

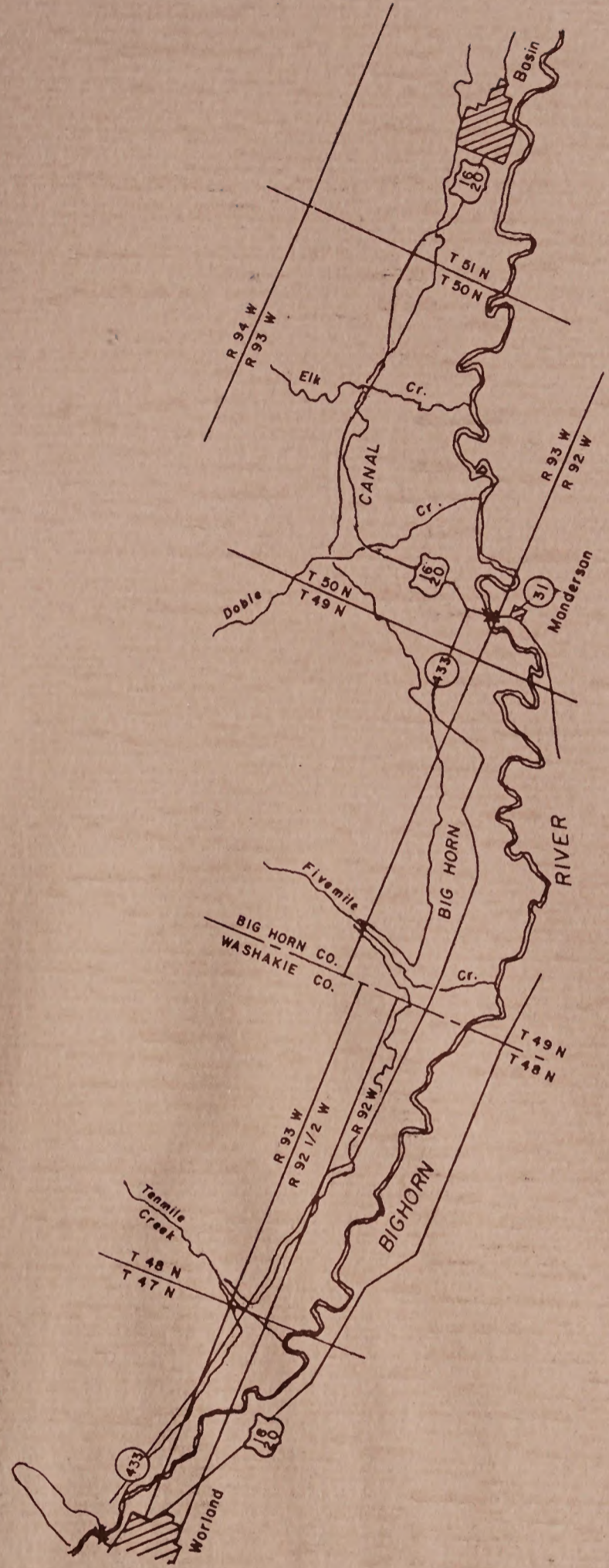
WESTSIDE IRRIGATION PROJECT



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BIG HORN BASIN DIVISION
PICK-SLOAN MISSOURI BASIN PROGRAM
WYOMING

PLANNING REPORT/ DRAFT ENVIRONMENTAL STATEMENT



U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION
MISSOURI BASIN REGION
BILLINGS, MONTANA

BUREAU OF LAND MANAGEMENT
GRASS CREEK RESOURCE AREA
WORLAND, WYOMING



STATE OF WYOMING

WYOMING WATER DEVELOPMENT
COMMISSION
CHEYENNE, WYOMING

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Planning Study/Draft Environmental Statement
OF
WESTSIDE IRRIGATION PROJECT

High-Dam Missouri Basin Program
Big Hole Basin Division

Prepared by: U.S. Department of the Interior
Bureau of Reclamation (Area 32000)

THIS REPORT WAS PREPARED PURSUANT TO THE FEDERAL RECLAMATION LAWS (ACT OF JUNE 17, 1902, AND ACTS AMENDATORY THEREOF OR SUPPLEMENTARY THERETO) AND THE FLOOD CONTROL ACT OF 1944 AND LATER ACTS. PUBLICATION OF THE FINDINGS AND CONCLUSIONS HEREIN SHOULD NOT BE CONSTRUED AS REPRESENTING EITHER THE APPROVAL OR DISAPPROVAL OF THE SECRETARY OF THE INTERIOR. THE PURPOSE OF THIS REPORT IS TO PROVIDE INFORMATION FOR FURTHER CONSIDERATION BY THE BUREAU OF RECLAMATION, THE SECRETARY OF THE INTERIOR, OTHER FEDERAL AGENCIES, AND STATE, LOCAL, AND OTHER AGENCIES AND INDIVIDUALS.

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Planning Report/Draft Environmental Statement
on
WESTSIDE IRRIGATION PROJECT

Pick-Sloan Missouri Basin Program
Big Horn Basin Division
Wyoming

Prepared by: U.S. Department of the Interior
Bureau of Reclamation (Lead Agency)
Missouri Basin Region
Billings, Montana

Bureau of Land Management
Grass Creek Resource Area
Worland, Wyoming

Wyoming Water Development Commission
Cheyenne, Wyoming

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Abstract: This planning report/draft environmental statement analyzes a Preferred Plan to irrigate 4,068 acres along the Big Horn River in northcentral Wyoming. The land is presently public-owned, administered by the Bureau of Land Management. The report also analyzes the situation which would prevail in the area in the No Action Alternative.

The Preferred Plan would cost about \$3,880 an acre to construct (which the State of Wyoming would fund) along with annual operations, maintenance and replacement costs of \$29 an acre. The Preferred Plan would return benefits of \$221 per acre (using State economic criteria).

This document meets Bureau of Reclamation planning requirements and complies with the National Environmental Protection Act, the Endangered Species Act (Section 7 Consultation), the National Historic Preservation Act and Executive Order 11593, "Protection and Enhancement of the Cultural Environment." The report is not being used to fulfill requirements of Section 404(r) of the Federal Water Pollution Control Act.

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Financial Report/Annual Financial Statement

UNITED STATES DEPARTMENT OF THE INTERIOR

Bureau of Land Management
1975-1976 Financial Report

Report for U.S. Department of the Interior
Bureau of Land Management
Washington, D.C.

Office of Land Management
Great Salt Lake Basin
Washington, D.C.

General Land Office
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This report is prepared in accordance with the provisions of the Federal Financial Management Act (FFMA) and the Department of the Interior Financial Management Act (DIFMA). It provides a summary of the financial activities of the Bureau of Land Management for the fiscal year ending September 30, 1976.

The report is organized into three main sections: (1) Summary of Financial Activities, (2) Detailed Financial Statement, and (3) Notes to the Financial Statement. The Summary of Financial Activities section provides a high-level overview of the Bureau's financial performance, including total revenues, expenditures, and net change in fund balances.

