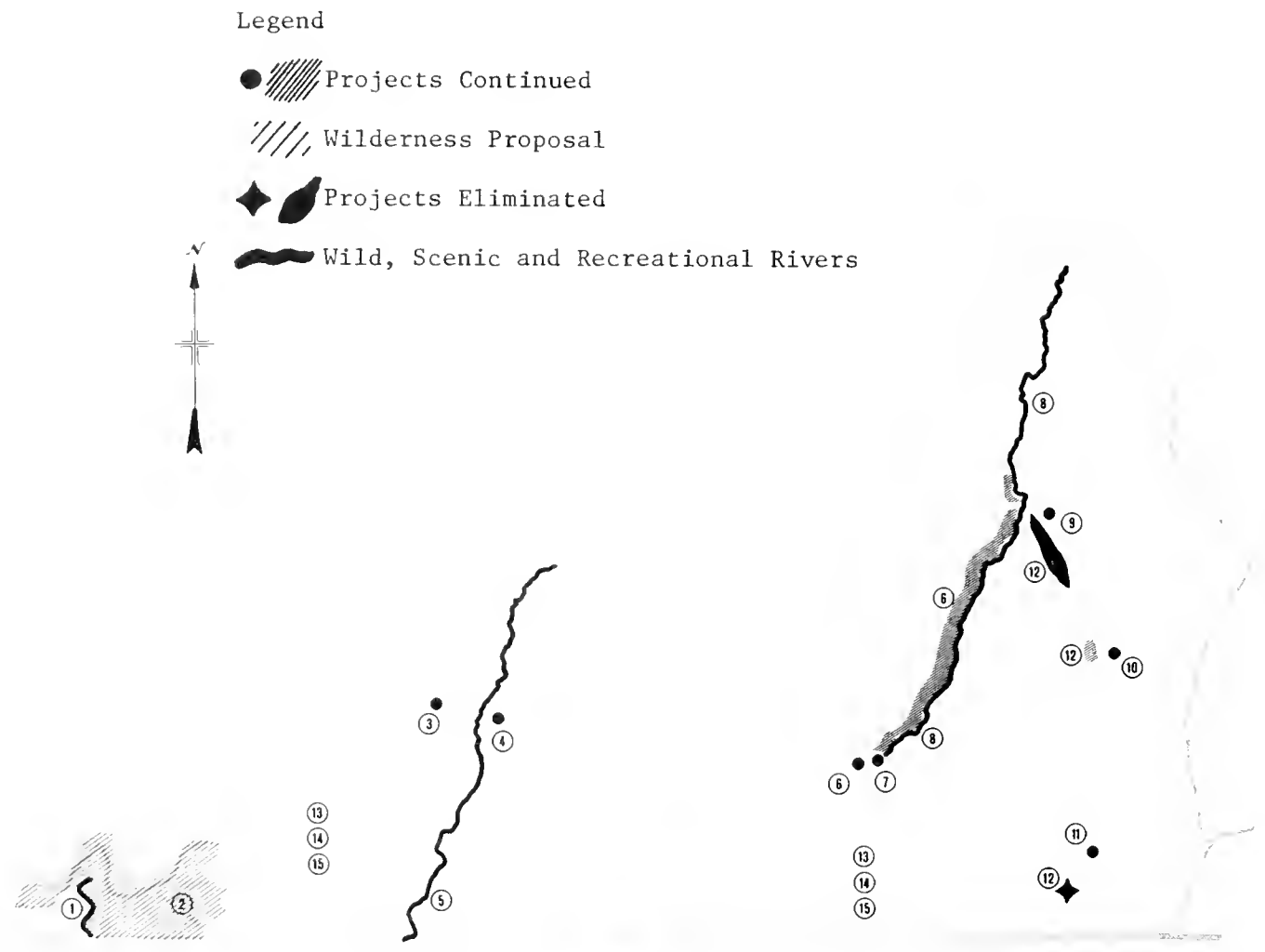
	Source
1. Support the Instream Flow Recommendation Made by the Montana Department of Fish and Game (DFG).4/	DFG
2. Classify the Beartooth and Absaroka Primitive Areas into a Single Wilderness Area.	State Study Team

Wild, Scenic, and Recreational Rivers

	Source
1. Bighorn River - 80 miles.	BOR
2. Clarks Fork River - 75 miles.	BOR
3. Clarks Fork River - 10 miles - U.S. Forest Service	BOR

4/ See the section on the Yellowstone Moratorium in Chapter II, the Instream Flow section in Chapter IV, and the EQ plan of Chapter VI for additional information.

PLATE V-1 LOCATION OF PROPOSED PROJECTS
AND PROGRAMS (OPPORTUNITIES),



YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY
MISSOURI RIVER BASIN COMMISSION

1. Upper Clarks Fork River Wild/Scenic
2. Beartooth Wilderness
3. Elbow Creek Storage
4. Blue Water - Five Mile Creek Storage
5. Lower Clarks Fork River Scenic/Recreational
6. Hardin Unit
7. Yellowtail Afterbay Power Plant
8. Bighorn River Scenic/Recreational
9. Gas Field Pumping
10. Long Otter Creek Pumping
11. Wyola - Lodge Glass Canal
12. Little Bighorn - Dunmore Unit
13. Streambank Greenbelt Program
14. Accelerated Land Conservation Program
15. Minimum Instream Flows

CHAPTER VI

PLAN FORMULATION

Principles and Standards

Criteria used for the evaluation of projects and formulation of the alternative plans set forth later in this chapter are those established under the multi-objective planning (MOP) approach of the U.S. Water Resources Council. Planning guidelines for the Yellowstone Level B Study conform with the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources, as published in the Federal Register of September 10, 1973.

Alternative plans for resource development and/or management for the Montana planning areas have been formulated to emphasize national economic development (NED), and environmental quality (EQ). A third, but partial, plan emphasizing state/regional development (SRD) has been included to identify projects that produce substantial local or regional benefits but that do not meet NED criteria. A fourth plan, called the Recommended Plan, is a combination of those projects or programs selected from the NED, EQ, and SRD plans that best meet the remaining needs outlined in Chapter V.

Plan formulation for the NED and SRD emphasis plans is tied primarily to the monetary benefit, cost and repayment evaluation of potential projects or programs (elements). The formulation criteria for retaining an element in the NED or SRD plan are that the results of the economic and financial appraisal of that element must show that user benefits exceed costs and that there is an apparent source of repayment of project costs. EQ plan formulation criteria do not relate to rigid economic standards but emphasize

enhancement, preservation, or management as the principal objectives. A combination of selected elements from the NED, SRD, and EQ plans makes up the recommended resource development and/or management plan for the Yellowstone Basin area; each of the four plans is described in more detail later in this chapter.

The beneficial and adverse effects of a proposed development are evaluated for the period of the useful life of the major project facilities, with an upper limit of 100 years. A discount rate of 6-3/8 percent has been used for the Yellowstone study. Benefits and costs occurring in different time frames over the period of analysis have been adjusted to comparable values by the use of the 6-3/8 percent discount rate. All costs and benefits are based on January 1975, prices.

The Four-Account System

Under the MOP procedures, each plan, regardless of which objective (e.g., NED, EQ, or SRD) is emphasized, is evaluated and displayed in terms of a four-account system--national, regional, environmental, and social factors accounts. This means that each project or program that is proposed for consideration in any of the plans is evaluated under the four-account system also.

Benefits and costs for the national and regional accounts are expressed as monetary values but also include a descriptive analysis of beneficial and adverse effects. For the other two accounts--environmental and social factors--the main emphasis is in identifying and evaluating changes that would occur with a plan and describing in a succinct narrative the beneficial or adverse effects associated with the changes. A simplified display chart of the plans and accounts follows:

	Alternative Plan			
	NED	SRD	EQ	Recommended
National Economic Development Account				
Benefits	$	$	$	$
Costs	$	$	$	$
State/Regional Development Account				
Benefits	$	$	$	$
	(-----Descriptive terms-----)			
Costs	$	$	$	$
	(-----Descriptive terms-----)			
Environmental Quality Account				
Beneficial effects	(-----Descriptive terms-----)			
Adverse effects	(-----Descriptive terms-----)			
Social Factors Well Being Account				
Beneficial effects	(-----Descriptive terms-----)			
Adverse effects	(-----Descriptive terms-----)			

National Economic Development Account

Benefits evaluated under the national account are direct user benefits. User benefits are displayed for the traditional project multipurposes of irrigation, flood control, recreation, fish and wildlife, M&I water, power, etc. User benefits are measured as net income increases, damage reductions, or proxy values of alternative actions to direct project beneficiaries. Income increases may include the net increases in salaries or persons who actually work on the project during construction or operation, and who would be unemployed or underemployed in the absence of the project. Benefits may not include second-level effects such as income to businesses resulting from the project. National account costs are measured as the economic values placed on the resources required to implement a plan and place it in operation.

State/Regional Development Account

Benefits and costs evaluated under the regional account are delineated for incidence of occurrence within the boundaries of the Montana study area. These local effects generally are offset by their effects on the "rest of the

Nation," because they would have occurred elsewhere had the expenditures for the project been made elsewhere.

Regional monetary benefits are estimated for four income categories: user benefits, induced and stemming from effects, construction inpacts, and unemployment and underemployment effects. User benefits are defined the same as for the national account.

Induced and stemming effects are estimated as the income generated from implementing plan services that are in addition to user benefits. Construction impacts are estimated as the income increase accruing to the region from wage payments to imported labor forces during the construction period. Income increases to the unemployed and underemployed persons in the region are estimated as portions of the preceding two categories--induced and stemming effects and constructions impacts--and are assumed to be significant only during the early years of project life.

Local costs include local payments toward construction and operation, and regional tax contributions. Both adverse and beneficial effects, not evaluated monetarily, are to be measured in appropriate terms, described, and displayed in the local account.

Environmental Quality Account

A water and land use plan may have a variety of effects--beneficial and adverse--on the environment. While monetary effects do occur, effects on the environment are generally characterized by their non-market, non-monetary nature.

Environmental effects are contributions resulting from the management, preservation, or restoration of one or more of the desirable environmental characteristics of an area under study. Adverse environmental effects are consequences of proposed actions that result in the deterioration of environmental characteristics of an area.

Social Well Being Account

Beneficial and adverse effects on social factors are derived from a plan's success or failure in meeting social needs. The identification and satisfaction of social needs will relate to the social deficiencies expected to prevail in the study area without a plan as compared to the expected changes, social gains, or losses, with a plan.

The MOP guidelines for evaluating social factors were written to emphasize the effects on those users of projects or programs who have, without the project or program, failed to share in rising economic standards. This would seem to focus on the unemployed or underemployed persons which according to regional benefit evaluation criteria would be significant only during the early years of project life because of the assumed long-range, full employment situation nationally.

Procedures are not available to measure the social status of future beneficiaries. Opportunities for improving social status are available through implementation of resource development; however, documentation of the actual benefiting social group is not possible. Social effects are, therefore, evaluated and displayed only for the projects and programs that are included in the alternative plans, and are not considered as an end in themselves.

Display of Data

In order to provide consistency in the display of information for various projects and programs that have been analyzed, data have been set forth in the general format suggested by Figure VI-1. In some cases, the form itself has been used, in other cases, separate sheets have been used for each account, but the arrangement and coverage is the same in either case.

Project Formulation

When data for a project or program that has been suggested for inclusion in the planning area has been evaluated and tabulated under the four-account system, it is then possible and necessary to test the proposal in terms of its acceptabilities for inclusion in the various "objective" plans--National Economic Development (NED); State/Regional Development (SRD); and Environmental Quality (EQ). Each of these plans has specific requirements that must be met if a project or program is to be included in that plan, and to the extent that this is so, the proposal's attractiveness for inclusion in the Recommended Plan is enhanced. The Recommended Plan is a selection of those components of the other three plans that best satisfy the needs identified in Chapter V. No project or program may be included in the Recommended Plan unless it has qualified for at least one of the three objective plans.

Summary--Clarks Fork-Bighorn Planning Area

The National Economic Development (NED) plan in this planning area emphasizes the expansion of irrigated agriculture (Table VI-1). The largest project is the Bureau of Reclamation's Hardin Bench Unit which is proposed to irrigate 42,000 new acres. This project is the largest proposed within the Yellowstone Basin. There are five Soil Conservation Service proposals in the planning area. Two are multipurpose projects located in the Clarks Fork drainage; the remaining three are single purpose irrigation projects found on the Little Bighorn River.

The lone NED energy proposal is a USBR plan for addition of an 11 MW power plant to the afterbay dam below the existing Yellowtail Dam.

No State-regional planning elements were proposed for this planning area.

Portions of both the Clarks Fork and Bighorn rivers have been proposed for wild, scenic, or recreational designation in the Environmental Quality (EQ) plan. Adequate instream flows for maintenance of fish and wildlife are also an integral part of the EQ plan.

Table VI-1. Agricultural NED Projects
Clarks Fork-Bighorn, Montana

Project	Source	Type	Irrigated Acres	
			Full	Supplemental
Elbow Creek Project	SCS	Storage	1,800	5,000
Blue Water-Five Mile Creeks	SCS	Storage	---0---	5,350
Wyola-Lodge Grass Canal	SCS	Gravity	2,900	---0---
Long Otter Pumping Unit	SCS	Pumping	1,000	---0---
Gas Field Pumping Unit	SCS	Pumping	1,170	---0---
Hardin Unit	USBR	Gravity and Pumping	42,800	950
Totals			49,670	11,300

THE

NATIONAL ECONOMIC DEVELOPMENT

PLAN

National economic development is achieved by increasing the value of the Nation's goods and services, by utilizing additional resources, or by improving the efficiency of existing resource use. Theoretically, the best NED plan would produce the maximum net benefits (excess of projected monetary benefits over monetary costs). A satisfactorily developed plan with NED emphasis would meet the following minimum requirements:

1. User benefits are in excess of total economic costs;
2. Separable costs of each functional component are less than benefits or the alternative cost of producing comparable benefits;
3. Sufficient capability is available to repay all reimbursable costs;
4. Significant local and State support is available; and
5. Output from the plan will be used to meet near-to-intermediate-term needs.

A project or program may not be included in the NED plan unless it meets, or is expected to meet, all of the above requirements at the time of development.

Multipurpose Projects

Elbow Creek

The Elbow Creek Watershed lies in northcentral Carbon County at the confluence of Rock Creek and the Clarks Fork River. The Elbow Creek-Rock Creek fan, called Poverty Flat, is the widest part of the watershed.

There are about 215 farm units in the watershed, most being irrigated or having some irrigated land. Farm population is about 660 persons, and the urban population is about 1,200 persons. The largest town is Joliet with a population of about 400 persons.