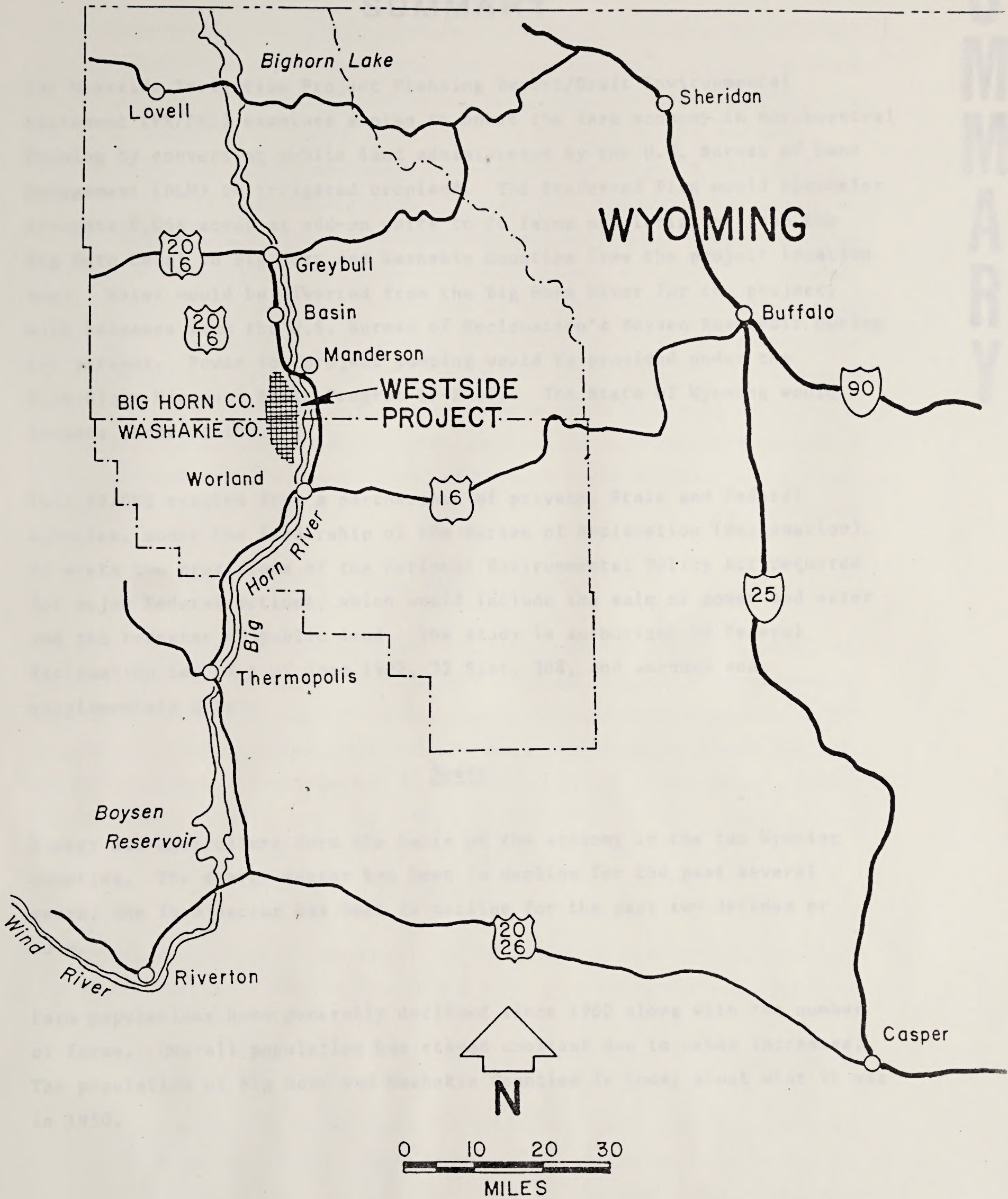
The Detailed Financial Statement section provides a more in-depth analysis of the Bureau's financial activities, broken down by major activity and sub-activity. This section includes a statement of revenues, a statement of expenditures, and a statement of net change in fund balances. The Notes to the Financial Statement section provides additional information and explanations regarding the data presented in the financial statements.

The Bureau of Land Management is committed to providing accurate and timely financial information to the public and to the Department of the Interior. This report is a key component of that commitment and provides a comprehensive overview of the Bureau's financial performance for the fiscal year 1975-1976.

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PROJECT LOCATION MAP

SUMMARY

The Westside Irrigation Project Planning Report/Draft Environmental Statement (PR/DES) examines a plan to boost the farm economy in northcentral Wyoming by converting public land administered by the U.S. Bureau of Land Management (BLM) to irrigated cropland. The Preferred Plan would sprinkler irrigate 4,068 acres as add-on units to 26 farms now irrigated from the Big Horn Canal in Big Horn and Washakie Counties (see the project location map). Water would be diverted from the Big Horn River for the project, with releases from the U.S. Bureau of Reclamation's Boysen Reservoir during dry periods. Power for project pumping would be provided under the Pick-Sloan Missouri Basin Program (P-SMBP). The State of Wyoming would finance construction.

This PR/DES results from a partnership of private, State and Federal agencies, under the leadership of the Bureau of Reclamation (Reclamation). It meets the provisions of the National Environmental Policy Act required for major Federal actions, which would include the sale of power and water and the transfer of public land. The study is authorized by Federal Reclamation Law (Act of June 1902, 32 Stat. 388, and amended and supplementary acts).

Needs

Energy and agriculture form the basis of the economy in the two Wyoming counties. The energy sector has been in decline for the past several years; the farm sector has been in decline for the past two decades or more.

Farm populations have generally declined since 1960 along with the number of farms. Overall population has stayed constant due to urban increases. The population of Big Horn and Washakie Counties is today about what it was in 1950.

Net farm income has dropped drastically in recent years because of the depressed state of agriculture. Net farm income dropped about 75 percent from 1979 to 1983, although gross income decreased only slightly.

The depressed state of agriculture and energy in the project area is reflected in employment. The labor force and employment has declined for about 5 years. Since 1984, employment has decreased by 17 percent. The unemployment rate has jumped from 5 percent to 13 percent. Much of the area workforce either works on or owns farms, so economic impacts are widespread.

More irrigation would improve the farm economy of the project area. The Preferred Plan would convert public rangeland to irrigated cropland. Public land presents the only opportunity to expand irrigation in the Westside area.

Environmental Concerns

Public meetings and meetings with the study partners brought out environmental concerns about the Westside Project. The most important of these was the loss of crucial antelope winter range. Other concerns were the effects of the project on present drainage problems, soil erosion, saline return flows, project effects on cultural resources and the loss of public land.

Alternatives

Two alternatives were investigated in this stage of Reclamation's planning process: the Preferred Plan of 4,068 acres, and the No Action Alternative.

Preferred Plan

The Preferred Plan would sprinkler irrigate fields averaging 156 acres each as add-on units to presently irrigated farms. Total irrigated acreage would be 4,068 acres.

The plan would divert 15,400 acre-feet annually from the Big Horn River, with releases from Boysen Reservoir during low-flow periods. The water would be conveyed 25-30 miles through the Big Horn Canal. The capacity of the canal would be increased by 87 ft³/s, with another gate and more freeboard added. Three pumping plants, ranging in capacity from 21 ft³/s at 274 feet of total dynamic head (TDH), to 37 ft³/s at 458 TDH, would pump from the canal. The plants would provide enough pressure to operate farm sprinklers.

About 11.2 miles of pipe 8-36 inches in diameter would be needed for the distribution system. The drainage system would be made up of 34 miles of relief and interceptor drains, with discharge to natural drainages. Three siphons, 20 farm bridges, 20 turnout structures, 4 wasteways and other miscellaneous checks and drop structures would be modified or replaced in the main canal.

Costs of the Preferred Plan are summarized in Table A.

Financial Analysis.--Wyoming would finance construction of the Preferred Plan. The State in the past has funded up to 75 percent of irrigation development costs as a grant (the percentage used in this analysis). The remaining 25 percent loan, for which Wyoming charges 4 percent interest, would be repaid by the irrigators. Assigned costs for water and power from P-S MBP would be repaid to the Federal Government.

TABLE A: PREFERRED PLAN COST SUMMARY
(December 1985 Prices)

CONSTRUCTION COST

<u>ITEMS</u>	<u>COST</u>
Big Horn Canal Earthwork	\$ 352,000
Big Horn Canal Structures	536,000
Pump Plants	2,395,000
Distribution System	2,759,000
Access Roads	542,000
Farm Services	192,000
Electrical Transmission, Substation	2,422,000
Right-of-Way Acquisition Costs	50,000
Subtotal	<u>\$ 9,248,000</u>
Contingency @25%	2,352,000
Total Field Cost	<u>\$ 11,600,000</u>
Engineering Design and Inspection Costs @15%	\$ 1,740,000
Drains	1,700,000
Mitigation Costs <u>1/</u>	284,525
Archeology Historical Preservation Studies	132,000
	350,000
Total Project Cost (Rounded)	<u>\$ 15,800,000</u>
Project Cost Per Acre	\$ 3,880

ASSIGNED COSTS

Pick-Sloan Project Power @ \$503/kW x 2,611 kW	\$ 1,313,000
Boysen Reservoir @ \$215/acre x 4,068 acres	875,000
Total Assigned Costs	<u>\$ 2,188,000</u>
Assigned Cost/Acre	\$ 538

OM&R

Project OM&R (pump plants, roads, canal improvements, pipelines, etc.)	\$ 61,300
Project Power (4,600,000 kWh @3.0 mills/kWh Pick-Sloan @2.5 mills and wheeling .5 mills)	13,800
Boysen OM&R (\$0.30 acre)	1,200
Depredation Fund <u>3/</u>	3,000
Mitigation	1,500
Administrative	37,000
TOTAL	<u>\$ 117,800</u>
	(Rounded)
OM&R Cost/Acre	\$ 29

1/ (1,088,300 lbs. of forage divided by 0.60 [sagebrush biomass needed from sheep grazing allotments @ 60 percent overlap] = 1,813,833 lbs.; divide by 780 lb./AUM = 2,325 AUM's; x 1.77 permitted AUM's/AUM grazed = 4,115 AUM's x \$35/AUM = \$144,025.) Water catchments: \$20,000; CMA's: \$58,500 (shelterbelts), \$12,000 (fences) and \$50,000 for design and implementation.

2/ Drains would be deferred until years 10 and 11 of the project.

3/ Maximum fund accumulation would be \$10,000.

Table B summarizes the investment and financial analysis. Estimated annual payment capacity would be \$744,400. After subtracting annual OM&R costs of \$117,800, the amount available for repaying reimbursable project costs, assigned costs, and for deferred drainage costs would be \$621,100 annually.

The actual amount to be repaid would be subject to negotiations between the State of Wyoming and the project sponsors. Based on a standard 40-year repayment period, however, the total annual financial requirement would be:

Reimbursable project costs (\$3,525,000)	\$ 178,100
Assigned costs	54,700
Deferred costs	56,900
OM&R	<u>117,800</u>
Total Annual Requirement	\$ 407,500

The earliest that project costs could be paid off with 4 percent interest would be 14 years, based on the following total annual financial requirement:

Reimbursable project costs (\$3,525,000)	\$ 333,700
Assigned costs	156,300
Deferred costs	106,600
OM&R	<u>117,800</u>
Total Annual Requirement	\$ 714,400

Table B: Investment and Repayment Summary for the Preferred Plan:
Wyoming Guidelines
(75 Percent Grant/25 Percent Loan)

ITEM	AMOUNT	ANNUAL FINANCIAL REQUIREMENTS W/AMORTIZATION OF COSTS - 40 YEARS, 4% PROJECT		ANNUAL FINANCIAL REQUIREMENTS W/AMORTIZATION OF COSTS OVER 14 YEARS, 4% PROJECT	
		ASSIGNED	DEFERRED	ASSIGNED	DEFERRED
Projects Cost Less Deferred Costs	\$14,100,000				
Reimbursable Project Costs (25%)	(3,525,000)	\$178,100		\$333,700	
Deferred Costs	1,700,000		\$ 56,900 1/		\$106,600 1/
Assigned Costs	875,000				
Boysen Storage (\$215/acre)					
Pick-Sloan Power 2/ (503/kw x 2,499 kw)	1,313,000				
Total Assigned Costs	\$ 2,188,000	\$ 54,700		\$156,300	
Interest During Construction					
Project Assigned	\$ 570,000		nonreimbursable		nonreimbursable
Boysen Storage (\$11/acre)	45,000				
Pick-Sloan Power (\$31.39/kw)	82,000				
Total Assigned IDC	\$ 127,000		nonreimbursable		nonreimbursable
Annual OM&R					
Project	\$ 61,300				
Project Power - 4,249,000 kwh @ 3.0 mills (Pick-Sloan @ 2.5 mills & wheeling .5 mills)	13,800				
Boysen OM&R (\$.30/acre)	1,200				
Administrative	37,000				
Depredation Fund	3,000				
Mitigation	1,500				
Total Annual OM&R	\$ 117,800	\$117,800		\$117,800	\$117,800
Annual Payment on Loan During Repayment Period	\$178,100 (\$44)			\$333,700 (\$82)	
Annual Payment Per Acre					
Annual Payment on Assigned Costs During Repayment Period		\$ 54,700		\$156,300	
Annual Payment on Deferred Costs During Repayment Period			\$ 56,900		\$106,600
Annual OM&R		\$117,800			\$117,800
Total Annual Financial Requirement		\$407,500			\$714,400

1/ Annual costs of drains determined by present-worthing equal annual expenditures (\$850,000) during years 10 and 11, and annualizing the present worth value over 40 years and 14 years, respectively, at 4 percent interest.

2/ Assigned costs apply only to project power, not to onfarm power.

Social Effects.--The most significant benefit of the Preferred Plan would be to stimulate the farm economy of the project area. A short-term benefit would be greater employment opportunities during the 2-year construction period, estimated to be 43 people each year, 40 percent of which would be filled by local workers. The equivalent of 12 full-time employees would result from the Preferred Plan.

The greatest social concern would be the loss of recreation on 4,693 acres of public land. Cooperative Management Areas (CMA's) would be developed in cooperation with BLM to compensate for this loss.

Environmental Effects.--Water would be diverted from the Big Horn River for the Preferred Plan. Releases from Boysen Reservoir during low-flow periods would offset project demands, thus avoiding impacts on the Big Horn River fishery. Project demands would not affect fish spawning or recreation in Boysen in an average year.

Water quality constituents (TDS, trace constituents/metallic elements and pesticides) in the Big Horn River would increase slightly with the Preferred Plan, but would pose no threat to humans or aquatic species. Increased sediment delivery to the Big Horn from the Preferred Plan would be insignificant. The only effect on ground water would be to increase iron levels to a mean concentration of 1.492 parts-per-million. This is considered an insignificant impact, since little use is made of project area ground water because of present low yields and poor quality.

Sagebrush habitat in the project area provides crucial winter range for antelope. Mitigation for the loss of the habitat would require that the project sponsors negotiate with grazing permittees to reduce or eliminate winter sheep grazing on allotments with crucial winter range. Sagebrush range would be improved in these areas and thus provide mitigation. It is acknowledged that the possibility of reducing winter sheep grazing sufficiently and improving the sagebrush range are unknown. To ensure that project effects would be mitigated for, construction would not begin until the necessary measures were completed.

Mitigation areas would have to meet certain requirements (contain the proper vegetation types, be bare of snow, etc.) and satisfy the Wyoming Game and Fish Department (WGFD) and BLM.

The CMA's would further compensate for lost habitat, as well as mitigate for lost recreational opportunities. The CMA's, parcels of the project area ranging in size from 20-120 acres, would be kept in public ownership, to be managed as upland game bird habitat by BLM. Total acreage of the CMA's would be 406 acres, or 10 percent of the project area. The CMA's would be leased, with restrictions placed on farming operations. Shelterbelts on nonirrigated tracts within the farm boundaries would be part of the CMA's.

The BLM could also manage land next to the CMA's (but outside of the project area) as feed plots to create blocks of habitat large enough to support hunting.

The WGFD is concerned about increased wildlife depredation claims in the project area as a result of the Preferred Plan. A fund would be established by the irrigators to pay claims on Westside Project land.

There are an estimated 234 archeological sites in the project area that could be eligible for the National Register of Historic Places (with about 800 acres of the project remaining to be surveyed). At least 20 of these sites would be disturbed by the Preferred Plan.

Threatened or endangered species that might be found in the project area are the black-footed ferret, bald eagle, and peregrine falcon. Black-footed ferrets were not found in a 1984-1985 survey of the two prairie dog towns, and no eagles nest in or near the project area. The project area holds no suitable sites for the peregrine falcon. Thus, the Preferred Plan would not affect threatened or endangered species.