Surplus early season runoff water of high quality is available from Rock Creek to store for late season use. A private irrigation canal diverts water out of Rock Creek and delivers it to a point near a good offstream

storage site. The elevation of this canal is such that it could be enlarged and extended to deliver water to the potential reservoir. A 884,700 cubic yard compacted earthfill dam with reinforced concrete pipe principal spillway and vegetated earthern emergency spillway would be constructed. The reservoir basin is principally State-owned rangeland with about 300 to 400 additional acres of private range needed for the reservoir and recreational facilities area.

The reservoir site is above the main canals serving Poverty Flat and would bring 1,800 acres of dry cropland into irrigation production and provide supplement-exchange water to increase production on 5,000 acres above the project area.

Structural development would include a new diversion structure on Rock Creek at the present point of diversion for the Highline Canal; a reconstruction, enlargement, and extension of the Highline Canal; a drop structure into Elbow Creek; a multipurpose reservoir in Sections 9 and 16, T5S, R22E; and recreational development, including a boat ramp and campground facilities.

Delivery to irrigated lands would be accomplished by conveying water down Elbow Creek to a new diversion for the Last Chance Canal and on to lower canals. On the higher elevation drylands, small new supply ditches would be constructed.

The drainage area of about 38 square miles above the dam site would provide an estimated 3,200 acre-feet of annual water yield and require about 700 acre-feet of sediment storage capacity. An additional diversion of 7,800 acre-feet of water per year from Rock Creek would bring total usable storage to 11,000 acre-feet.

Water-based recreational needs in the watershed are largely a function of the close proximity of Billings and the heavy tourist traffic to

Yellowstone Park. Full development of recreation potential in a reservoir on Elbow Creek would only partly relieve the intensive recreation pressure in the area. Fishing, water skiing, and camping would be principal recreation uses associated with the reservoir.

Bluewater-Fivemile Creek

Bluewater Creek and Fivemile Creek arise along the northwest slopes of the Pryor Mountains and discharge into the Clarks Fork River about 20 miles and 13 miles, respectively, upstream from Laurel, Montana.

The Bluewater Creek site is about three and one-half miles downstream from the Bluewater State Fish Hatchery on a narrow drainage emptying into the Clarks Fork River. Bluewater Creek, downstream from the hatchery, is excellent trout habitat, but is almost all private property with trespassing prohibited. The reservoir would provide additional resting area for migrating waterfowl and fishing access.

Structural measures would consist of a multipurpose reservoir on Bluewater Creek, basic recreational facilities, and a diversion from Bluewater Creek to the Orchard Canal. Storage capacity of the reservoir would consist of 1,100 acre-feet of sediment storage; 3,500 acre-feet of recreational water; 4,900 acre-feet of irrigation water; 400 acre-feet of fish and wildlife water to augment streamflow during peak irrigation; 400 acre-feet to offset evaporation; and 1,700 acre-feet for reservoir operation storage for a total of 12,000 acre-feet.

Provision of supplemental water for 5,350 acres of irrigated land would insure a full irrigation water supply.

The reservoir site, about 35 miles from Billings, would provide an excellent opportunity for recreational development for fishing and water skiing and help alleviate recreation pressure on existing water areas.

Wyola-Lodge Grass Canal

Population is estimated at 270 persons living on 54 farm units and 15 Indian residences.

The Wyola-Lodge Grass Unit would include a diversion structure on the Little Bighorn River below the Pass Creek confluence, 18.7 miles of new canals, and 5.7 miles of laterals. This direct diversion from the Little Bighorn River would irrigate an additional 2,900 acres. The project would deliver water to all of the 54 farm units.

The presently irrigated land has an adequate water supply, but needs improved irrigation water management to increase irrigation efficiencies and reduce sediment deposition into streams. There are about 7,000 acres of potentially irrigable land in the watershed identified by the Montana Department of Natural Resources and Conservation. Development of this land would enhance the economic and employment situation on the reservation. Underdevelopment of natural resources and underutilization of the labor force are major problems in the watershed and surrounding area. Employment opportunities are mostly agricultural but extremely limited.

Long Otter and Gas Field Pump Units

The Long Otter Creek and Gas Field Pump Units are small areas in the Little Bighorn watershed which lie entirely within the Crow Indian Reservation in Big Horn County, Montana. Population of the watershed is approximately 100 persons living on 23 farm units.

Underdevelopment of natural resources and underutiliziation of the labor force is a major problem in the watershed and surrounding area. The Long Otter Creek area is about eight miles south of Crow Agency. Water could be pumped from the Little Bighorn River to irrigate about 1,000 acres with a

maximum pump lift of 55 feet. The Gas Field Bench lies east of the Little Bighorn River near its confluence with the Bighorn River. Water could be pumped from the Little Bighorn River to irrigate about 1,170 acres with a maximum pump lift of 65 feet. There are sufficient natural recharge and irrigation return flow waters in the river at each pumping site to supply these irrigation pumping units and downstream demands. The land has been classified irrigable by the Montana Department of Natural Resources and Conservation.

Structural measures would consist of two pumping plants and their separate canal systems. The Long Otter Creek Pump Unit would consist of a concrete intake structure with skimming devices and multiple electric pumps. These pumps would deliver water to 5 miles of canals through a 3,000-feet-long, 30-inch-diameter pipeline.

The Gas Field Pump Unit would consist of a similar pumping plant. Water would be delivered through 300 feet of pipeline to three small canals with a total length of 10 miles.

Hardin Unit

Hardin Unit is proposed for development in conjunction with the existing Yellowtail Unit. Yellowtail Dam and Reservoir impounds flows of the Yellowstone River and would provide a reliable supply of water from a high level diversion. The first 325 feet of an outlet tunnel for this purpose was constructed in the left abutment of the dam.

The Hardin Unit Plan includes potential full irrigation service for 42,800 acres of land and a supplementary water supply to 950 acres. About 52 percent of the irrigable land is in Indian ownership. The unit is divided into three geographic areas; each would be served by a separate distribution system. Hardin Bench, which would be served by the Hardin Canal, contains 27,500 acres of irrigable land lying in a practically continuous strip two to three

miles wide and 40 miles long on the west bank of the river. The upper benches--Campbell, Beacon, and Woody--which would be served by the Campbell Canal, contain 12,700 acres of irrigable land that lies on terraces adjacent to and above the upper portion of Hardin Bench.

The Fort Smith area, which would be served by the Fort Smith Canal, contains 2,400 acres of irrigable land that lies on the east side of the river at the upper end of the unit. This area also includes the 950 acres of presently irrigated land which would be furnished a supplementary water supply from unit works.

Hardin Unit would require 862 cubic feet per second (cfs) of water be diverted through the outlet in the left abutment into the Grapevine Tunnel, which would carry the water 0.8 mile to the Grapevine Penstock. The penstock would be 1.2 miles long and would deliver 70 cfs to the Campbell Pumping Plant. The tunnel penstock, which would be under pressure, would supply the hydraulic turbines that would drive the pumps. This water energy would be used to pump 239 cfs into the Campbell Canal. The remaining 553 cfs, after going through the turbines and providing power for the pumps would discharge into the Hardin Canal.

The Hardin Canal, about 50 miles long, would have nine major inverted siphons with a combined length of about 6 miles, and would terminate in a 10 cfs wasteway carrying water back to the Bighorn River.

The Campbell Canal, about 12.5 miles long, would terminate in the lateral system on Woody Bench. Two major inverted siphons with a combined length of about 4 miles would be required to cross Hay Creek and Beauvais Creek.

The Fort Smith Canal, about 1.5 miles long, would cross the Bighorn River with a 12,465-foot-long inverted siphon near the Fort Smith community. A wasteway would be provided at mile-8 where the canal crosses Mountain Pocket Creek. The last reach would serve primarily as a supply canal for Soap Creek Ditch.

Unit lands are relatively flat, but contain some isolated low areas. Lateral construction would be relatively easy except for above-normal amounts of cut-and-fill. All laterals with a capacity of 50 cfs and less would be concrete-lined. The laterals under the three canals total to 142 miles in length and are divided as follows:

Area	Miles of Laterals
Hardin Bench	83
Upper Benches	51
Fort Smith	8
Total	142

Arable soils on Hardin Unit have developed from a fine-textured alluvium deposited on terraces and usually overlie a thick layer of sand and gravel. The depth of soil mantle over this incoherent sand and gravel layer ranges in thickness from 2 to 80 feet. Depth of the terrace soils usually is from 2 to 8 feet. The soils on the unit have retained most of their initial fertility and have good productive capacity. All crops adapted to the area will produce well with proper management.

The topography of the unit is characterized by surface irregularities, and moderate to heavy leveling would be required in some areas if the land were to be irrigated by gravity methods.

Numerous deep natural drainageways will limit the amount of facilities required to provide adequate drainage. Some rather heavy cuts would be required to take surface water out of the isolated low areas. Sand and gravel deposits underlying most of the irrigable land would enable good

surface drainage. The estimated requirements for drains are summarized below:

Area	Surface Drains		Subsurface Drains	
	Constructed	Channel Protection	Constructed	Channel Protection
Hardin Bench	43	32	42	28
Upper Benches	10	31	22	25
Fort Smith	4	2	6	0
Total	57	65	70	53

Prior to the completion of Boysen and Yellowtail Dams and Reservoirs, a substantial portion of the sediment in the Yellowstone River originated in the Bighorn drainage. However, since, 1965, the removal of sediment, stream depletion, and temperature moderation provided by Yellowtail Reservoir operations has allowed a valuable river fishery to develop from just below the dam to St. Xavier and beyond. The Bureau of Reclamation intends to maintain this fishery in as fine a condition as possible. To accomplish this, over $3,120,000 has been programmed for Hardin Unit drainage protection works.

Energy

Yellowtail Afterbay Powerplant

The Yellowtail Afterbay Powerplant would have a potential of 11.4 MW that could be constructed at the existing Afterbay Dam located about 2 miles below Yellowtail Powerplant. It would be operated in conjunction with the existing 250 MW Yellowtail Powerplant. Net generation would be 56 GWH/yr.

The powerplant would utilize the head ranging to about 30 feet between the Afterbay Reservoir and the Bighorn River for generation of power. The plant would contain four bulb turbines. The plant would be operated

to maintain the existing downstream regime of the Bighorn River in a manner equivalent to the present-day afterbay operation. It would require about 1 mile of 115 kV transmission line with terminal facilities at the plant and the existing 115-kV Yellowtail switchyard. The power output would be integrated into the Pick-Sloan Missouri Basin System.

Land Conservation

Accelerated Land Conservation Program

Under the accelerated land conservation program, 50 percent of the untreated lands that would have been left by the year 2000, given the present ongoing programs, would be added to the current programs and treated by that time. About 410,500 acres in the Clarks Fork-Bighorn Planning Area would be treated under the accelerated program.

Table VI-2 Display of Beneficial and Adverse Effects, NED Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
MULTIPURPOSE PROJECTS				
Elbow Creek Project SCS Wind/Bighorn Survey, Carbon County	First Cost 2,656,800 Annual Benefits 367,500 Annual Costs 200,200 Net Benefits 167,300	Beneficial Effects: 340-acre lake, increased water-fowl habitats, reduced water/wind erosion. Adverse Effects: Mud flats exposed with draw-down, 340-acre reduction of sagebrush habitat, preclude development of marginal coal deposit, slight increase TDS in streams.	User Benefits 367,500 Regional Benefits 162,900 Net Benefits 331,000	Beneficial Effects: Increased/stabilized income preserves family farms/help merchants, more seasonal jobs. Adverse Effects: Up to 16 construction workers for 2 seasons would benefit rather than have adverse impact on Joliet/Fromberg/ Bridger.
Blue Water--Fivemile Creek Project SCS Wind/Bighorn Survey, Carbon County	First Cost 2,750,900 Annual Benefits 315,900 Annual Cost 192,900 Net Benefits 123,000	Beneficial Effects: 310-acre lake, greening effect of irrigation, resting area for waterfowl. Adverse Effects: Mud flats exposed with draw-down, loss of 310 acres of sagebrush habitat.	User Benefits 315,900 Regional Benefits 128,400 Net Benefits 251,400	Beneficial Effects: Increased/stablized income would preserve family farms/ help merchants, more seasonal jobs. Adverse Effects: Up to 16 construction workers for 2 seasons would have no adverse impact on Fromberg and Bridger.
SINGLE PURPOSE PROJECTS				
Wyola-Lodge Grass Canal SCS Wind/Bighorn Survey (Upper Little Bighorn River), Big Horn County	First Cost 551,800 Annual Benefits 253,900 Annual Costs 34,700 Net Benefits 214,200	Beneficial Effects: Greening effect, ditchbank, wildlife habitat, reduced soil/wind erosion. Adverse Effects: Reduced river flows detri-mental to fishes/amphibians, higher TDS in River.	User Benefits 253,900 Regional Benefits 102,600 Net Benefits 316,800	Beneficial Effects: Population stabilization, save family farms, more seasonal jobs, more income to merchants. Adverse Effects: 6 to 8 construction workers for one season would not have adverse impact on community.

Table VI-2 (Cont.) Display of Beneficial and Adverse Effects, NED Plan
Clarks Fork-Bighorn, Montana

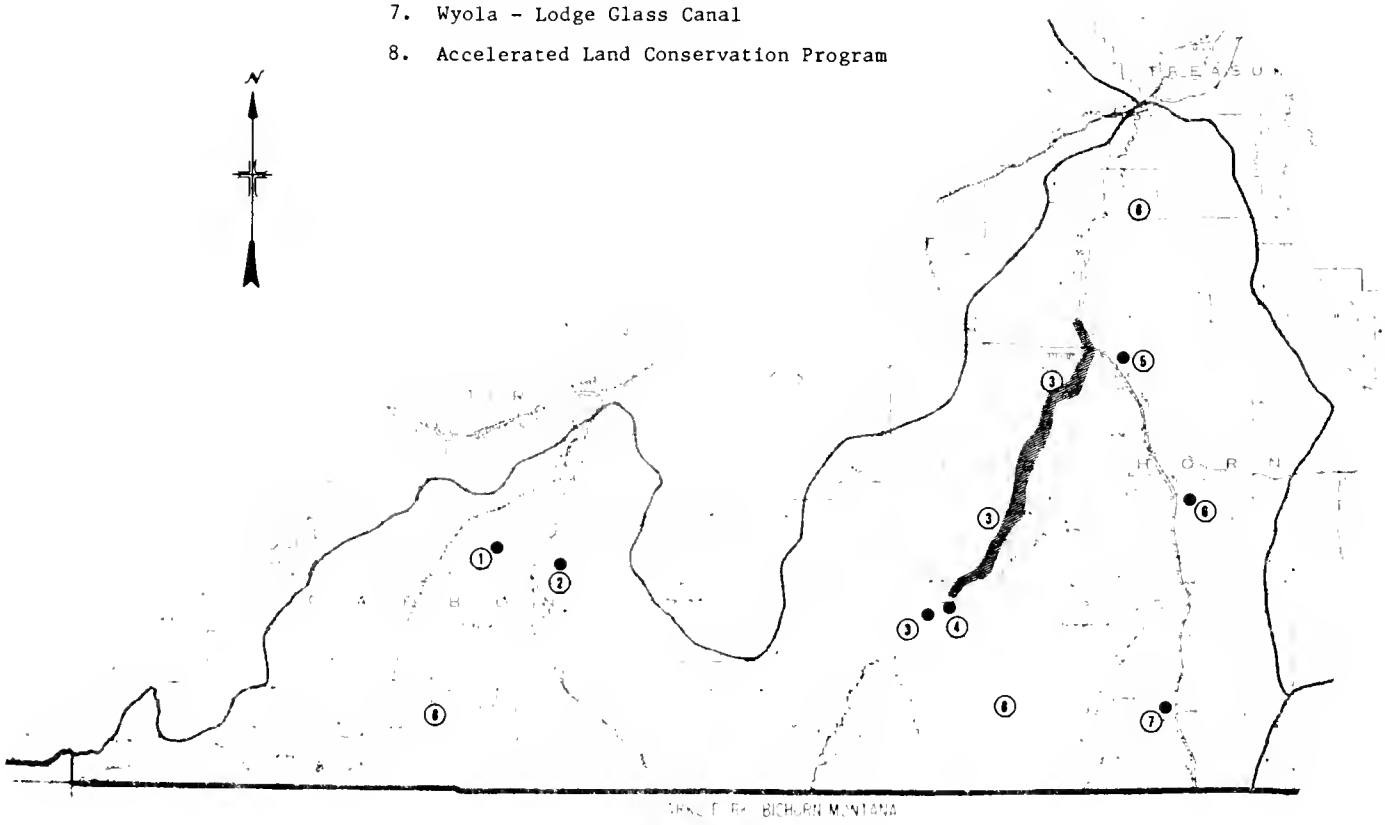
PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
SINGLE PURPOSE PROJECTS (Cont.) Long Otter and Gas Field Pumping Units SCS Wind/Bighorn Survey (Lower Little Bighorn Eastside); Big Horn County	First Cost 454,500 Annual Benefits 198,800 Annual Costs 38,700 Net Benefits 160,100	Beneficial Effects: Greening effect; create ditchbank habitat, reduce runoff sediment yield/wind erosion. Adverse Effects: Slight reduction in flows/ increase in TDS detrimental to warm-water fishes/ amphibians.	User Benefits 198,800 Regional Benefits 102,600 Net Benefits 316,800	Beneficial Effects: Improve income/stability of feed base for 12 ranches; more seasonal jobs, more income for merchants. Adverse Effects: 6 to 8 construction workers for one season would not have adverse impact on area.
Hardin Unit USBR Pick-Sloan Missouri Basin Program, Big Horn County	First Cost 66,731,000 Annual Benefits 6,221,400 Annual Costs 4,478,800 Net Benefits 1,742,600	Beneficial Effects: Upland game bird/waterfowl populations increase 100%; hydropowered pumping plant would not consume energy resources; muskrats and mink populations increase 200%; Bozeman Trail and Fort Smith sites would have public access and security; reduced wind erosion. Adverse Effects: Deer/antelope populations decrease 50%, features are visual intrusions; Bighorn Lake depleted 3%; TDS increase 3-6%, sulphate 4-7% in Bighorn River.	User Benefits 6,221,400 Regional Benefits 12,347,400 Net Benefits 14,090,000	Beneficial Effects: 131 additional farm units; 407 people directly involved in farm operation; increased/ stabilized income for farmers/merchants. Adverse Effects: 488 construction workers/ families including 166 school children.
ENERGY Yellowtail Afterbay Powerplant (Hydropower)--11 MW USBR Big Horn County	First Cost 10,490,000 Annual Benefits 1,127,800 Annual Costs 751,100 Net Benefits 376,700	Beneficial Effects: Opportunity to generate power in an existing dam, would not alter river flow. Adverse Effects: Visual impact of one mile of power line, would require effort to preclude se[illegible] short term river pol[illegible] during constructio[illegible]	User Benefits 1,127,800 Regional Benefits 503,000 Net Benefits 879,700	Provide employment for small operation and maintenance force. Increase Montana's power capacity.

Table VI-2 (Cont.) Display of Beneficial and Adverse Effects, NED Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
LAND CONSERVATION [illegible]rated Land Conservation [illegible]	[illegible] *Ann[illegible] – Not c[illegible]uted [illegible]ed to be at leas[illegible] to costs 6-3/8 percent [illegible]nterest for 25 years	[illegible] Improved quality of Fish and Wildlife habitat, including cover, forage, watering places, waterfowl resting sites, and establishment of fisheries. Reduce soil nutrients from entering streams and the underground water table. Reduction of undesirable return flows to streams. Adverse Effects: Additional depletion of streams due to increased consumptive use by added vegetative cover. Increased depletion of water resulting from added surface evaporation from ponds. Increase fire hazard from added production of forage plant species.	Ma[illegible] the [illegible]ices [illegible] [illegible] Provide [illegible] employment in pro[illegible]ssing increased goods and services.	Ensures that the resource will be available for use in the future. Downstream water quality and the general aesthetics of the land would improve.

PLATE VI-1 NED PROJECTS

1. Elbow Creek Storage
2. Blue Water - Five Mile Creek Storage
3. Hardin Unit
4. Yellowtail Afterbay Power Plant
5. Gas Field Pumping
6. Long Otter Creek Pumping
7. Wyola - Lodge Glass Canal
8. Accelerated Land Conservation Program



YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY
MISSOURI RIVER BASIN COMMISSION

THE
ENVIRONMENTAL QUALITY
PLAN

The objective of the Environmental Quality (EQ) Plan is the management, conservation, preservation, restoration, or improvement of the area's natural (or cultural) resources and ecological systems. Although the EQ Plan is not subjected to a benefit/cost analysis, the plan should reflect the most efficient and effective way of obtaining desired results.

Environmental quality is considered fully as important as economic development in the Level B planning process. However, EQ elements are frequently submitted with insufficient economic and/or physical data to be thoroughly evaluated. It is difficult to put a dollar value on environmental change, positive or negative; and often there is a lack of baseline data to properly evaluate the environmental effects of a man-caused change.

Fish and Wildlife[1/]

Instream Flows

The instream flow recommendations found in Table IV-16 and IV-17 for the Clarks Fork and Bighorn rivers have been adopted for the EQ Plan; these flows are the same as those requested by the Montana Department of Fish and Game in its instream flow reservation request. The Department of Health and Environmental Sciences has no such reservation request in this planning area.

Increased water withdrawals over existing levels will, in the long run, reduce the availability of habitat and consequently reduce the number of organisms which can healthily occupy that habitat. There is a limit to

1/ The Montana Department of Fish and Game has furnished much of the following EQ narrative in this and the other Montana Level B Reports.

the amount of water which can be removed from any stream channel without severely changing the quantity and type of the aquatic species present.

Reduced streamflows also affect the quality of water which is necessary to sustain these organisms. Possible consequences of reduced streamflows are higher water temperatures and increased amounts of dissolved solids. In short there are at least three ways reduced streamflow can adversely effect aquatic organisms: (1) reduction of the physical size or character of living space, (2) alteration of the food chain or reducing availability or food organisms, and (3) change of water quality which alters living conditions for plant and animal life.

Beartooth Wilderness Area

The creation of the Beartooth Wilderness Area would combine the Absaroka and Beartooth Primitive Areas into a unit ensuring the preservation and protection of a unique natural area that lies within the Upper Yellowstone and Clarks Fork-Bighorn planning areas.

Land Conservation

Accelerated Land Conservation Program

Under the accelerated land conservation program 50 percent of the untreated land that would have been left by the year 2000, given the present ongoing programs, would be added to the current programs and treated by 2000. About 410,500 acres in the Clarks Fork-Bighorn Planning Area would be treated under the accelerated program (identical to NED proposal).

Streambank Greenbelt Program

This program could be developed with the aid of the SCS, local soil conservation districts, and the 208 programs. The program would provide: (1) protection from streambank erosion; and (2) improved fish and wildlife

habitat. Existing denuded areas would be restored while forested and grassed areas would be protected from development.

Wild, Scenic, and Recreational Rivers

Bighorn River

The 50-mile reach of the Bighorn River from the Bighorn Canyon National Recreation Area to its confluence with the Yellowstone River is proposed as a potential scenic or recreational river to be managed by the State of Montana. The Montana State Comprehensive Outdoor Recreation Plan (SCORP) has noted that the Bighorn River "offers areas in which river floating and swimming may be engaged in," and "the demand for such water access probably will continue to increase in the future."

This segment is located near a considerable portion of the State's urban population, and the river and its environment can offer visitors recreation opportunities in fishing, hunting (waterfowl), camping, picnicking, sightseeing, canoeing, rafting, and other water-related activies, provided that agreements can be reached with the Crow Indian Tribe regarding Non-Indian usage.

Clarks Fork River

Two segments of the Clarks Fork River are proposed for possible designation, one for State designation and the other to be managed by the U.S. Forest Service. The first is the uppermost reach which heads above Cooke City and flows southward to the Wyoming border; at that point it joins the river segment recommended by the Wyoming Study Team to become part of the national system, and to be managed by the Forest Service.

The second is the 75-mile segment from the Montana-Wyoming border to the Yellowstone River. The major portion of the lands adjoining this reach

of the river is in private ownership. As with the Clarks Fork in Wyoming, adequate lands along this reach of the river should be acquired by easement or fee title and managed by the State to preserve future recreational values of the river and the historic values of the Nez Pierce Trail which follows the river course.

This plan includes acquisition of land in fee title for both major and minor access areas and acquisition of lands in easement for the protection of the river and its environment.

TABLE VI-3 Display of Beneficial and Adverse Effects
EQ Plan, Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
FISH AND WILDLIFE Instream Flows Same as reservation request of Department of Fish and Game. (See Tables IV-16 and IV-17.)	Beneficial Effects: Maintaining the recommended instream flows would tend to maintain water quality at its present level by preserving flows for the assimilation and dilution of wastes, thereby preventing increased water treatment costs to municipalities. These flows would stimulate river-based recreation and maintain quality water for existing irrigators. Adverse Effects: If implemented, these flows would make water unavailable for use in new full-service irrigation. Some irrigation expansion would probably occur but only with a partial water supply.	Preservation of existing fish and wildlife habitat and water quality. Prevents any further degradation.	Same as NED	Beneficial Effects: Increased employment for recreational oriented businesses. Positive effects on population as resource is maintained for recreational uses. Adverse Effects: Potential negative effects on agricultural employment. Possibly limits industrial and domestic future uses of river water-again limiting income and employment.
Classify the Beartooth and Absaroka Primitive Areas as a Wilderness Area.	Not Available	Maintain a unique natural area in its natural state.	Not Available	Not Available
LAND CONSERVATION Accelerated Land Conservation A. State and Private Lands 385,000 acres B. National Resource Lands 25,500 acres C. Forest Service Lands 0 acres	A. Cap. Cost $9,296,000 *Ann. Equiv. Cost $753,300 B. Cap. Cost $303,000 *Ann. Equiv. Cost $24,600 C. Cap. Cost 0 *Ann. Equiv. Cost 0 *Annual Benefits - Not computed - assumed to be at least equal to cost. 6-3/8 percent interest for 25 years.	Beneficial Effects: Improved downstream water quality for all uses. Improve general aesthetics of the land. Additional reduction of soil loss and sediment yield above future-without condition. Increased vegetative cover resulting from improved management of existing resources.	Maintain and/or enhance the output of goods and services to users in the region. Provide additional employment in the application and maintenance of proposed measures. Provide additional permanent employment in processing increased goods and services	Ensures that the resource is available for use in the future.

Table VI-3 (Cont.) Display of Beneficial and Adverse Effects
EQ Plan, Clarks Fork-Bighorn, Montana

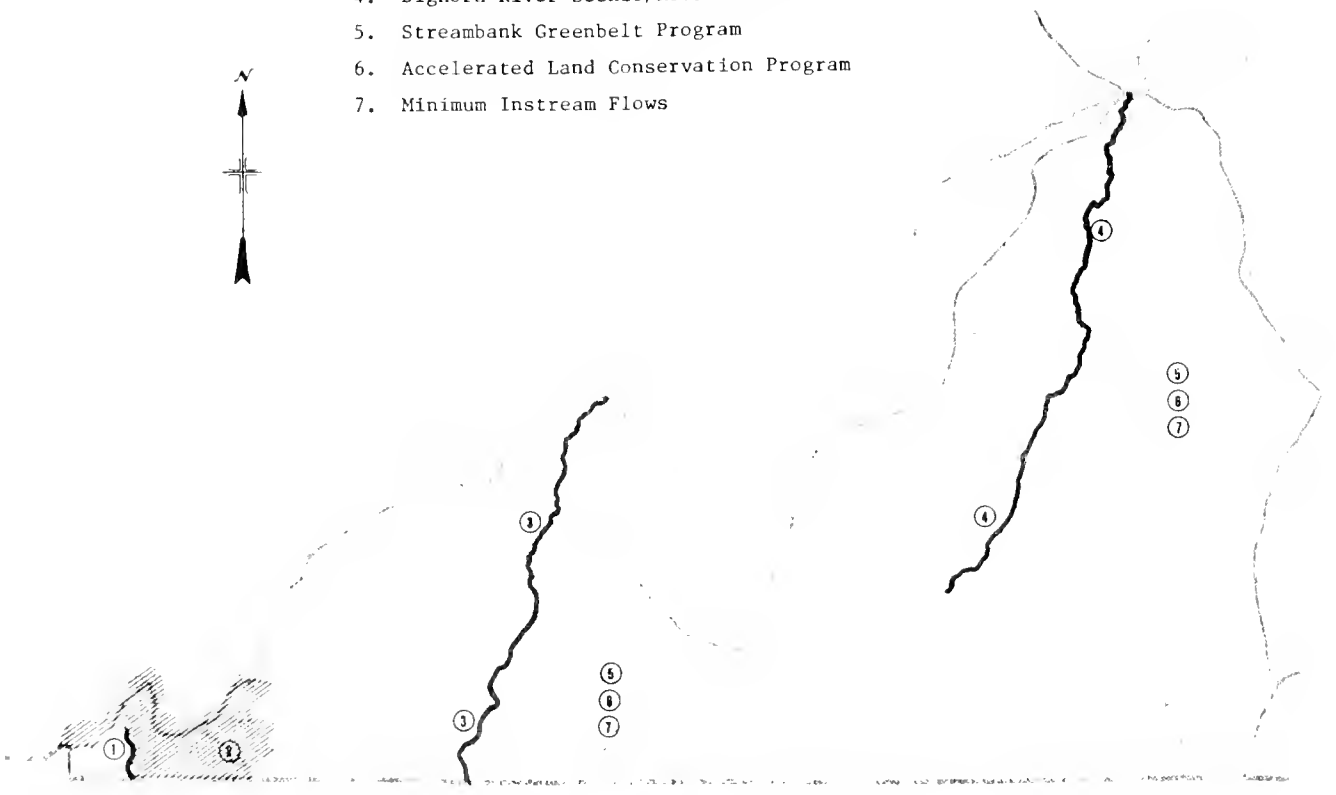
PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
LAND CONSERVATION (Cont.) Accelerated Land Conservation		Beneficial Effects: Improved quality of Fish and Wildlife habitat, including cover, forage, watering places, waterfowl nesting sites, and establishment of fisheries. Reduce soil nutrients from entering streams and the underground water table. Reduction of undesirable return flows to streams. Adverse Effects: Additional depletion of streams due to increased consumptive use by added vegetative cover. Increased depletion of water resulting from added surface evaporation from ponds. Increased fire hazard from added production of forage plant species.		
Streambank Greenbelt Program	Not Available	Program would add to fish and wildlife habitat while helping to prevent streambank erosion.	Not Available	Not Available
WILD, SCENIC, AND RECREATIONAL RIVERS Bighorn River Establish State scenic/ recreation river designation for the Bighorn River - Below Bighorn National Recreation Area to Yellowstone River - 50 miles. (Legislation establishing State designation is recommended.)	First Cost 8,044,000 Annual Benefits 525,000 Annual Costs 698,700 Net Benefits (173,700) 1/ 1/ Parentheses denote a negative number.	The natural beauty along these reaches of streams would be preserved for present and future generations. Flora and Fauna habitat values will be protected. A higher level of recreation use will be offset by better protection of the resource.	Tourism is a major contributor to the area and State economies. Recreation benefits resulting from preservation of these river reaches is in the State/regional interest.	The pleasures associated with river-oriented recreation are important to social well-being. Local residents as well as tourists relax and revitalize themselves through their association with the pleasures provided by nature.