Table C summarizes the environmental effects.

No Action Alternative

The No Action Alternative would mean that no irrigation project would be built. Without the project, the area would continue to be public land managed by BLM. Main uses are livestock grazing, petroleum exploration, and recreation. Range condition is presently poor-to-fair, which BLM is required to improve (BLM 1987).

The No Action Alternative would probably mean no further demands would be made on the water resources of the Westside area. Flows in the Big Horn River would remain as at present. Irrigators could obtain water from shallow wells or drain ditches that pick up seepage from the Big Horn Canal. Neither source would allow irrigation to expand much beyond the present.

Combined net farm income decreased about 75 percent from 1979-1983, and this downturn, compounded by depressed energy prices, has caused unemployment to climb to relatively high levels. Little change is anticipated in the near future without improved agriculture and energy sectors of the economy.

The No Action Alternative would leave wildlife species and habitat as at present. Crucial antelope winter range would be unaffected. No appreciable changes probably would occur to cultural resources in the project area, except from natural forces.

Table C compares environmental effects of the alternatives while Table D compares the other factors.

TABLE C: Environmental Quality

ENVIRONMENTAL FACTOR	PRESENT CONDITION	FUTURE W/O PROJECT (NO-ACTION ALTERNATIVE)	PREFERRED PLAN 1/	SIGNIFICANCE 2/
<u>Surface Water Quantity:</u> (Big Horn River)	Unappropriated flows available through early summer in average years.	Same as present.	Unappropriated flows used to meet project needs when available (15,400 acre-feet). When flows are 580 ft ³ /s or less at the Big Horn Canal headgate releases would be made from Boysen Reservoir to replace Westside diversions.	0
<u>Surface Water Quality:</u> (Big Horn River)				
TDS	649 ppm	649 ppm	653 ppm	0
Arsenic	8.55 ppb	8.55 ppb	8.55 ppb	0
Cadmium	0.24 ppb	0.24 ppb	0.24 ppb	0
Iron	72.5 ppb	72.5 ppb	72.7 ppb	0
Selenium	2.20 ppb	2.20 ppb	2.20 ppb	0
<u>Pesticides:</u>				
Carbaryl	Not Known ^{3/}	Not Known ^{3/}	0.00 ppm ^{4/}	0
Dicamba	Not Known ^{3/}	Not Known ^{3/}	0.00 ppm ^{4/}	0
Aldicarb	Not Known ^{3/}	Not Known ^{3/}	0.03 ppm ^{4/}	0
<u>Sediment Load</u>	156 tons/year	156 tons/year	172 tons/year	0
Phosphorus	1.80 ppm	1.80 ppm	1.80 ppm	0
Nitrates/Nitrites	4.80 ppm	4.80 ppm	4.81 ppm	0
<u>Ground Water Quantity:</u>	Existing wells downslope of project area have limited capacity (up to 15 gpm)	Same as present.	No change except seepage and deep percolation will add to ground water supplies.	0
<u>Ground Water Quality:</u>	Generally of poor quality (up to 1,590 ppm TDS)	Same as present.	Projected levels for iron (mean value of 1,492 ppb) would exceed Federal Primary or Secondary Drinking Water Standard of 300 ppb, causing water to be unappealing and unpalatable.	-
<u>Fisheries:</u>	Being maintained by present flows and/or reservoir elevations/storage.	Same as present.	No change. Westside diversions will be replaced by releases from Boysen Reservoir, when necessary.	0
<u>Wildlife:</u>				
Crucial Winter Range - Acres	Approximately 94,100 acres of crucial winter range occur within the range of the Fifteenmile Antelope Herd unit.	Same as present.	Development of Preferred Plan would result in loss of 4,302 acres of antelope crucial winter range.	-
Crucial Winter Range - Sagebrush biomass	An estimated 909,450 pounds of forage exist on lands that would be irrigated.	Same as present.	The forage (sagebrush) on lands to be irrigated would be lost, but would be replaced through changes in grazing allotments.	0
Depredation	N/A - Public rangeland	Same as present.	Depredation claims would be paid from a fund established by irrigators.	0
<u>Land Use:</u>				
Acres	4,693 acres of 4,950 acres in project boundaries are public rangeland. Over 2,000,000 acres of public land occur in two-county area.	Same as present.	4,693 acres of public rangeland would be converted to privately owned irrigated cropland.	0
Public Access	Unlimited access to public land.	Same as present.	OMA's to mitigate for loss of recreation.	0
<u>Livestock Grazing:</u>	Predominant use of public land in the area is grazing of cattle and sheep.	Same as present.	Project development would eliminate four grazing allotments for 2,309 AUMs. Additional allotments would be modified to provide antelope crucial winter range mitigation.	-
<u>Cultural Resources:</u>	234 archeological sites in project boundaries with 800 acres yet to be surveyed.	Sites would continue to exist with some degradation due to natural forces.	At least 20 sites would be disturbed by project construction but would be mitigated by excavation and/or data recording.	-
Total EQ Effect ^{1/}		0	-	
Rank Order of Plan		1	2	

1/ Compared to the Future Condition.

2/ - Minor adverse

- - - Highly adverse

3/ Field data has not been collected: Present Condition and Future W/O Project were estimated based on model projections.

4/ Resultant values estimated from model projections.

0 No significant effect

+ + Moderately beneficial

- Moderate adverse

+ Slightly beneficial

+++ Highly beneficial

CONTENTS

TABLE D: SUMMARY OF THE ALTERNATIVES

	<u>Preferred Plan</u> <u>(4,068 Acres)</u>	<u>No Action</u> <u>Alternative</u>
<u>Acres Irrigated</u>	4,068	0
<u>Water Source</u>		
Big Horn River (acre-feet) (and Boysen Reservoir)	15,400	0
<u>Major Facilities</u>		
Pumping Plants	3	
Distribution System (mi)	11.2	
Subsurface Drains (mi)	34	
Big Horn Canal Enlargement (ft ³ /s)	87	
Energy Required		
Average Annual (kWh)	4,600,000	
Peak (kW)	2,611	
<u>Economic/Financial Factors 1/</u>		
Total Project Costs	\$14,100,000 <u>1/</u>	0
Reimbursable Project Costs (25%)	3,525,000	
Annual Project Costs	178,100	
Deferred Costs	56,900	
Assigned Costs	54,700	
Annual OM&R	117,800	
Total Annual Financial Requirement	\$ 407,500 <u>2/</u>	
Annual Requirement Per Acre	\$ 100	
Payment Capacity/Acre	183	
<u>Social Factors</u>		
Number of Farms	26	26
Increased Farm Income	\$ 875,000	0
Land Lost to Recreational Purposes (acres)	4,693	0

1/ Total construction cost minus the cost of deferred drains.

2/ Based on amortized costs over 40 years at 4 percent interest. See Table 4.8 for derivation of costs.

Conclusions

The Preferred Plan meets the tests of completeness, since all necessary investments to achieve the plan's objectives would be made; effectiveness, because the plan fulfills the objective to develop the water resources of the area; and acceptability, as the Preferred Plan is supported by the State, irrigation district, and the project sponsors. Although the Preferred Plan fails the test of "National Economic Development" efficiency, it meets the efficiency standards of Wyoming. The Wyoming Water Development Commission, while it does not have rigid economic evaluation criteria, compares direct benefits to costs, discounting the benefits at a "real discount rate" of about 4 percent (WWDC 1987).

The effects of the Preferred Plan on the environment of the project area would be mitigated. The effects on regional development and social conditions would be beneficial.