Table VI-3 (Cont.) Display of Beneficial and Adverse Effects
EQ Plan, Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
WILD, SCENIC, AND RECREATIONAL RIVERS (Cont.) Clarks Fork River Establish State scenic/recreation river designation for the Clarks Fork - Montana-Wyoming border to Yellowstone River - 75 miles. (Legislation establishing a State scenic and recreational river system is recommended.) The Clarks Fork - Source to Montana-Wyoming border - to be administratively managed by the U. S. Forest Service as a wild/scenic river - 10 miles.	First Cost 11,946,000 Annual Benefits 307,100 Annual Costs 943,300 Net Benefits (636,200) 1/ 1/ Parentheses denote a negative number.	The natural beauty along these reaches of streams would be preserved for present and future generations. Flora and Fauna habitat values will be protected. A higher level of recreation use will be offset by better protection of the resource.	Tourism is a major contributor to the area and State economies. Recreation benefits resulting from preservation of these river reaches is in the State/regional interest.	The pleasures associated with river-oriented recreation are important to social well-being. Local residents as well as tourists relax and revitalize themselves through their association with the pleasures provided by nature.

PLATE VI-2 EQ PROJECTS

1. Upper Clarks Fork Wild/Scenic
2. Beartooth Wilderness
3. Lower Clarks Fork Scenic/Recreational
4. Bighorn River Scenic/Recreational
5. Streambank Greenbelt Program
6. Accelerated Land Conservation Program
7. Minimum Instream Flows



YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY
MISSOURI RIVER BASIN COMMISSION

CHAPTER VII

THE RECOMMENDED PLAN

Selection of Plan Elements

The plan described in this chapter is a selection of alternatives from the NED, EQ, and SRD plans that the Study Team considers acceptable for implementation if the necessary water supply can be made available. It is a known fact, however, that the flow in the Yellowstone system is not adequate to serve all of the needs of all of the plan elements. For example, the instream flow element, taken from the EQ plan, would preclude the provision of a full water supply for all of the irrigation described in the F/WO situation, plus that selected from the NED plan. Conversely, if all of the identified diversions were in fact made, they would significantly infringe on the instream flow needs.

No tradeoff analysis was performed to select the optimum combination of instream flows and diversion projects. This analysis was not made for several reasons, primary among which were (1) there was little time to do tradeoff analyses after the NED and EQ plans were completed, and more importantly (2) the Montana Departments of Fish and Game, and Health and Environmental Sciences had requests for reservations of water from the Yellowstone Basin pending with the Board of Natural Resources. These agencies were committed to defending their full request and were not able to accept a tradeoff-type Recommended Plan for the Level B Study that would compromise their request for a reservation. Under these conditions, no consensus on instream flows was possible, and the instream flows described in this plan are levels designed to meet a Fish and Wildlife and Water Quality objective rather than a recommended level formulated by tradeoff analysis. When the reservation issue has been decided by the Board of Natural Resources, it will be possible to determine

how many of the development proposals contained herein are compatable with that decision.

The number of elements that have been selected for the Recommended Plan is therefore greater than it would have been if reservation decision results had been immediately available to the Study Team.

Hydrology Supplement

The hydrology studies, released in the form of a supplement to the planning area reports, evaluate the Recommended Plans of each planning area.[1/] In Montana, the following set and subsets of projects (alternatives) were examined:

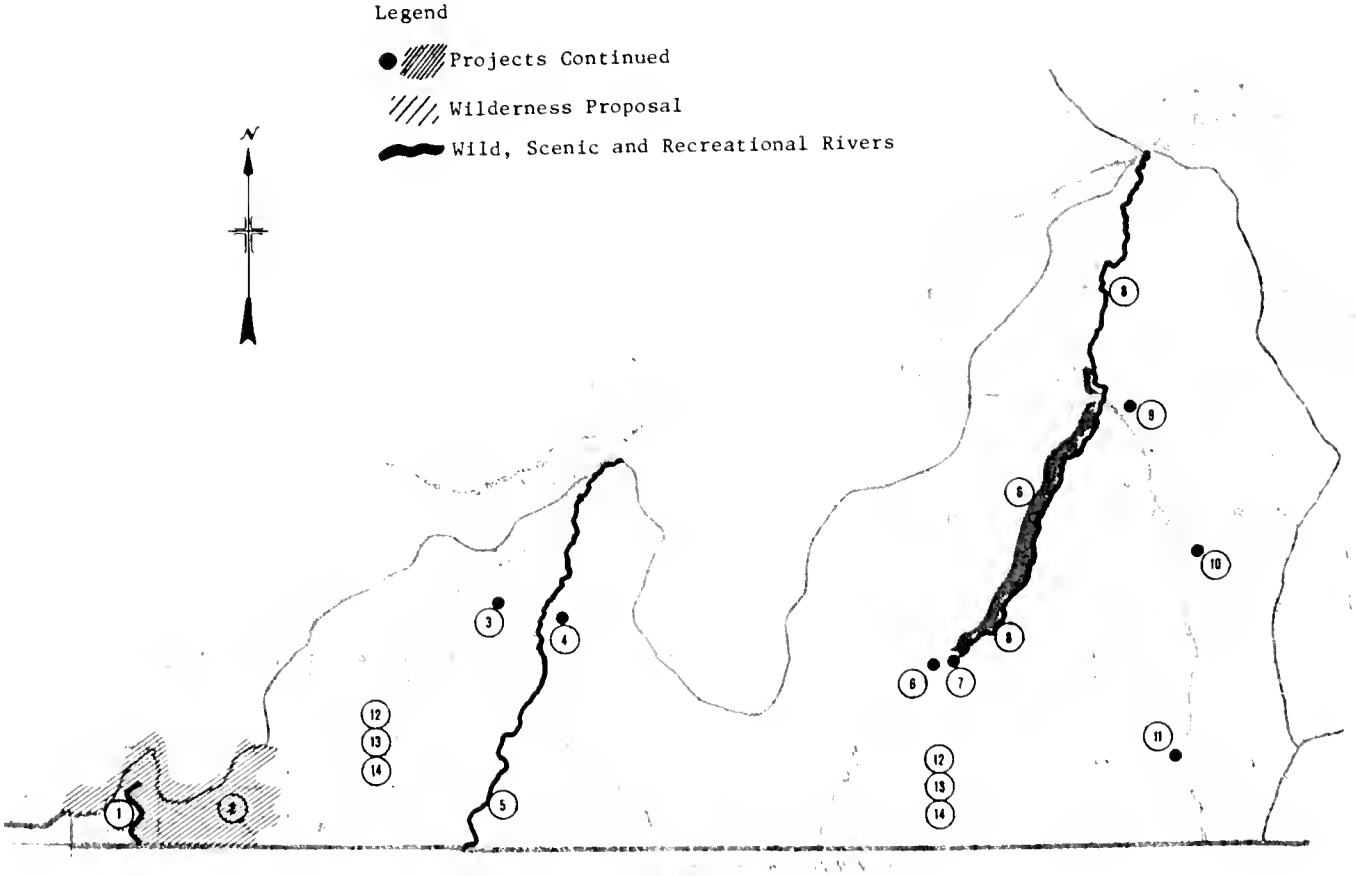
1. The F/WO situation.
2. All recommended projects.
3. Recommended projects minus SRD projects.
4. Recommended projects minus pumping and SRD projects.
5. Recommended projects minus storage and SRD projects.
6. Recommended projects minus the Hardin Unit and SRD projects.

In addition, a water quality analysis (total dissolved solids) is tied to each of the alternatives. Each alternative can be compared to the reservation requests (Chapter's II, IV, and VI) of the Montana Departments of Fish and Game, and Health and Environmental Sciences, and to other levels of instream flow that ultimately may be recommended.

The hydrology studies also assume a certain amount of private development which is represented by the F/WO situation described in Chapter V; therefore, all consumptive uses of water should be accounted for by the studies. The Hydrology Supplement is critical to proper assessments of the impacts stemming from the elements that follow in the Recommended Plan. It is hoped that the Plan, in conjunction with the Hydrology Supplement, can serve the people of the area in the sense that they may view the consequences of alternative courses of action.

1/ The U.S. Bureau of Reclamation conducted the hydrology studies from its Field Planning Office in Billings, Montana.

PLATE VII-1 ELEMENTS OF THE
RECOMMENDED PLAN



YELLOWSTONE BASIN AND ADJACENT COAL AREA LEVEL B STUDY
MISSOURI RIVER BASIN COMMISSION

1. Upper Clarks Fork River Wild/Scenic
2. Beartooth Wilderness
3. Elbow Creek Storage
4. Blue Water - Five Mile Creek Storage
5. Lower Clarks Fork River Scenic/Recreational
6. Hardin Unit
7. Yellowtail Afterbay Power Plant
8. Bighorn River Scenic/Recreational
9. Gas Field Pumping
10. Long Otter Creek Pumping
11. Wyola - Lodge Glass Canal
12. Streambank Greenbelt Program
13. Accelerated Land Conservation Program
14. Minimum Instream Flows

Display of the Plan

The elements selected for the Recommended Plan and their suggested implementation dates (subject to Level C studies) are shown in Plate VII-1. A summary of beneficial and adverse affects (four-account analysis) of each element is found at the end of this chapter in Table VII-1. In addition to these plan elements, the recommendations listed in Chapter X are also part of the Recommended Plan.

In the Clarks Fork-Bighorn Planning Area, the NED and EQ plans were combined to form the Recommended Plan with no alterations. However, it must be noted that F/WO development coupled with new irrigation projects are bound to affect the instream flow levels sought in the same plan. It is for just this reason that the elements found in this chapter should not be considered to be immutable--they must be considered in light of the forthcoming water reservations and the Hydrology Supplement. Narratives regarding the elements found in the Recommended Plan have already been presented in Chapter VI.

Table VII-1. Display of Beneficial and Adverse Effects, Recommended Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
MULTIPURPOSE PROJECTS				
Elbow Creek Project SCS Wind/Bighorn Survey, Carbon County	First Cost $2,656,800 Annual Benefits 367,500 Annual Costs 200,200 Net Benefits 167,300	Beneficial Effects: 340 acre lake, increased water-fowl habitats, reduced water/wind erosion. Adverse Effects: Mud flats exposed with draw-down, 340-acre reduction of sagebrush habitat, preclude development of marginal coal deposit, slight increase TDS in streams.	User Benefits $367,500 Regional Benefits 162,900 Net Benefits 331,000	Beneficial Effects: Increased/stabilized income preserves family farms/help merchants, more seasonal jobs. Adverse Effects: Up to 16 construction workers for 2 seasons would benefit rather than have adverse impact on Joliet/Fromberg/Bridger.
Blue Water--Fivemile Creek Project SCS Wind/Bighorn Survey, Carbon County	First Cost $2,750,900 Annual Benefits 315,900 Annual Costs 192,900 Net Benefits 123,000	Beneficial Effects: 310-acre lake, greening effect of irrigation, resting area for waterfowl. Adverse Effects: Mud flats exposed with draw-down, loss of 310 acres of sagebrush habitat.	User Benefits $315,900 Regional Benefits 128,400 Net Benefits 251,400	Beneficial Effects: Increased/stabilized income would preserve family farms/help merchants, more seasonal jobs. Adverse Effects: Up to 16 construction workers for 2 seasons would have no adverse impact on Fromberg and Bridger.
SINGLE PURPOSE PROJECTS				
Wyola-Lodge Grass Canal SCS Wind/Bighorn Survey (Upper Little Bighorn River), Big Horn County	First Cost $551,800 Annual Benefits 253,900 Annual Costs 34,700 Net Benefits 214,200	Beneficial Effects: Greening effect, ditchbank, wildlife habitat, reduced soil/wind erosion. Adverse Effects: Reduced river flows detrimental to fishes/amphibians, higher TDS in River.	User Benefits $253,900 Regional Benefits 102,600 Net Benefits 316,800	Beneficial Effects: Population stabilization, save family farms, more seasonal jobs, more income to merchants. Adverse Effects: 6 to 8 construction workers for one season would not have adverse impact on community.

Table VII-1 (Cont.). Display of Beneficial and Adverse Effects, Recommended Plan, Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
SINGLE PURPOSE PROJECTS (Cont.)				
Long Otter and Gas Field Pumping Units SCS Wind/Bighorn Survey (Lower Little Bighorn Eastside), Big Horn County	First Cost $454,500 Annual Benefits 198,800 Annual Costs 38,700 Net Benefits 160,100	Beneficial Effects: Greening effect; create ditchbank habitat, reduce runoff sediment yield/wind erosion. Adverse Effects: Slight reduction in flows/ increase in TDS detrimental to warm-water fishes/ amphibians.	User Benefits $198,800 Regional Benefits 102,600 Net Benefits 316,800	Beneficial Effects: Improve income/stability of feed base for 12 ranches; more seasonal jobs, more income for merchants. Adverse Effects: 6 to 8 construction workers for one season would not have adverse impact on area.
Hardin Unit USBR Pick-Sloan Missouri Basin Program, Big Horn County	First Cost $66,731,000 Annual Benefits 6,221,400 Annual Costs 4,478,800 Net Benefits 1,742,600	Beneficial Effects: Upland game bird/waterfowl populations increase 100%; hydropowered pumping plant would not consume energy resources; muskrats and mink populations increase 200%; Bozeman Trail and Fort Smith sites would have public access and security; reduced wind erosion. Adverse Effects: Deer/antelope populations decrease 50%, features are visual intrusions; Bighorn Lake depleted 3%; TDS increase 3-6%, sulphate 4-7% in Bighorn River.	User Benefits 6,221,400 Regional Benefits 12,347,400 Net Benefits 14,090,000	Beneficial Effects: 131 additional farm units; 407 people directly involved in farm operation; increased/stabilized income for farmers/merchants. Adverse Effects: 488 construction workers/ families including 166 school children.
ENERGY Yellowtail Afterbay Powerplant (Hydropower)--11 MW USBR Big Horn County	First Cost $10,490,000 Annual Benefits 1,127,800 Annual Costs 751,100 Net Benefits 376,700	Beneficial Effects: Opportunity to generate power in an existing dam, would not alter river flow. Adverse Effects: Visual impact of one mile of power line, would require effort to preclude serious short term river pollution during construction.	User Benefits 1,127,800 Regional Benefits 503,000 Net Benefits 879,700	Provide employment for small operation and maintenance force. Increase Montana's power capacity.