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Appendices (in separate volumes, available on request from:
Bureau of Reclamation, Missouri Basin Region, P.O. Box 36900,
Billings, Montana 59107-6900)

- Land Classification
- Economics
- Engineering
- Hydrology
- Cooperating Agencies Reports
- Environment
- Plan Formulation
- Public Involvement
- Social Assessment

CHAPTER 1 INTRODUCTION

Purpose and Scope

The purpose of this study is to examine sprinkler irrigating add-on units to farms irrigated from the Big Horn Canal in northern Wyoming. Water would be supplied from the Big Horn River. Releases from the Bureau of Reclamation's Boysen Reservoir would replace water diverted for the project during low-flow periods.

The study is a cooperative effort of State, private and Federal agencies, under leadership of the Bureau of Reclamation; the present report on the project is the third produced by this partnership. This Planning Report/Draft Environmental Impact Statement (PR/DES) is intended to serve the double function of meeting Reclamation's requirements for water resource development and the Bureau of Land Management's requirements for the transfer of public land, since BLM presently administers the project area.

The "preliminary findings report" on the Westside area, the first step in Reclamation's planning system, was completed in November 1985. That report concluded that the project warranted further study. The second step, the "plan formulation working document" (PFWD) was completed in August 1986 by Nelson Engineering, Inc., a consultant commissioned by the Wyoming Water Development Commission (WWDC). The PFWD analyzed two plans to irrigate the Westside area, choosing the 4,068-acre plan as the Preferred Plan.

This PR/DES examines the Preferred Plan in greater detail, considering plan accomplishments, water requirements, development costs, economic benefits, financial analysis, and social and environmental consequences in the chapters to follow.

Location

The Westside Irrigation Project area lies to the west of the Big Horn River in Big Horn and Washakie Counties in northern Wyoming (see the map at the front). It is west of the Big Horn Canal between the towns of Worland to the south and Basin to the north.

Authority

Federal Reclamation Laws (Act of June 1902, 32 Stat. 388, and amended and supplementary acts) provide the authority for this study.

Previous Studies

Reclamation first studied an irrigation project in the area in 1942. Twenty years later the Report on Bighorn Basin Division (Reclamation 1962) analyzed a 2,556-acre project about 10 miles north of Worland. Water would have been pumped from the Big Horn Canal to an open canal system to irrigate by gravity for these plans.

The Feasibility Study of Bighorn Westside Irrigation Project was done for the Big Horn Irrigation Development Association by Clyde-Criddle-Woodward Development Association, Inc., in June 1975. The report examined a 21,000-acre irrigation project, using return flows pumped from the river into the Big Horn Canal downstream of Worland. Water would have been pumped from the canal for sprinkler irrigation. The Bureau of Land Management analyzed the environment for the project, but no detailed economic analysis was made at the time.

The Westside Irrigation Project Study (Engineering Associates) was done for the Wyoming Engineer's Office in March 1978 by Engineering Associates. Plans to irrigate 21,000 acres (Clyde-Criddle-Woodward's plan), 19,630 acres, 9,185 acres, 7,505 acres and 3,900 acres were considered in this study. The last two alternatives were judged the "most likely to produce an economically viable project."

Under the 7,505-acre alternative, water could have been pumped from the Big Horn River to the Big Horn Canal or diverted directly into the canal at the headgate. It would then have been distributed from the canal to laterals.

Water would have been diverted from the river to the canal through its headgate in the 3,900-acre alternative and then distributed as in the 7,505-acre alternative. A drainage system was considered unnecessary because the land would have been sprinkler irrigated. The consultant assumed the Big Horn Canal could be enlarged for these two alternatives during normal maintenance work.

The Report on the Westside Irrigation Project Water Payment Possibilities Worland-Manderson-Basin Area, Wyoming was released in November 1977 by the Wyoming Agricultural Extension Service. It was a companion report to the Westside Irrigation Project Study, covering the economic aspects of that report.

Public Participation

Public meetings were held in Worland, Wyoming on February 21 and March 5, 1985. Issues raised at the meetings were used in formulating the Preferred Plan for this PR/DES. Meetings (and the issues raised at them) are described in Chapter 6.

Cost Sharing

The State has shared the costs of the study, the WWDC having provided about 50 percent of the study funds to date. Wyoming would fund the construction costs of the project but wants the PR/DES completed before committing construction funds.

The Westside Irrigation District is pursuing State funding for water resource development through the WWDC. The sponsors are seeking a 4-percent loan for 25 percent of the project costs from the Wyoming Legislature, and a grant for the remaining 75 percent. The Westside Project would be authorized as part of the Pick-Sloan Missouri Basin Program (P-S MBP). Sponsors would repay assigned cost for Boysen Reservoir storage and assigned power and operation, maintenance, and replacement costs for P-S MBP. The project would receive no repayment assistance from P-S MBP.

CHAPTER 2 NEED FOR ACTION

Agriculture and energy production form the economic basis of the Westside Project area. Farmers have been irrigating more in recent years than in the past, 169,640 acres being irrigated in 1983 in the two counties (Wyoming Department of Administration and Fiscal Control 1983).

Net farm income dropped drastically in Big Horn and Washakie Counties in the early 1980's, as did the agricultural economy throughout the country. Combined net farm income dropped by about 75 percent from 1979-1983 (Figure 2.1). At the same time, overall income in the two counties increased by about 4 percent. Total county income at present is stagnant, however, even declining somewhat on a real income basis due to the decline in the energy-producing industries (Table 2.1).

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Table 2.1: County Personal Income ^{1/}

Year	Big Horn County	Washakie County	Total
1984	\$96,000,000	\$110,000,000	\$206,000,000
1985	\$95,000,000	\$111,000,000	\$206,000,000

^{1/} Estimated personal income less transfer payments.

Source: Denison and Doll, 1985.

Recent cutbacks in the energy-producing industries, along with the depressed state of agriculture, have caused unemployment in the two counties to climb to relatively high levels (Table 2.2).