Table VII-1 (Cont.). Display of Beneficial and Adverse Effects, Recommended Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
LAND CONSERVATION Accelerated Land Conservation A. State and Private Lands 385,000 acres B. National Resource Lands 25,500 acres C. Forest Service Lands 0 acres	A. Cap. Cost $9,296,000 *Ann. Equiv. Cost $753,300 B. Cap. Cost $303,000 *Ann. Equiv. Cost $24,600 C. Cap. Cost 0 *Ann. Equiv. Cost 0 *Annual Benefits - Not computed - assumed to be at least equal to costs. 6-3/8 percent interest for 25 years.	Beneficial Effects: Improved downstream water quality for all uses. Improve general aesthetics of the land. Additional reduction of soil loss and sediment yield above future-without condition. Increased vegetative cover resulting from improved management of existing resources. Improved quality of Fish and Wildlife habitat, including cover, forage, watering places, waterfowl nesting sites, and establishment of fisheries. Reduce soil nutrients from entering streams and the underground water table. Reduction of undesirable return flows to streams. Adverse Effects: Additional depletion of streams due to increased consumptive use by added vegetative cover. Increased depletion of water resulting from added surface evaporation from ponds. Increase fire hazard from added production of forage plant species.	Maintain and/or enhance the output of goods and services to users in the region. Provide additional employment in the application and maintenance of proposed measures.	Ensures that the resource will be available for use in the future. Esthetics of the area would improve, and downstream water quality would be better for all uses.

Table VII-1 (Cont.). Display of Beneficial and Adverse Effects, Recommended Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
LAND CONSERVATION (Cont.)				
Streambank Greenbelt Program	Not Available	Program would add to fish and wildlife habitat while helping to prevent streambank erosion.	Not Available	Not Available
FISH AND WILDLIFE Instream Flows Same as reservation request of Department of Fish and Game. (See Tables IV-16 and IV-17.)	Beneficial Effects: Maintaining the recommended instream flows would tend to maintain water quality at its present level by preserving flows for the assimilation and dilution of wastes, thereby preventing increased water treatment costs to municipalities. These flows would stimulate river-based recreation and maintain quality water for existing irrigators. Adverse Effects: If implemented, these flows would make water unavailable for use in new full-service irrigation. Some irrigation expansion would probably occur but only with a partial water supply.	Preservation of existing fish and wildlife habitat and water quality. Prevents any further degradation.	Same as NED	Beneficial Effects: Increased income for recreational oriented businesses. Positive effects on population as resource is maintained for recreational uses. Adverse Effects: Potential negative effects on agricultural employment. Possibly limits industrial and domestic future uses of river water-again limiting income and employment.
Classify the Beartooth and Absaroka Primitive Areas as a Wilderness Area.	Not available.	Maintain a unique natural area in its natural state.	Not Available.	Not Available.

Table VII-1 (Cont.). Display of Beneficial and Adverse Effects, Recommended Plan
Clarks Fork-Bighorn, Montana

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	STATE-REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
WILD, SCENIC, AND RECREATIONAL RIVERS				
Bighorn River Establish State scenic/recreation river designation for the Bighorn River - Below Bighorn National Recreation Area to Yellowstone River - 50 miles (Legislation establishing a State scenic and recreational river system is recommended.)	First Cost $8,044,000 Annual Benefits 525,000 Annual Costs 698,700 Net Benefits (173,700) 1/	The natural beauty along these reaches of streams would be preserved for present and future generations. Flora and Fauna habitat values will be protected. A higher level of recreation use will be offset by better protection of the resource.	Tourism is a major contributor to the area and State economies. Recreation benefits resulting from preservation of these river reaches is in the state/regional interest. Other analyses are not available.	The pleasures associated with river-oriented recreation are important to social well-being. Local residents as well as tourists relax and revitalize themselves through their association with the pleasures provided by nature.
Clarks Fork River Establish State scenic/recreation river designation for the Clarks Fork - Montana-Wyoming border to Yellowstone River - 75 miles. (Legislation establishing a State scenic and recreational river system is recommended.) The Clarks Fork - Source to Montana-Wyoming border - to be administratively managed by the U.S. Forest Service as a wild/scenic river - 10 miles.	First Cost $11,946,000 Annual Benefits 307,100 Annual Costs 943,300 Net Benefits (636,200)	Same As Above.	Same As Above.	Same As Above.

1/ Parentheses denote a negative number.

CHAPTER VIII

RECOMMENDED PLAN EVALUATION

The remaining needs were defined and presented in Chapter V; the purpose of this chapter is to see how well the elements of the Recommended Plan satisfy those needs.[1/]

Some needs appear to be in direct conflict (e.g., instream flows vs. expansion of irrigated agriculture). Others seem to be fairly compatible (e.g., scenic/recreational rivers and expansion of irrigated agriculture). Since economic development and environmental quality are equal partners in the planning process, there is inevitably competition for resources. Although there are projects and programs that will enhance or maintain the environment in this report, the effects of economic development inevitably add to the pressures on the environment. On the other hand, most economic development and especially coal/energy development is in the national interest, even though it has detrimental effects on the environment.

An evaluation of the Plan, by functional area, is summarized in the following paragraphs.

Agriculture

The forecasts used for agriculture have been previously discussed in Chapters IV and V. Table V-2 has shown the possible limits to irrigated acreage according to those forecasts and the probable F/WO situation.

1/ Since the energy portion of the Recommended Plan is very close to the Harza "most probable" forecast, estimates of certain needs (e.g., municipal/domestic consumption and outdoor recreation) are based on the "most probable" population level shown in Chapter IV.

In the face of the substantial difference between the upper and lower limits shown by the table, the Recommended Plan takes a cautious stance. Although the total proposed plan acreage surpasses the upper limits (49,670 acres of new projects), there appears to be no immediate need for new State or federally sponsored irrigation projects. Therefore, it appears that private irrigation development will be able to meet future needs (at least through 1985) for agricultural commodities, and will expand or contract according to market conditions. Given the current agricultural situation, the majority of the six projects proposed in the Recommended Plan have been scheduled for the year 2000 (given a need at that time). However, due to the relatively high unemployment rate found among the Indian population residing on the Crow Indian Reservation, it can be argued that the early implementation of the Hardin Unit, the Wyola-Lodge Grass Canal, and the Long Otter-Gas Field Pumping Units could go far in solving that chronic problem (see Chapter III). Those projects lie on Indian lands.

Flood Control

The two storage projects included in the Recommended Plan would provide some flood control benefits for two tributaries of the Clarks Fork River. Generally, flood plain zoning, flood insurance programs, land conservation measures and preparedness programs (e.g., civil defense) are preferred to structural measures (see recommendations in Chapter X).

Outdoor Recreation

Designation of the Bighorn and lower Clarks Fork rivers as wild and scenic rivers under State mangement would do much to alleviate the needs for water-based recreation in this and the adjacent Upper Yellowstone Planning Area by providing better access to 125 miles of quality streams. Additional

flat-water recreational acres would be provided by the construction of the two storage projects proposed on tributaries to the Clarks Fork.

Land Conservation

The Plan includes an accelerated land conservation program that would provide for mechanical and managerial conservation measures on one-half of the Federal and non-Federal lands that would not have been included under existing programs. By the year 2000, 88 percent of the lands needing conservation measures would be treated under the accelerated program at an additional capital cost of $9.6 million.

The streambank greenbelt program would aid in stabilizing streambank erosion problems while concurrently maintaining riparian wildlife habitat.

Fish and Wildlife

There are two proposals that would benefit the fish and wildlife resources of the area; they are the minimum instream flow requirements set forth by the Montana Department of Fish and Game and the Beartooth Wilderness Proposal. Both proposals would simply maintain the resource that presently exists by protecting it.

The provisions for minimum instream flows are probably the most bitterly debated. The effects of the F/WO and Recommended Plan consumptive uses on these proposed minimum flows are shown in the Hydrology Supplement.

Other Functional Areas

The needs of the other functional areas (see Chapters IV and V) will be met by the F/WO situation as discussed previously in Chapter V.

Cost of the Program

Implementation of all of the elements in the Recommended Plan would bring new capital expenditures of approximately $113.22 million into the

Clarks Fork-Bighorn Planning Area. The total is differentiated by project type in Table VIII-1.

Table VIII-1. -Capital Costs, Recommended Plan
Clarks Fork-Bighorn, Montana

Project Type	$ Millions
Multi-purpose	5.41
Hydroelectric Power[2/]	10.49
Single Purpose	67.35
Land Conservation[1/]	9.60
Outdoor Recreation	20.37
Total	$113.22

1/ Capital costs are not available for all land conservation programs.
2/ From the Yellowtail Afterbay Power Plant project.

Annual costs and benefits that would accrue by project type are shown in Table VIII-2. SRD benefits are included.

Table VIII-2. Annual Costs and Benefits, Recommended Plan
Clarks Fork-Bighorn, Montana

Project Type	$ Millions	
	Annual Costs	Annual Benefits
Multi-purpose	0.39	0.68
Hydroelectric Power	0.75	1.13
Single Purpose	4.53	6.44
Land Conservation	0.78	0.78[1/]
Outdoor Recreation	1.67	1.86[2/]
Totals	8.12	10.89

1/ Benefits assumed to equal costs. Costs and benefits are not available for all land conservation programs.
2/ Direct benefits from hunting and fishing are not included.

Table VIII-3 shows costs allocated by function, which better describes the mix of Plan elements. These costs were allocated by using the Separable Costs-Remaining Benefits method prescribed for use in this Level B Study.

Table VIII-3. Summary of Capital Cost by Function, Recommended Plan, Clarks Fork-Bighorn, Montana

Function	$ Millions
Irrigation	72.66
Hydroelectric Power[1/]	10.49
Outdoor Recreation	20.37
Fish and Wildlife	0.10[1/]
Land Conservation	9.60[1/]
Totals	113.22

1/ Costs are not available for all fish and wildlife and land conservation proposals.

CHAPTER IX

IMPACTS OF THE RECOMMENDED PLAN

The purpose of this chapter is to compare the impacts stemming from the projects found in the Recommended Plan to the present (1975) and/or the F/WO situations.[1/] However, the reader is reminded that there are elements of the plan that are in direct conflict (e.g., instream flows vs. water consumptive types of development). These conflicts, shown by the Hydrology Supplement, can be resolved only after the reservations for future use of the Yellowstone water have been established by the State of Montana.

Population

Inasmuch as the level of energy development is the same under the F/WO and the Recommended Plan, and since energy developments are the major cause of anticipated population increases, it follows that the plan elements other than energy are not expected to have any major impact on population levels. As explained in the preceding chapter, the "most probable" population projection (first shown in Chapter IV, Table IV-7) best represents the population effects stemming from both the elements of the Recommended Plan and the F/WO developments that are expected. Table IX-1 illustrates the magnitude of the anticipated population changes in this area. These figures take into account coal/energy development in eastern Montana and its indirect impact on the Clarks Fork-Bighorn Planning Area. The table shows a population increase of 7,000, or 38 percent, by the year 2000.

1/ Comparisons of the NED, EQ, and Recommended Plans are shown in Chapter VIII of the main report--Yellowstone Level B Study Report--which treats the three States and seven planning areas as a whole.

Table IX-1. Population Changes 1975-2000
Clarks Fork-Bighorn, Montana[1/]

Population	1975	1985	2000
Totals	18,600	21,500	25,600
Differences: 1975		2,900	7,000

1/ Totals rounded to the nearest hundred.

Water Consumption

Table IX-2 shows the major water consuming sectors of the Clarks Fork-Bighorn Area. These sectors have been previously described in Chapters IV and V. The table shows an increase in water consumption of 142,365 af/y over the 1975 level of development; 98 percent of the increase (139,653 af/y) would come from expanded private (F/WO) and public irrigation projects.

Table IX-2. Additional Water Consumption by Sector, 1975-2000
Recommended Plan Plus F/WO
Clarks Fork-Bighorn, Montana[1/]

Sector	Consumption of af/y
Irrigation[2/]	139,653
Energy	---0---
Domestic/Municipal	406
Industrial	---0---
Non-Energy Minerals	6
Livestock[3/]	2,300
Total	142,365

1/ Given implementation of all projects, disregarding minimum instream flows.

2/ An increase of 119,253 af/y over the F/WO.

3/ Includes evaporation.

Implementation of the proposed irrigation projects found in the Recommended Plan accounts for the consumption of 119,253 af/y, or 84 percent of the total additional water requirements at the year 2000.

Land Use

The largest change in land use patterns over the next 25 years would probably be due to expanded irrigation, given favorable market conditions for agricultural products. Additional lands totaling (F/WO + Recommended Plan) 57,270 acres would be brought under irrigation by the year 2000. Of that total, only 7,600 acres would probably be privately (F/WO) developed, while nearly 49,670 acres are proposed to be developed by governmental entities. Table IX-3 illustrates the land use changes associated with elements of the Recommended Plan.

The Beartooth Wilderness Area would encompass 300,000 acres in this area and 613,500 in the adjacent Upper Yellowstone Area. The development of wild, scenic, and recreational rivers would entail the purchase of easements on 27,500 acres of private lands. These redesignations would not involve significant changes in land use, but would prevent major change in the future.

Environment

Table IX-4 presents the plan element impacts on the environment. Little of the data from these projects are available in a quantifiable form, so they are presented in the descriptive manner shown below. Instream flows would be affected by new irrigation developments and population growth; those quantitative effects can be seen in the Hydrology Supplement.