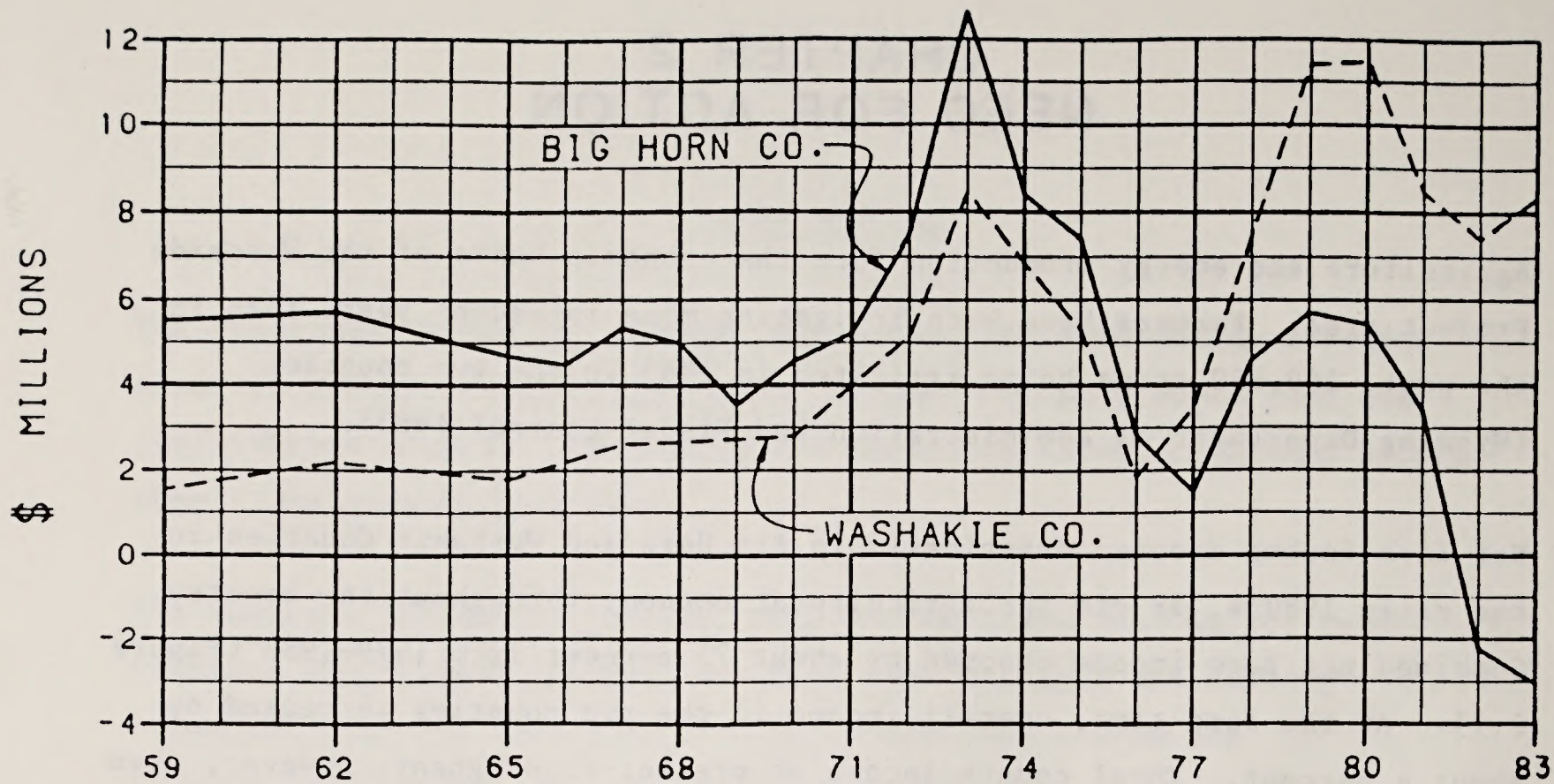


FIG. 2.1: NET FARM INCOME

SOURCE: WYOMING DEPARTMENT OF ADMINISTRATION AND FISCAL CONTROL, 1984 and UNIVERSITY OF WYOMING, 1985.

Table 2.2: Unemployment (Percentage)

Year	Big Horn County	Washakie County
1977	4.2	3.0
1978	3.7	3.3
1979	2.7	3.1
1980	3.4	3.5
1981	3.4	3.2
1982	7.1	5.4
1983	9.3	7.5
1984	6.5	5.0
1985	9.3	6.8
1986	14.4	11.6

Source: Wyoming Employment Security Commission, 1985.

Total population in Big Horn County has dropped since 1980, but population in Washakie County has increased slightly. Combined population of the two counties is now at about the level of 1960 (Table 2.3).

Table 2.3: Projected Baseline Total Population in Local Impact Area 1/

<u>Year</u>	<u>Big Horn County</u>	<u>Percent Change</u>	<u>Washakie County</u>	<u>Percent Change</u>
1950	13,176		7,252	
1960	11,898	- 9.7	8,883	22.5
1970	10,202	-14.0	7,569	-14.8
1980	11,896	16.1	9,496	25.5
1985	11,160	- 6.2	9,823	3.4
1990	10,713	- 4.0	9,823	0.0

1/ Projections made by linear regression.

Source: Bureau of the Census, 1960, 1970 and 1980.

With the project, arid rangeland would be converted to irrigated cropland. Adding irrigation would increase farm income and farm employment, thereby raising the tax base. Increased income would help stabilize the economy and the population in the two counties.

From interviews in September 1984, it appears area operators are expanding into more "livestock backgrounding" (fattening weaned calves to about 750 pounds before selling them to feedlots). Currently the project area is designated a "feed deficit" area: even at current levels, operators have to purchase livestock feed from outside. More irrigated land would allow more feed to be produced in the locality.

Without the project, an opportunity to improve the farm economy in Big Horn and Washakie Counties would be lost.

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CHAPTER 3 RESOURCES

Water

Surface Water

The Wind River flows more than 120 miles through central Wyoming from its headwaters near the Continental Divide to the Bureau of Reclamation's Boysen Reservoir south of Thermopolis. After passing through the Wind River Canyon, the river becomes the Big Horn. The Big Horn below Boysen has an average discharge of 1,443 ft³/s, or 1,045,000 acre-feet per year.

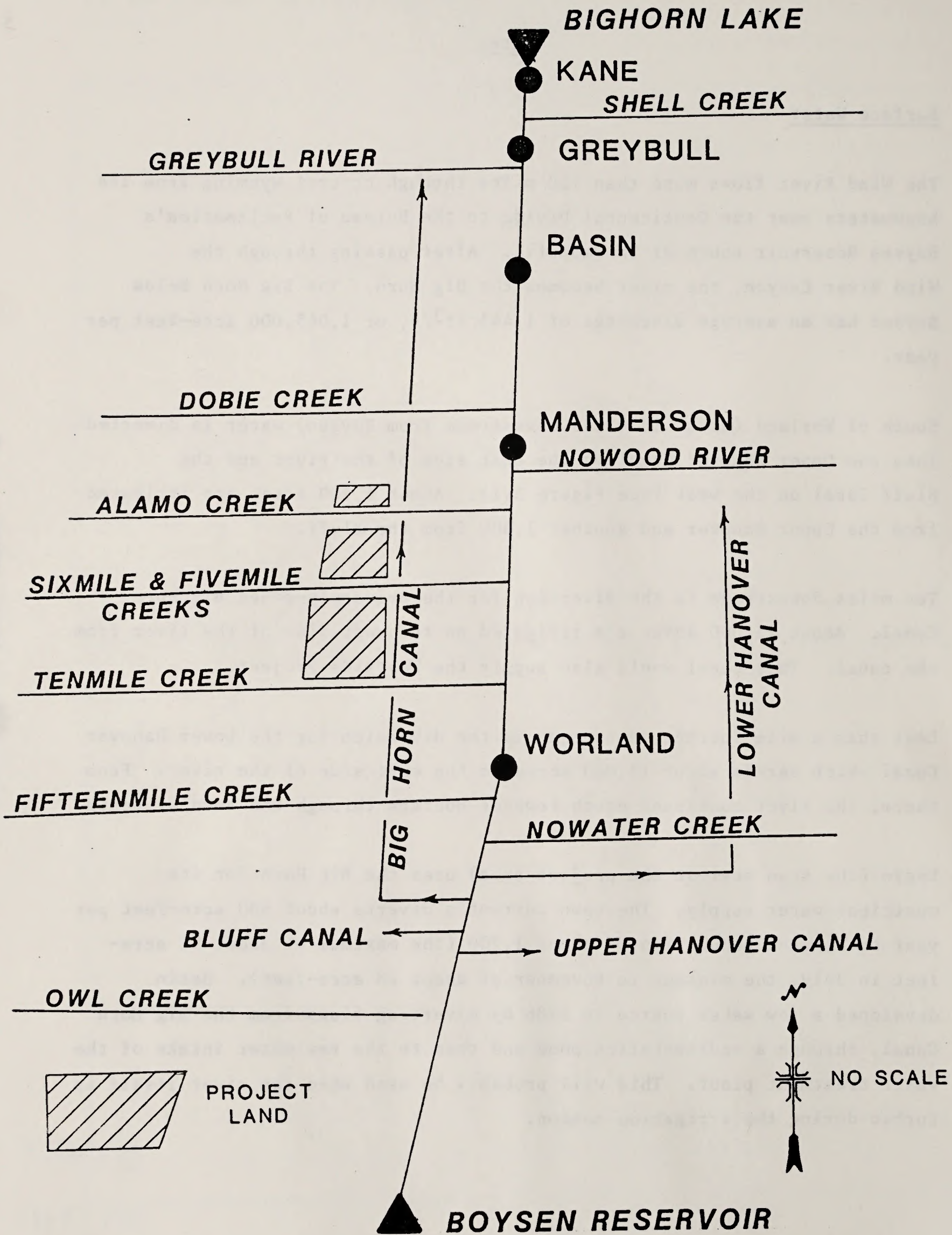
South of Worland (about 18 miles downstream from Boysen) water is diverted into the Upper Hanover Canal on the east side of the river and the Bluff Canal on the west (see Figure 3.1). About 6,100 acres are irrigated from the Upper Hanover and another 1,300 from the Bluff.

Ten miles downstream is the diversion for the privately-owned Big Horn Canal. About 25,000 acres are irrigated on the west side of the river from the canal. This canal would also supply the Westside Project.

Less than a mile further downstream is the diversion for the Lower Hanover Canal which serves about 13,000 acres on the east side of the river. From there, the river continues north towards Montana through the town of Basin.

Basin (the town nearest the project area) uses the Big Horn for its municipal water supply. The town currently diverts about 600 acre-feet per year to serve a population of about 1,200 (the maximum of about 92 acre-feet in July, the minimum in November of about 28 acre-feet). Basin developed a new water source in 1986 by diverting flows from the Big Horn Canal, through a sedimentation pond and then to the raw water intake of the water treatment plant. This will probably be used when the river itself is turbid during the irrigation season.

Figure 3.1: BIG HORN RIVER FLOW SCHEMATIC



From Basin, the river flows into Big Horn Lake (impounded behind Yellowtail Dam).

Water discharged from Boysen Reservoir is of generally high quality all year. Natural discharges from hot springs at Thermopolis, irrigation return flows, natural runoff and industrial waste water gradually increase the concentration of minerals and chemicals. The return flows also carry silt and clay particles which increase turbidity in the river.

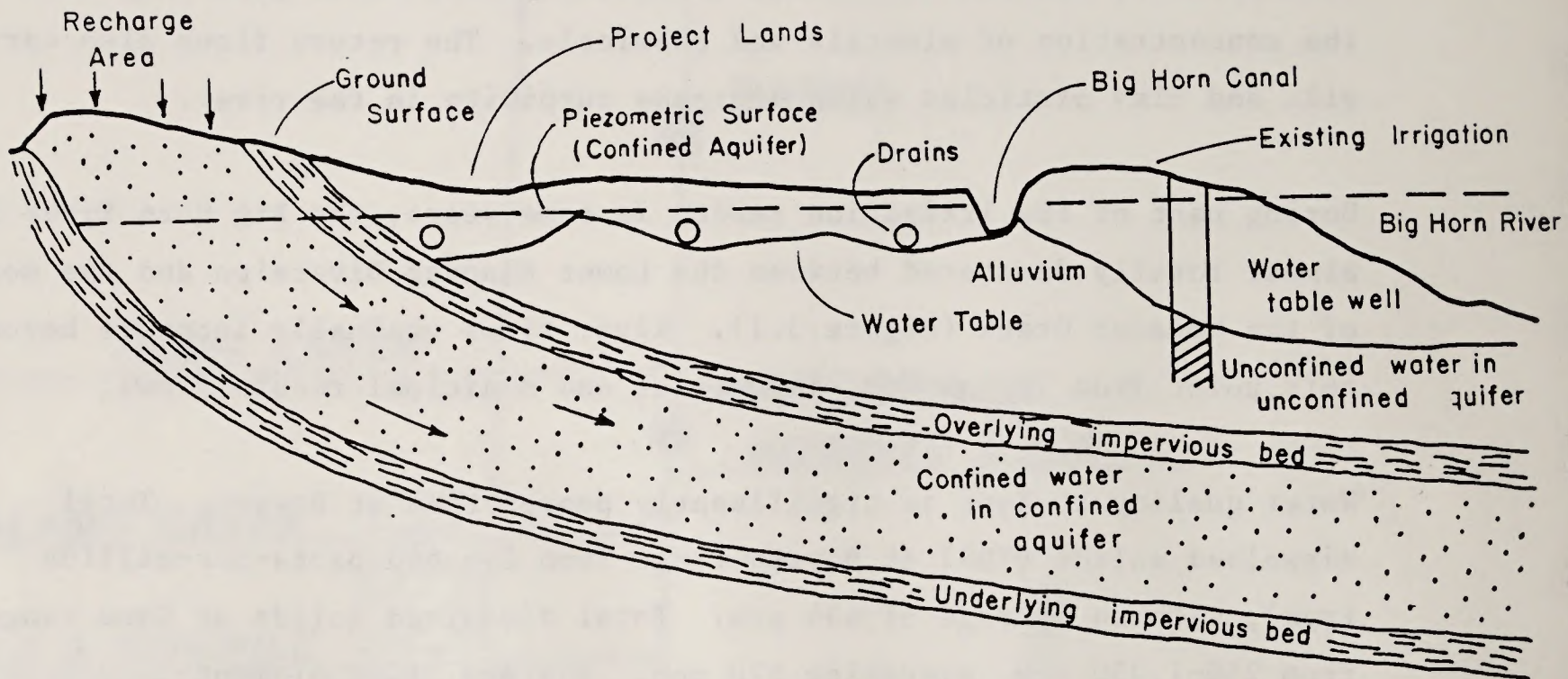
During part of the irrigation season in some years, the Big Horn River is almost totally dewatered between the Lower Hanover Diversion and the mouth of the Nowater Creek (Figure 3.1). River flows gradually increase beyond this point from irrigation, industrial and municipal return flows.

Water quality at Kane is significantly poorer than at Boysen. Total dissolved solids (TDS) at Boysen range from 246-600 parts-per-million (ppm), with an average of 434 ppm. Total dissolved solids at Kane range from 250-1,050 ppm, averaging 620 ppm. Average trace element concentrations also increase: from 2.08 parts-per-billion (ppb) at Boysen to 11.86 ppb at Kane for arsenic, 66.88 ppb at Boysen to 100.47 ppb at Kane for iron. Selenium concentrations below Boysen average 1.08 ppb. (The concentration at Kane is unavailable.) Comparison of cadmium shows a reduction from Boysen at 1.29 ppb to 0.33 ppb at Kane. The water at this point is still of acceptable quality for irrigation and municipal uses, according to U.S. Environmental Protection Agency drinking water standards.

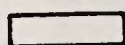
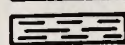
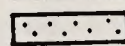
Ground Water

Ground water in the region comes from Big Horn River Valley alluvium or the Willwood Formation (Figure 3.2). Water levels in the alluvium range from the surface to about 40 feet during the irrigation season, dropping a few feet thereafter (Nelson Engineering 1985). The Willwood Formation is high in clay content, which restricts yields from wells to between 2-15 gallons per minute (gpm). Yields up to 5 gpm at depths at 300-350 feet in water and oil producing zones have also been reported.

Figure 3.2: GROUND WATER DIAGRAM



LEGEND

-  Alluvium
-  Impervious bed
-  Permeable sandstone

The project area lies 100-200 feet higher than the Big Horn Valley, underlain by ancient alluvium and the Willwood Formation. A few shallow domestic and livestock wells are located in the vicinity of the project, most of which lie down-gradient, between the Big Horn River and the canal. Most of the recharge to these wells is from seepage from the canal (Figure 3.2).

Little is known about ground water quality in the project area, but total dissolved solids as high as 1,590 ppm have been found in some samples.

Project Supply

The water supply for the Westside project would be unappropriated Big Horn River flows, and water from Boysen Reservoir.

Boysen Reservoir is a Bureau of Reclamation facility built in 1951. It has active conservation capacity of 549,867 acre-feet, with an additional 150,428 acre-feet of exclusive flood control space. Boysen's total capacity is 952,432 acre-feet at elevation 4732.2, including 252,137 acre-feet of dead and inactive storage. It currently serves about 70,000 irrigated acres. Current releases are to meet downstream prior water rights and storage-contract commitments. Minimum historical end-of-month content (April 1, 1956) was 259,500 acre-feet. About 57,000 acre-feet of storage is available for new projects (Reclamation 1983b).

The Big Horn below Boysen has an average discharge of 1,443 ft³/s, or 1,045,000 acre-feet per year.

Land

Soils and Topography

Main topographic features in the Westside Project area are a series of remnant terraces west of the Big Horn River, separated by steep to very steep escarpments and tributary drainages. Other features are gently to moderately sloping fans and footslopes below terrace escarpments, narrow

floodplains next to major tributary drainages, and hilly uplands at higher elevations. Sandstone and shale belonging to the Tertiary Willwood Formation occur near or at the surface in the uplands and along the terrace escarpments. A light to moderate surface cover of gravel is common on terraces. Moderate to heavy surface gravel and cobble is present on eroded terrace edges and drainage sideslopes.