Table IX-3. Identified Land Use Changes Stemming from Recommended Plan, 1975-2000
Clarks Fork-Bighorn, Montana

Project or Program	Net Land Use Changes										
	Acres									Other	
	Irrigated Cropland and Pasture	Non-Irrigated Cropland and Pasture	Forest and Woodland	Rangeland	Urban	Water Surface	Private	Public	Streambank (Acres)	Streambank (Miles)	Other
Multipurpose	1,300	- 1,800	1/	1/	--	704	1/	1/	-704	-3	--
Single Purpose	47,770	-47,770	1/	1/	--	--	1/	1/	--	--	--
Energy	--	--	--	--	--	--	--	--	--	--	1/
Land Conservation	1/	1/	1/	1/	--	--	--	--	1/	1/	1/
Instream Flows	--	--	--	--	--	--	--	--	--	--	1/
Beartooth Wilderness Area	--	--	300,000 3/	1/	--	--	1/	1/	--	--	1/
Wild, Scenic, and Recreational Rivers	--	--	--	--	--	--	-140	140	27,640 2/	155	--

1/ Land use changes not determined.

2/ Easements total 27,500 acres.

3/ Represents a change in management practices rather than in land use.

Table IX-4. Identified Environmental Impacts Stemming from the Recommended Plan 1975-2000, Clarks Fork-Bighorn, Montana1/

Environmental Impacts	Projects or Programs							
	Multipurpose	Single Purpose	Energy	Land Conservation	Instream Flows	Beartooth Wilderness Area	Wild, Scenic, and Recreational Rivers	Population
Open Space and Greenbelts (Acres)	0	0	0	+	0	+	+	-
Creation of Fish and Wildlife Habitat (Acres)	+	0	0	0	0	0	0	0
Improvement or Stabilization of Existing Habitat (Acres)	0	0	0	3/	+	+	+	-
Wilderness, Primitive, and Natural Areas (Acres)	0	0	0	0	0	300,000	0	0
Instream Flow Values (Acre-Feet)	-	-	0	0	4/	+	0	-
Native Species (Flora and Fauna)	-	-	0	+	+	+	+	-
Water Quality--TDS (Mg/L)	2/	2/	0	+	0	0	0	-
NO_X (1000 Tons)	0	0	0	0	0	0	0	0
SO_X (1000 Tons)	0	0	0	0	0	0	0	0
Particulates (1000 Tons)	0	0	0	0	0	0	0	0
Streams (Miles)	-3	0	0	+	0	0	155	0

1/ The nature of the entries of this table illustrate the lack of data related to environmental effects; (-) indicates negative effect, (+) indicates positive effect, and (0) indicates minimal effect.

2/ See Hydrology Supplement for these values.

3/ See Chapters VII and VIII.

4/ See Chapters IV and V.

Outdoor Recreation

The Recommended Plan contains a proposal to form a Beartooth Wilderness Area, two proposals for new reservoirs, and three proposals for wild, scenic, or recreational rivers. Table IX-5 illustrates the increased opportunities for outdoor recreation due to these elements. The land and water areas translate into at least 444,100 additional recreation days and 132,700 fishing days upon implementation of these proposals, and leave a possible surplus of 472,949 recreation days in the Clarks Fork-Bighorn Planning Area. This surplus is deceptive, however, because it would be used by people traveling into the area from the heavily populated adjacent Upper Yellowstone Area. Even at that, the Clarks Fork-Bighorn can only supply roughly one-half of the demand from the adjacent area.

Table IX-5. Identified Recreation Impacts, Stemming from the Recommended Plan, 1975-2000, Clarks Fork-Bighorn, Montana

Projects	Land Area (Acres)	Water Area (Acres)	Streams (Miles)	Recreation Days	Fishing Days
Reservoirs	1/	704	-3	166,600	132,700
Wild, Scenic, and Recreational Rivers	27,640	1/	155	277,500	-
Beartooth Wilderness Area	300,000	1/	1/	1/	1/
Totals 2/	327,640	704	152	444,100	132,700

1/ Undetermined.
2/ Only partial totals.

Economic Impacts

The economic impacts that would stem from elements of the Recommended Plan are varied and related to the alternative uses that could be put to the

area's water resources by the year 2000. The major impacts on this area, that are associated with the elements of the Recommended Plan, would come from the development of federally sponsored irrigation projects (especially the Hardin Unit). Development of these projects, which lie primarily on the Crow Indian Reservation have the potential of relieving some of the chronic employment problems suffered on the reservation (see Chapter III).

Future development of the agricultural, recreational, mineral, and fish and wildlife resources in Clarks Fork-Bighorn Area are tied to the water reservation issues that exist throughout the Yellowstone Basin (see Chapter II). Additional consumption of water by any sector will have the effect of destroying portions of the area's existing river and riparian habitat. When the value of the last environmental unit destroyed equals the value of the last economic unit produced, additional water depletions should end.

CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

The conclusions presented below summarize some of the salient facts garnered from the Level B effort in Montana. The recommendations present the Study Team views on actions that need to be taken if resource development, conservation, and preservation are to be most effective in the years ahead.

The conclusions and recommendations for all of the four Montana planning areas have been combined into this Chapter for the convenience of the reader. This obviates the need for the reader to piece together the individual planning area reports in order to put the entire study into a basinwide perspective.

Conclusions

1. Total additional water consumption (associated with the Plan) in the Yellowstone Basin by the year 2000 will vary from the low option of 350,000 acre-feet per year (af/y) to the Recommended Plan level of 612,000 af/y, depending upon how the instream flow issue is ultimately settled. In this time period, additional water consumed by irrigation will be from 2 to 7 times that of coal/energy uses.
2. The United States has a need for coal/energy production. Montana has substantial coal resources that can help in meeting the national need.
3. It appears that the State's citizens support the State's official coal export "policy" as opposed to in-state conversion of coal to other forms of energy.

4. Export by slurry pipeline consumes less Montana water than conversion of coal to electricity (water-cooled plants) or synthetic gas.
5. Export of coal by rail consumes a negligible amount of water but it adds a burden to land owners and citizens of small communities that cannot gain access to areas "across the tracks," due to the railway traffic. In addition, railway traffic has some air and noise pollution associated with it.
6. Total coal/energy related water consumption in the Basin could range anywhere from 83,000 af/y to 219,000 af/y at the year 2000, depending on the level of development (the Study Teams recommend the lesser; see Chapter VII of the Tongue-Powder and the Lower Yellowstone Reports).
7. Lack of agricultural production is not foreseen to become a major problem in either the Nation or the Yellowstone Basin by the year 2000; private irrigation ventures are expanding, at present, but there does not appear to be a great need for new State or Federal irrigation projects until after 1985 and perhaps not until 2000--depending on market conditions.
8. The 3E projections (based on OBERS E and E' forecasts, see Chapter IV) have indicated a need for increased roughage production to support future expanded cow/calf operations. However, it is unclear whether or not income from hay and alfalfa in conjunction with cow/calf operations can match the costs of bringing substantial land areas under irrigation.
9. No mainstem Yellowstone River reservoir will be needed within the time frame considered in this study.
10. Lack of access is a major recreation problem.
11. Scenic and recreational river designations will not adversely affect or interfere with senior water rights.

12. Outdoor recreation will be of increasing importance in the area, partly as a result of anticipated population increases in the major energy-resource development areas.

Recommendations

The following recommendations are presented as part of the Recommended Plan discussed previously in Chapter VII. The recommendations result from the Study Team's analysis and consideration of problems that may be confronted in moving the plan from the inactive stage to one where it can be used as a flexible guide for future water and related land resource management in the Yellowstone Basin.

Miscellaneous

1. The State of Montana should identify Montana streams of major significance and provide appropriate protection for those streams to supplement the National Wild and Scenic Rivers System.
2. The Yellowstone Compact should be amended to recognize minimum instream flow and water quality values.
3. The Yellowstone River should remain a free-flowing river.
4. Indian and Federal "reserved" water rights should be defined, quantified, and adjudicated at the earliest possible date.

Coal Impacts

1. The Montana State Legislation should reconsider the ban on the use of water in interstate slurry pipeline operations. Such a mode of transportation could supplement rail traffic in the export of Montana coal to the demand regions.

2. The General Accounting Office should audit federally funded stripmine reclamation research projects. The object of this audit would be to identify duplication of effort and note areas not being adequately studied.
3. An evaluation study and public information program should be undertaken by the Department of Interior to illustrate opportunities and techniques for making mineral ownership exchanges between Federal, State, and/or private land owners in order to mitigate potential environmental problems associated with coal production.
4. In order to meet future energy demands, Congress should: (1) adopt a national energy conservation program designed to reduce current and projected energy demands; and (2) provide additional funds for development of innovative renewable energy programs.

Flood Damage Reduction

1. State and Federal land management agencies, in conjunction with private landowners, should institute best management practices in order to retard runoff and reduce flood hazards throughout the study area.
2. City and county governments should continue to improve flood preparedness, and act to ensure adequate and operable flood warning systems.
3. The Congress should continue funding the installation of selected river management projects using variations of different types of structural bank protection measures at 24 key locations between Intake, Montana, and the mouth of the Yellowstone River. These measures should be coordinated with other Federal and State agencies to assure that existing recreational fish and wildlife, and esthetic resources are not adversely affected.[1/]

1/ See Fish and Wildlife comments that follow.

4. The Corps of Engineers West Billings Flood Control Project is not included in the plan elements. Instead the Study Team has recommended a non-structural approach to the flood problem (e.g., flood plain zoning and flood insurance programs).

Irrigation and Industrial Development

1. Federal, State, and local agencies should continue to support and provide technical and financial assistance to landowners in identifying and applying good land and water conservation practices.
2. Strategic off-stream storage sites should be selected and evaluated at a feasibility level to see if such projects can be supported by potential users in the future.

Fish and Wildlife

1. The Broadview-Wheat Basin wildlife refuges should be further developed; plans for improvement should reflect the potentials of the Billings Water/Calamity Jane Project.
2. A study should be made to determine if the diversion structure in the Yellowstone River at Intake, Montana, should be modified to allow for passage of paddlefish. This could reduce the amount of water required for fish and wildlife needs in that reach of the river. Other diversions in the basin might benefit from modifications for fish passage.
3. In a number of tributaries, trout habitat is severely degraded by irrigation diversions in late summer. A study should be made to locate and evaluate off-stream damsites in which water could be stored during periods of excess flow and released to augment the flow during the summer months. The proposed project on Shields River is an example (Antelope Creek Storage).

Domestic and Municipal Water Supply

1. State, county, and local agencies responsible for providing or regulating domestic water supplies in the Yellowstone River Study Area should take advantage of provisions of Federal Safe Drinking Water Act, P.L. 93-523, in order to receive cost sharing and other benefits that would aid in improving domestic water quality.
2. Programs should be accelerated to aid in the discovery and delivery of water to water-short rural communities in Eastern Montana.

Land Conservation

1. The Soil Conservation Service and other State and Federal land management agencies should formulate and implement best management practices throughout the Yellowstone Basin to reduce man-caused sediment and related problems.
2. Overutilized private and public lands in the Shields River Drainage should be inventoried and then managed to achieve rehabilitation of soils, vegetation, and water quality. Organizations such as the Soil Conservation Service and Forest Service should contribute to the effort within the scope of their responsibilities.

Water Quality

1. A method(s) should be devised whereby the costs imposed by a degradation of water quality on present users can be determined, and considered as a cost of future development.
2. The water quality changes brought about by large withdrawals of water and associated return flows should be evaluated more thoroughly by appropriate State and Federal agencies, and the study results should be published as a part of project development impact data.
3. Montana's water quality surveillance system should be evaluated to see if it can meet the demands that will be placed on it with growth of the State's economy.

General Environment

1. The Water Resources Council should be provided the authority to ensure that all Federal water planning agencies, including those dealing directly with the environment, will actively participate in multipurpose planning efforts. State agencies that have responsibilities related to water resources should alse be required to actively participate in State-Federal cooperative studies.
2. Significant archaeological and historical sites in the study area should be identified and preserved.
3. The Congress and State Legislature should be encouraged to fund badly needed Environmental Quality projects, even though calculated benefit-cost relations are unfavorable.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

IN REPLY REFER TO:

August 30, 1977

Mr. Martin Oleson, Study Manager
Montana State Study Team
Missouri River Basin Commission
404 North 31st Street - Room 332
Billings, MT 59101

Dear Mr. Oleson:

We have received a draft copy of chapter ten, "Conclusions and Recommendations," for the Montana portion of the Yellowstone Level B study. Recommendation number three under the "Flood Damage Reduction" section indicates the study team is urging Congress to continue funding the Erosion Control and Demonstration program for the Yellowstone River - Intake, Montana to the mouth which was authorized by the Streambank Erosion Control and Demonstration Act of 1974, plus amendments.

We wish to record our objections to this recommendation based on probable losses to fish and wildlife resources if the program is carried out. Our analysis of this entire program was outlined in a letter dated August 15, 1977, to the Corps of Engineers. A copy of that letter is enclosed for your information.

Sincerely,

Burton W. Rounds
Area Manager

Enclosure
cc: Regional Director, FWS. Denver, CO (ENV)

United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION
10597 West Sixth Avenue
Lakewood, Colorado
Across From Federal Center

IN REPLY REFER TO:

ENV

AUG 15 1977

District Engineer
Attention: R. G. Burnett, P.E.
Chief, Engineering Division
Omaha District, Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha, NE 68102

Dear Sir:

This letter contains U.S. Fish and Wildlife Service (FWS) preliminary comments on the Corps of Engineers document entitled, "Erosion Control Demonstration Program for the Yellowstone River - Intake, Montana to the Mouth," transmitted to us by your letter dated March 15, 1977.

Authorization for the proposed bank stabilization demonstration projects on the Missouri River was granted under Section 32 of the Water Resources Development Act of 1974. Section 155 of the 1976 Omnibus Bill amended the original bill by adding two additional reaches of rivers for construction of demonstration projects. The lower Yellowstone River from Intake, Montana, to its mouth was one of the rivers added. Our comments on the proposal were prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.).

The project area was inspected by air on April 7, 1977, by members of this office and the Billings Area Office. Preliminary ground inspection of individual project sites within Montana was conducted on April 19 and 20, 1977, with the cooperation of Montana Fish and Game Department personnel. Project sites in North Dakota were inspected on May 5, 1977, by personnel of the Billings and Bismarck Area Offices of the FWS and the North Dakota Game, Fish and Parks Commission.

This letter briefly discusses the existing situation for fish and wildlife in the area, the erosion problem generally, and the Corps' proposed solution as reflected by the Demonstration Program. An analysis of impacts is presented along with recommendations for acceptable demonstration sites and possible alternative actions.

The Yellowstone River within the project area generally has a large, braided stream channel with many islands, side channels, extensive backwaters, cutoff oxbow lakes, and sand or gravel bars. This stream form is the result of dynamic, ongoing channel formation and adjustment processes. A consequence

The proposed solution includes 24 individual bank stabilization projects designed to prevent erosion and loss of croplands, and man-made structures. The "demonstration" would cost an estimated $3,840,000 to stabilize approximately 26.7 miles of bank along the lower 63 miles of the Yellowstone River (13.8 miles of bank stabilization on Montana and 12.9 miles in North Dakota). Approximately one third of the project sites would protect constructed facilities such as roads, bridges, or irrigation structures; the remainder would primarily protect agricultural lands from natural erosion.

It is the general policy of the Fish and Wildlife Service not to object to the construction of stream alteration projects that are planned with due attention to environmental values. The Service policy is to consider favorably those stream alteration projects which meet the following conditions: 1) The proposal is clearly demonstrated, by substantial evidence, to be warranted in the public interest to protect human life, health, safety, or welfare; and 2) all alternatives to the proposal have been evaluated, and it has been clearly demonstrated to the satisfaction of the Service that none are feasible which could accomplish the demonstrated public need. However, we cannot support such projects where there would be significant damage to fish and wildlife resources and would have only localized, mainly private benefits to a relatively few people.

Implementation of the proposed project would result in cumulative and long-term adverse impacts to wildlife resources. An overall loss of wildlife habitat (primarily brush and tree habitat types) could be expected to occur at an accelerated pace as stabilized lands are cleared and cultivated as a result of protection from bank erosion and the related cycles of land accretion and serial vegetative succession. Bank stabilization on the lower Missouri River and many other streams has demonstrated that such land use changes are induced following bank stabilization projects. That is, once the river banks are stabilized, it becomes feasible for private landowners to clear brush and bottomland forest habitats and put these areas to intensive agricultural use. This indirect impact of bank stabilization has the potential to damage wildlife habitat much more than the direct losses associated with project construction and maintenance. Additional habitat losses can be postulated as an accumulative reduction in anabranches, backwaters,and similar habitat niches takes place.

Still another indirect loss of wildlife habitat may occur downstream from individual project demonstration sites, impacting primarily islands and lands immediately adjacent to the river channel. This could come about if the river channel, now directed at a stabilized bank, becomes redirected into an island or shoreline not protected by the project, thus eroding those banks.

The FWS is prepared to work with the Corps if the Demonstration Program proceeds despite our objections. Certainly, it will be necessary to arrive at acceptable wildlife mitigation measures for individual projects and the cumulative losses associated with this proposal if construction proceeds.

In the past, we agreed to implementation of the portion of the Bank Stabilization and Demonstration Program on the Missouri River without the preparation of an Environmental Impact Statement. However, this was done with the clear understanding that information gained from that experimental project would be used to make decisions regarding future bank stabilization measures. It now appears to us that the Bank Stabilization and Demonstration Program, as proposed on the Lower Yellowstone River, is of such magnitude that it constitutes a major Federal action affecting the quality of the human environment. Thus, an environmental impact statement should be prepared for this portion of the program. This would permit the discussion of nonstructure alternatives such as we have presented in this letter.

Please contact our Billings Area Office for additional consultation and planning assistance.

Sincerely yours,

Marvin P. Duncan

Marvin P. Duncan
Acting Regional Director

cc: Bismarck Area Office
U.S. Fish and Wildlife Service
Department of Interior
P.O. Box 1897
Bismarck, North Dakota

Montana Fish and Game Department
Helena, Montana 59601

North Dakota Fish and Game Department
2121 Lovett Avenue
Bismarck, North Dakota 58501

United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION
10597 West South Avenue
Lakewood, Colorado
Across From Federal Center

IN REPLY REFER TO

ENV

AUG 15 1977

District Engineer
Attention: R. G. Burnett, P.E.
Chief, Engineering Division
Omaha District, Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha, NE 68102

Dear Sir:

This letter contains U.S. Fish and Wildlife Service (FWS) preliminary comments on the Corps of Engineers document entitled, "Erosion Control Demonstration Program for the Yellowstone River - Intake, Montana to the Mouth," transmitted to us by your letter dated March 15, 1977.

Authorization for the proposed bank stabilization demonstration projects on the Missouri River was granted under Section 32 of the Water Resources Development Act of 1974. Section 155 of the 1976 Omnibus Bill amended the original bill by adding two additional reaches of rivers for construction of demonstration projects. The lower Yellowstone River from Intake, Montana, to its mouth was one of the rivers added. Our comments on the proposal were prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.).

The project area was inspected by air on April 7, 1977, by members of this office and the Billings Area Office. Preliminary ground inspection of individual project sites within Montana was conducted on April 19 and 20, 1977, with the cooperation of Montana Fish and Game Department personnel. Project sites in North Dakota were inspected on May 5, 1977, by personnel of the Billings and Bismarck Area Offices of the FWS and the North Dakota Game, Fish and Parks Commission.

This letter briefly discusses the existing situation for fish and wildlife in the area, the erosion problem generally, and the Corps' proposed solution as reflected by the Demonstration Program. An analysis of impacts is presented along with recommendations for acceptable demonstration sites and possible alternative actions.

The Yellowstone River within the project area generally has a large, braided stream channel with many islands, side channels, extensive backwaters, cutoff oxbow lakes, and sand or gravel bars. This stream form is the result of dynamic, ongoing channel formation and adjustment processes. A consequence

of the existing channel formation is a large quantity and high quality and diversity of riverine wildlife habitat largely unequalled in this region. Besides a diversity and large number of game mammals and birds occupying this habitat, many nongame species occur including, for example, beavers, wintering eagles, and a myriad of migrating and nesting song birds.

This highly productive fish and wildlife resource area is maintained within and is largely dependent upon the naturally functioning floodplain of the Yellowstone River. There are areas within this floodplain where uplands are being eroded by the river channel (Figure 1), while other areas are being filled in by silt deposition. The lands created by sediment deposition at first support a growth of willow and young cottonwood trees (Figure 2). Then, as time passes and the river channel traverses the floodplain, the newly accreted lands may become a forest of mature cottonwood trees. This bottomland forest in turn succumbs to bank erosion as the river channel returns to its original side of the floodplain. It is largely this continuous process which establishes and maintains the diversity of channels, islands, and differing bank conditions that create the range of habitats and abundance of wildlife present in the lower Yellowstone River.

A stated purpose of the Demonstration Program is to provide basic information on the extent and nature of erosion problems along the lower Yellowstone River and to evaluate the potential solutions for such problems. The erosion problem results from a naturally functioning river system eroding floodplain lands, thus threatening "vital irrigation facilities . . . , prime cropland and other vital facilities such as roads, bridge abutments, power lines, and municipal sewer and water plants." The Montana Department of Natural Resources and Conservation (DNRC) concluded in its EIS for Water Reservation Applications in the Yellowstone River Basin that: "The impact of several decades of water diversion on the morphology of the Yellowstone mainstem has been small, principally because the mainstem is still essentially free flowing . . . . The major influence on channel morphology has been riprap, which stabilizes the banks and limits the operation of natural processes." Thus, solution of the erosion problem creates a conflict between the need to limit the natural processes of the stream by stabilization of its banks and the need to allow the river to function in its dynamic fashion.

The Corps' proposed solution to the erosion problem was formulated by a technical review board composed of agricultural interests, the Bureau of Reclamation, and the Corps of Engineers. The review board concluded that "a comprehensive erosion monitoring and control plan should be developed for the entire reach" of the Yellowstone River within the project area. The review board then selected demonstration sites and design criteria and determined four erosion control techniques to be applied.

The proposed solution includes 24 individual bank stabilization projects designed to prevent erosion and loss of croplands, and man-made structures. The "demonstration" would cost an estimated $3,840,000 to stabilize approximately 26.7 miles of bank along the lower 63 miles of the Yellowstone River (13.8 miles of bank stabilization on Montana and 12.9 miles in North Dakota). Approximately one third of the project sites would protect constructed facilities such as roads, bridges, or irrigation structures; the remainder would primarily protect agricultural lands from natural erosion.

It is the general policy of the Fish and Wildlife Service not to object to the construction of stream alteration projects that are planned with due attention to environmental values. The Service policy is to consider favorably those stream alteration projects which meet the following conditions: 1) The proposal is clearly demonstrated, by substantial evidence, to be warranted in the public interest to protect human life, health, safety, or welfare; and 2) all alternatives to the proposal have been evaluated, and it has been clearly demonstrated to the satisfaction of the Service that none are feasible which could accomplish the demonstrated public need. However, we cannot support such projects where there would be significant damage to fish and wildlife resources and would have only localized, mainly private benefits to a relatively few people.

Implementation of the proposed project would result in cumulative and long-term adverse impacts to wildlife resources. An overall loss of wildlife habitat (primarily brush and tree habitat types) could be expected to occur at an accelerated pace as stabilized lands are cleared and cultivated as a result of protection from bank erosion and the related cycles of land accretion and serial vegetative succession. Bank stabilization on the lower Missouri River and many other streams has demonstrated that such land use changes are induced following bank stabilization projects. That is, once the river banks are stabilized, it becomes feasible for private landowners to clear brush and bottomland forest habitats and put these areas to intensive agricultural use. This indirect impact of bank stabilization has the potential to damage wildlife habitat much more than the direct losses associated with project construction and maintenance. Additional habitat losses can be postulated as an accumulative reduction in anabranches, backwaters, and similar habitat niches takes place.

Still another indirect loss of wildlife habitat may occur downstream from individual project demonstration sites, impacting primarily islands and lands immediately adjacent to the river channel. This could come about if the river channel, now directed at a stabilized bank, becomes redirected into an island or shoreline not protected by the project, thus eroding those banks.

The most significant threat here may be that additional bank stabilization measures could be encouraged. However, potential direct losses of habitat, in some instances, are relatively great as on Crittenden and Seven Sisters Islands.

It appears that several of the selected demonstration sites are designed to protect man-made structures that are not in immediate danger from erosion or are of a nonessential nature. The majority of the proposed sites, moreover, would primarily protect "agricultural" lands from natural erosion. Many of these latter projects will result in secondary clearing of floodplain vegetation and replacement by cultivated crops and other impacts as previously outlined. The FWS cannot support such stabilization proposals which would have only localized, mainly private benefits to a relatively few people and would result in significant damage to fish and wildlife resources. In these cases, the FWS recommends adoption of floodplain management programs in preference to stream channel alteration via bank stabilization measures.

Our cursory inspection of the 24 proposed projects revealed that only four have a clear potential to be in the general public interest: the Sidney Bridge Area, River Road Area, Cartwright Bridge Area, and the Upper Sioux Area. These four projects would protect existing bridges, roads, or irrigation structures (Figure 3). However, even these four projects appear to call for more construction than is needed to protect only the vital facilities. That is, they appear to include protection of associated agricultural lands. Thus, modification of these proposed structures appears warranted.

The 20 remaining projects in the program are unacceptable to the FWS because of potential losses to fish and wildlife resources. In this connection, and as previously noted, the basic stated purpose of the Demonstration Program is to demonstrate and evaluate potential solutions to the bank erosion problem. The Corps already has bank stabilization demonstration projects at several other locations in the Missouri River drainage in North and South Dakota and Nebraska. We recommend that before initiation of the Yellowstone River project, these ongoing demonstrations and other existing bank protection works be fully evaluated to determine their cumulative economic and environmental effects. The magnitude of potential wildlife habitat loss is too great on the lower Yellowstone River to be sacrificed for demonstration purposes, especially when other ongoing projects may achieve the same objective.

Our field inspections revealed that the Bureau of Reclamation also has numerous bank stabilization structures already in place in the lower Yellowstone River. The hard point system proposed for demonstration and evaluation by the Corps exists (at least functionally) at several locations (Figure 4). Some of the Bureau of Reclamation revetments also appear functionally similar to those proposed for evaluation by the Corps. An evaluation of these existing structures may meet some of the Corps objectives.

The FWS is prepared to work with the Corps if the Demonstration Program proceeds despite our objections. Certainly, it will be necessary to arrive at acceptable wildlife mitigation measures for individual projects and the cumulative losses associated with this proposal if construction proceeds.

In the past, we agreed to implementation of the portion of the Bank Stabilization and Demonstration Program on the Missouri River without the preparation of an Environmental Impact Statement. However, this was done with the clear understanding that information gained from that experimental project would be used to make decisions regarding future bank stabilization measures. It now appears to us that the Bank Stabilization and Demonstration Program, as proposed on the Lower Yellowstone River, is of such magnitude that it constitutes a major Federal action affecting the quality of the human environment. Thus, an environmental impact statement should be prepared for this portion of the program. This would permit the discussion of nonstructure alternatives such as we have presented in this letter.

Please contact our Billings Area Office for additional consultation and planning assistance.

Sincerely yours,

Marvin P. Duncan
Acting Regional Director

cc: Bismarck Area Office
U.S. Fish and Wildlife Service
Department of Interior
P.O. Box 1897
Bismarck, North Dakota

Montana Fish and Game Department
Helena, Montana 59601

North Dakota Fish and Game Department
2121 Lovett Avenue
Bismarck, North Dakota 58501

STATE OF MONTANA

DEPARTMENT OF

FISH AND GAME

Helena, Montana
February 21, 1978

Missouri River Basin Commission
Suite 40 3, 10050 Regency Circle
Omaha, Nebraska 68114

Gentlemen:

We are attaching a copy of a letter sent to the Corps of Engineers regarding their proposals for streambank stabilization on the lower Yellowstone River in Montana. We would like you to consider this letter as our comment on item number 3 on page X-5 in the January 1978 Yellowstone Basin and Adjacent Coal Area Level B Study, Volume 3.

Sincerely,

Fletcher E. Newby
Deputy Director

FEN/RWB/gk
cc: Orrin Ferris
Keith Seaburg

Attachment

STATE OF MONTANA

DEPARTMENT OF
FISH AND GAME

Helena, Montana
September 6, 1977

Mr. R. G. Burnett, P.E.
Chief, Engineering Division
Army Corps of Engineers
6014 U.S. Post Office & Courthouse
Omaha, Nebraska 68102

Dear Mr. Burnett:

This correspondence concerns the Corps of Engineers' proposal entitled "Erosion Control Demonstration Program for the Yellowstone River, Intake, Montana to the Mouth." We wrote to your office on April 14, 1977, requesting information on this proposal, and you responded on May 4, 1977, including a description of project proposals.

Since that date we have inspected all of the sites in Montana where erosion control measures are proposed. This inspection included both the biological and engineering aspects of the proposal, and was performed by this department's and Montana State University personnel. We found, with minor exception, that streambank erosion was not significant enough to justify a program of this scope on even a demonstration and evaluation basis.

It was impossible to comprehend the rationale behind the selection of the proposed sites. In many instances, control structures are being proposed for areas on well vegetated, stable, or near stable banks. In other cases, extensive bank stabilization measures are planned for areas far removed from the main channel, and in one case, on an already diked off flood channel. If the proposed structures are installed and remain functional over any period of time, it will probably be the result of having placed them in areas of minimal erosive activity, rather than of the design of the structures themselves.

Cause of the erosion that now exists, including land clearing and cropping to the river's edge, previous bank stabilization attempts, geomorphology, and basic hydraulic functions, were not adequately identified or addressed in the report. It appears that individual sites were given only cursory field inspection, if any, before including them in the program.

-continued-

There also seemed to be only superficial consideration given to preserving wildlife habitat or other environmental values in areas where control structures are proposed. The outstanding wildlife values on this reach of the Yellowstone stem primarily from the densely vegetated riparian areas interspersed with agricultural lands, and stable islands of willow and cottonwood. On some project sites, much of the established wildlife habitat would be destroyed in the act of constructing the projects. At other sites, the stabilization practices would exert adverse hydraulic pressures on adjacent river banks or on established vegetated islands, most of which contain valuable wildlife habitat.

In light of the above and considering that a similar proposal has been made for sections of the Missouri River, and considering that numerous dikes, revetments, riprap, hardpoints, etc. have already been constructed on probably all of the nation's major rivers and streams (including this section of the Yellowstone River) and that most of these are available for evaluation, we can see no justification for your proposal.

Therefore, in our opinion, your proposal does not conform with the intent of the Fish and Wildlife Coordination Act in protecting wildlife and wildlife habitat, or with the legislative policies of the state of Montana to preserve streams in their natural condition, as is feasible and desirable.

We suggest that a better method of improving river bank conditions in this area would be to carefully remove and properly dispose of existing jacks which are no longer functional. These are esthetically about equal to car body riprap, and also pose distinct hazards to boat navigation. There should also be an intense public informational effort to advise local land owners of the erosion hazard in clearing and cropping land to the river's edge. At least two such projects are now underway with vegetation being disposed of on the river bank which are probably Section 10 or 404 violations.

In your correspondence of May 4, 1977, you pointed out the preliminary and provisional state of this proposal. We appreciate and acknowledge that fact, and hope our general comments at this time will serve to indicate our deep concern that the need for and the ramifications of the proposal need much greater in-depth investigation and public discussion. The Yellowstone River is a valuable natural asset to the State of Montana and should not be subjected to unnatural and unnecessary streambank manipulation.

Sincerely,

Robert F. Wambach

Robert F. Wambach
State Fish and Game Director

RFW/RWB/gk
cc: Congressional Delegation
Governor's Office
Burt Rounds
Keith Seaburg

BURLINGTON NORTHERN

JOHN O DAVIES
Vice President – Billings Region

600 First Northwestern Bank Center
175 North 27th Street
Billings, Montana 59101

March 1, 1978

Mr. Paul Shore, Study Manager
Yellowstone Basin and Adjacent
Coal Area. Level B Study
Northfork Star Route
Cody, Wyoming 82414

Dear Mr. Shore:

Copies of your four volumes of the Level B Studies covering Montana have been furnished us, and we feel it is important to the integrity of the study to point out some significant errors in the methodology and findings as they concern coal and coal transportation.

Although the "high scenarios" in the Harza study relating to coal production are disavowed by your conclusion No. 3 on page X-1 in both the Lower Yellowstone and Tongue-Powder studies, the figures and other data relating to this scenario are referred to frequently throughout the text. We wish, therefore, to make it clear that the coal production volumes anticipated are much higher than we anticipate. Our expectations are based on mine-to-mine estimates done with the cooperation of the companies who will actually mine the coal in Montana and Wyoming.

If we can assume by your disclaimer in No. 3 conclusion on page X-1 that you are abandoning the "high" scenario in favor of the "most probable", this changes the base drastically. Either scenario below the "high" would, in our opinion, totally obviate the need for slurry pipelines as "supplemental" or other useful functions in the movement of Montana coal. As a logical follow-up, it would seem it would also destroy the rationale for your recommendation No. 1 under coal impacts, page X-4 in both studies, calling for recognition of water for interstate pipelines as a "beneficial" use in Montana and recommending such recognition by the State Legislature, which has already held such use to be illegal. Also, it was readily conceded at the February 23 meeting of the State Study Team in Billings that the Lower Yellowstone study data does not support or require slurry pipeline transportation, yet the recommendation appears in that study as well as the Tongue-Powder study.

I call attention to a letter to Mr. Jeff White from Mr. Don L. Brown of the Montana Department of Fish and Game, dated December 14, 1977, regarding Chapter X, page 2, items 4 and 5, stating: "Slurry lines appear to be endorsed without proper reference to any adverse impacts they may have, while rail transport is apparently dismissed without benefits it may offer." Likewise, I call your attention to Mr. Brown's further comment on February 22, 1978, referring to the final draft X-2, items 5 and 6, recommending again that these be changed. We feel Mr. Brown's suggestions are firmly based and appropriately taken.

Also, the study assumptions about rail capacity limitations are wrong for reason the study chooses completely to ignore a basic fact about rail capacity, i.e., rail capacity can be expanded faster than volume to be hauled. The "high scenario" coal volumes given in the study for the Lower Yellowstone, for example, exceed our wildest expectations; but even if the volumes were to be in the neighborhood of 100 million tons by 1985, BN could expand its capacity on the line east of Forsyth in plenty of time to handle that entire volume. In addition. there would still be room to move volume by means of our line that runs through Minot as well as over our Wyoming line.

The theoretical model used by Harza to calculate rail capacity does not recognize what practical experience shows to be true. A railroad system is not a static or fixed entity as their model assumes. In reality, when a line segment appears to be approaching its practical limit, adjustments are routinely made to accomodate those limits. We are constantly doing this on our coal lines, with each year's construction providing for the needs of the following year's traffic. This process has been recognized by almost every major study of coal transportation done in recent year, with the prominent exception of the Harza study. Dr. Paul Polzin of the University of Montana in an article in MONTANA BUSINESS QUARTERLY, Spring, 1977, pointed out a study he had done indicated that if the line east of Forsyth were double-tracked and equipped with centralized train control, "it could carry the entire projected annual output of Montana coal for the next thirty years with sufficient leeway to allow significant amounts of Wyoming coal to be routed through the state toward the Upper Midwest."

In summary, unrealistic assumptions about Montana coal production and rail capacity produce a compounding of errors that leads to the false conclusion that massive amounts of water should be exported by means of coal slurry pipelines. In the absence of any logical or factual substantiation, this conclusion is misleading and does significant harm to the overall believability of the study.

Very truly yours,

J. O. Davies

cc: Mr. James R. Walker
Mr. J. U. Dickson
Mr. John Delano
Mr. Jack Knott

United States Department of the Interior
BUREAU OF OUTDOOR RECREATION
MID-CONTINENT REGION

MAILING ADDRESS
Post Office Box 25387
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION
603 Miller Court
Lakewood, Colorado
Telephone 234-2634

IN REPLY REFER TO

D6427

MAR 2 1978

Memorandum

To: Paul Shore, Study Manager

From: Agency Coordinator, Yellowstone Level B Study

Subject: Final Draft of Montana Study Team Reports

We have reviewed the above final draft provided with your memorandum of February 7, 1978. Editorial and figure changes are shown on the enclosed pages copied from the draft report.

Discussion of instream flow requirements in the report did not address recreation requirements directly, except for fishery maintenance. The Heritage Conservation and Recreation Service (HCRS, formerly Bureau of Outdoor Recreation), in cooperation with the Instream Flow Group, Western Energy and Land Use Team, U.S. Fish and Wildlife Service, is developing instream flow requirement methodologies for recreation. Future river recreation planning should utilize the results of this study to best consider what flows are required for various recreation activities and how existing or proposed developments will affect the river recreation environment.

One recommendation submitted by HCRS to be included in Chapter X of the draft report was not included and is therefore presented here.

Outdoor Recreation

Recreation and related environmental data for regional and river basin planning are not comparable to the data available for water development, flood control, and other purposes. In addition, considerable variation exists between States on recreation and related environmental data that do exist. Therefore, Federal, State, and private entities responsible for managing recreation areas should establish a uniform method of inventorying existing recreation resources, reporting use, and identifying recreational use capabilities. This system should be kept current and made available for all resources planning purposes.

Recreation costs and benefits for multipurpose projects were calculated by HCRS with respect to reservoir size estimates given by the assistant study manager. Estimated recreation days attributed to multipurpose reservoir projects were included in Chapter IX; however, estimated costs and benefits were not included in the recommended plan. A table of recreation data for each project is attached.

Although we are pleased with the wild, scenic, and recreation river proposals presented in the recommended plan, discussion of recreation resources needs is sparse and often too generalized.

The HCRS is pleased with the environmental integrity of these reports and would like to commend all those who participated in this study effort.

Emanuel Lauck

Enclosure

cc: Montana SLO

Planning Area	Bighorn-Clarks Fork		Upper Yellowstone		
Project	Elbow Creek	Blue Water - 5 Mile Creek	Flathead Creek	Prior Creek	Antelope Cre
Estimated WSA	340	255	300	250	300
Annual Recreation Days (General Recreation)	95,200	71,400	84,000	70,000	84,000
Annual Fisherman Days	74,800	56,100	66,000	55,000	66,000
Total Recreation Days	170,000	127,500	150,000	125,000	150,000
Land Acres Required for Recreation	366	274	323	269	323
Total Construction Costs	1,791,800	1,343,850	1,581,000	1,317,500	1,581,000
Land Acquisition	102,000	82,200	96,900	80,700	96,900
Annual Operation, Maintenance, and Replacement	102,900	77,100	90,800	75,600	90,800
Annual Equivalent Cost	Not Amortized	Not Amortized	Not Amortized	Not Amortized	Not Amortized
Annual Benefits	564,400	423,300	498,000	415,000	498,000

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Billings Area Office
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

IN REPLY REFER TO:

March 17, 1978

Mr. Paul Shore, Study Manager
Yellowstone Level B Study
Missouri River Basin Commission
Northfork Star Route
Cody, WY 82414

Dear Mr. Shore:

We have reviewed the final draft report (volumes 2 through 5) for the Montana portion of the Yellowstone Basin and Adjacent Coal Area Level B Study. In general, it appears that our concerns regarding the quality of baseline fish and wildlife data (and other environmental information) that would be developed and used in the study have been confirmed.

Although the information presented in the report admittedly represents what is most readily available, it is, in our opinion, neither comprehensive enough nor detailed enough for the intended purpose. Baseline information describing and quantifying even the major fish and wildlife habitat types in the area is extremely limited. Also, no quantified projected requirements for fish and wildlife habitat needs appear in the report, although such needs certainly exist and should have been a major thrust of the study. In addition, environmental baseline information was never assembled in such a manner to permit any meaningful assessments of the impacts and trade-offs of alternative plans. A more formal, systematic, and better documented procedure was, in our opinion, necessary to properly evaluate resource trade-offs and assess impacts.

In the early phases of the study, the Fish and Wildlife Service suggested methods for assembling at least some of the needed natural resource baseline data. It was hoped these suggestions would lead to further discussions and eventual adoption of some procedure for bringing together the essential information. However, the suggestions were rejected and no alternative solutions for gathering the data were proposed. Management personnel insisted that the study be conducted using "existing" data, but no adequate procedure for assembling such existing data was incorporated into the study.

Finally, we question whether the study was conducted entirely in accordance with guidelines set forth in the Water Resource Council's "Principles and Standards" which require that equal consideration be given to the National Economic Development and Environmental Quality Planning Objectives. We do not believe equal emphasis is reflected. To some extent, we believe this particular shortcoming was built into the plan of study. As you may recall, the Service expressed concern on this point on numerous occasions early in the study. In fact, it was our concern with procudrual shortcomings outlined herein that led us to limit our later involvement in the study.

Our specific comments on the draft report follow:

Chapter II - Natural Resource Baseline, Fish and Wildlife Resources (Volumes 2-5)

No quantified data are presented in these sections of the report volumes. While the descriptive information presented is interesting and informative, it does not, in our opinion, give a good picture of the existing fish and wildlife resource base. Some quantified estimates of both terrestrial and aquatic habitats important for fish and wildlife are needed as a basis for later comparisons.

The bald eagle should be included among those species noted in the report as endangered or threatened. The eagle was recently added to the national endangered list. It is probable that bald eagles occur in all four Montana planning areas.

Chapter IV - Projected Requirements, Fish and Wildlife (Volumes 2-5)

The information presented in these sections of the report volumes does not appear to address the primary issue, i.e., "projected requirements" or future needs for fish and wildlife resources. No quantified data relating to resource (fish and wildlife species) needs or use (by man) needs are presented. A very limited and general discussion of the need for stream access is contained in each volume, but only the Upper Yellowstone report contains even a vague idea of specific locations.

It is our opinion that the needs of selected animal species or groups, or for selected habitat types, should be considered in a study of this nature.

Chapter V - Future Without (F/WO) and Remaining Needs, Fish and Wildlife (Volumes 2-5)

The inadequacies pertaining to quantified fish and wildlife resource needs cited previously in comments on chapters II and IV also apply to these sections of the volumes.

Chapter VII - The Recommended Plan (Volumes 2-5)

The only elements of this plan which we could support without detailed fish and wildlife studies are:

1) Removal of fish spawning barriers to tributary streams
2) Proposals for additions to the National Wild and Scenic Rivers System or designation of river segments as State Recreation Rivers

Chapter VIII - Recommended Plan Evaluation, Fish and Wildlife (Volumes 2-5)

It is interesting to note that this section does not describe, in any detail, how the recommended plan will meet future specific needs for fish and wildlife resources. It merely states that plan elements would "maintain and/or enhance existing habitat" or "create new habitat". This may or may not be true; however, in most instances, it can't be definitely stated based on the limited data presented in the report. It was, of course, probably impossible to describe in this section how the recommended plan would meet future fish and wildlife needs since no attempt was made to adequately describe or quantify these needs. However, it seems that any viable plan should certainly address this issue.

Chapter IX - Impacts of the Recommended Plan, Fish and Wildlife (Volumes 2-5)

This section does not in any meaningful way describe or quantify even the major impacts of the recommended plan on fish and wildlife resources. However, it seems obvious that such information should be considered essential for a study of this type. In this instance, the study procedure and the information base incorporated were inadequate to attempt meaningful evaluations.

Chapter X - Conclusions and Recommendations (Volumes 2-5)

Conclusions - We question the validity and advisability of conclusion number ten for two reasons. First, the essentially permanent allocation of a resource as valuable as water in the study area should, in our opinion, be viewed on a long-term need basis rather than a short-term or "immediate" need basis. Secondly, we do not believe fish and wildlife needs in terms of water were analyzed in sufficient detail in this study to permit ranking with other water uses.

Recommendations - Fish and Wildlife - The only recommendation listed which we could support without additional detailed studies is the modification of the diversion structure in the Yellowstone River at Intake, Montana to allow for passage of paddlefish.

In connection with Recommendation 3, page X-5, Volume 5, we reiterate our position as outlined in a letter to the Corps of Engineer's dated August 15, 1977. We note that a copy of that letter is included in your study report. We might also point out that the "24 sites" alluded to in your recommendation and in our letter presently appears to be an

"outdated" concept at best.

In summary, we do not believe the study supports approval of Level C studies since it has been conducted in an inadequate manner with respect to fish and wildlife resources specifically and environmental concerns generally.

Sincerely,

Barry Betts

Barry Betts
Acting Area Manager

cc: Regional Director, USFWS, Denver, CO (ENV)