Land with favorable topography for sprinkler irrigation are terraces, fans, and footslopes. The fans and footslopes generally have smooth surfaces with slopes of 2-6 percent. Little or no land grading would be necessary for sprinkler movement. Terrace surfaces are variable, ranging from nearly level to moderately undulating with many swales and random incised drainages. Slopes are mostly 1-6 percent, with some drainage sideslopes 8-12 percent. Some land grading might be necessary on the terraces (particularly along drainages) to improve surface conditions for sprinkler movement.

Soils in the project area are highly variable in depth to bedrock or coarse materials, texture, and content of soluble salts and exchangeable sodium. Terrace soils are usually deep and well-drained with moderate to high water-holding capacity. They are older and more developed than other soils in the project area. Loams and sandy loams are the predominant surface textures, normally only a few inches thick. The B horizons (which extend from 17-20 inches below the surface) may be either sandy clay loam or clay loam. The texture of the C horizon or subsoils is similar to that of the B horizon. The A and B horizons normally contain 5-15 percent gravel, whereas the C horizons often contain 5-50 percent cobble and gravel.

Griffy, Uffens and Rairdent are the primary terrace soils. The Griffy soils are nonsaline and nonsodic. The Rairdent soils generally have moderate or higher concentrations of soluble salts and gypsum, as well as gravelly substratum. Soluble salts should readily leach from these soils. The Uffens soils are affected by moderate to high concentrations of soluble salts and sodium and might require some form of chemical treatment (i.e., gypsum, sulfuric acid).

Soils occupying fans, footslopes, and swales are deep, light-colored soils which lack structural B horizons. These Entisols (primarily Lost Wells, Apron and Youngston) have moderate to high water-holding capacities, and are calcareous. Some subsoils are moderately saline, but leaching of soluble salts should occur readily under irrigation with adequate drainage.

Major soils considered unsuitable for sprinkler irrigation in the project area are the Clifterson and Persayo Series, which both have low water-holding capacities, and the Persayo soils are underlain by bedrock at depths less than 3 feet.

Land Use

There would be 4,950 acres within the boundaries of the Westside Project. Of these acres, 4,692.5 acres are presently public land managed by the Bureau of Land Management, 217.5 acres are privately owned, and 40 acres belong to Wyoming. The public land is leased for sheep and cattle grazing.

Other land uses include petroleum exploration, gravel production, and recreation (hunting, horseback riding, trapping, hiking, four-wheeling, rockhounding, etc.). There are also rights-of-way for powerlines, pipelines, telephones, the Big Horn Canal, and access roads.

Wildlife

Terrestrial Wildlife

The project area's greatest importance to wildlife is to provide crucial winter habitat for about 300 antelope occurs within the project area. Antelope browse the entire project area: sagebrush stands provide cover for fawning and high quality winter feed.

About 150-200 mule deer winter in the project area, and a recent survey showed a summer herd of 200-275 animals (WGFD 1982). Sagebrush and creek bottoms are the most important habitat for mule deer. White-tailed deer also populate the project area along the Big Horn River and Fivemile and Tenmile Creeks below the canal.

Other terrestrial wildlife in the project area include furbearers like beaver, muskrat, weasel and badger, small nongame animals and a small game animal--cottontail rabbit. Game birds in the project area are partridge, pheasant, and sage grouse. Waterfowl--Canada geese and various species of ducks--can be found in the project area as can songbirds.

See the Coordination Act Report in the Cooperating Agencies Appendix for more details on wildlife in the Westside area.

Threatened and Endangered Species

Prairie dog towns in the project area could provide habitat for black-footed ferrets, although no ferrets were found in a 1984-85 survey. The Big Horn River is an important bald eagle wintering area, but no eagles nest on or next to the project area. Peregrine falcons migrate through the area.

Fisheries

Boysen Reservoir is noted for its walleye fishery, and also supports rainbow and brown trout. The Big Horn River supports a trout fishery that

ranges from excellent near Boysen Reservoir to poor at Worland. The main fish species in the river are walleye, sauger, ling, and catfish. The shovelnose sturgeon and sturgeon chub, species classified as rare by the Wyoming Game and Fish Department (WGFD), may be in the Big Horn River, too.

Constraints on the Project

Legal

The transfer of public land for the Westside Project would be affected by the U.S. District Court's preliminary injunction order, dated February 10, 1986, involving the National Wildlife Federation vs. Burford et al. Lawsuit, Civil Action No. 85-2238. The legal action concerns the public land withdrawal review program and prohibits modifying, terminating or altering any withdrawal, classification or other designation governing the protection of lands in the public domain that was in effect on January 1, 1981. The subject lands located within the W-47613 - Protective Withdrawal Application in Aid or Classification, and BLM 031748 - Withdrawal MRB Reclamation Project are affected by the legal action.

This legal action remains unresolved.

Food Security Act.--The "Sodbuster Provision" of the Food Security Act applies to lands not planted to annually tilled crops during 1981-1985. This provision discourages the conversion of highly erodible lands to cropland. Under the Act, breaking up highly erodible soils and planting it to agricultural commodities without an approved conservation system would cause the farmer to become ineligible for certain U.S. Department of Agricultural (USDA) program benefits on all lands farmed by the particular farmer.

To be considered highly erodible lands, potential erosion must be higher than eight times the rate at which the soil can be eroded and still maintain productivity (USDA Fact Sheet, January 1987). This rate is referred to as the "tolerance" (T) factor. The T factor is assigned to a topsoil series by the Soil Conservation Service (SCS), based on soil depth

and erodibility judgments made by soil scientists. It is anticipated that the Westside land would not be considered highly erodible under irrigation.

The SCS has been contacted and maps in the Soil Survey of Washakie County, Wyoming, have been reviewed. Based on this information, the estimated T factors for the major soil series in the project area (Uffens, Rairdent, and Griffy) are:

T Factor

Uffens - 1 ton per year
Rairdent - 5 tons per year
Griffy - 5 tons per year (SCS 1983)

The Uffens soils in the Washakie County part of the Westside Project area are mapped exclusively in the Uffens-Rairdent complex, 1 to 10 percent slopes. This unit is 40 percent Uffens loam with slopes of 1 to 8 percent, 30 percent Rairdent fine sandy loam with slopes of 1 to 10 percent. Also in this unit is about 10 percent Griffy sandy loam, with slopes of 1 to 10 percent. The Uffens soils are in the lower lying areas and in depressional areas of terraces, while the Rairdent and Griffy soils are in the higher lying areas of fans and terraces. Also included in this unit are small areas of Clifterson, Muff, and Neiber soils which make up about 20 percent of the total acreage. The percentage varies from one area to another. The components of this unit are so intricately intermingled that it was impractical to map them separately at the scale used.

To determine highly erodible lands under the Food Security Act, SCS uses the T factor of the largest component within a complex. Thus all lands mapped as Uffens-Rairdent complex, 1 to 10 percent slopes would be considered highly erodible.

Soil surveys on the Big Horn County part of the project are tentative and therefore subject to change.

CHAPTER 4 ALTERNATIVES AND SELECTED PLAN

All three soils have a rooting depth of 60 inches or more, but Uffens is assigned a much lower T factor because it is classified as "Typic Natrargid," having a subsoil (B horizon) with one of its most important characteristics being a high amount of exchangeable sodium (a sodium adsorption ratio - SAR - of 13 or more). This high amount of exchangeable sodium causes the soil to disperse and seal up, severely restricting permeability to air and water and inhibiting root penetration. Natric horizons are considered limiting to soil development, thus the lower T factor. Only 1 ton per year can be eroded on Uffens soils, in comparison to 5 tons per year on Rairdent soils, and maintain productivity under dryland conditions.

The high amount of sodium in the natric horizon of Uffens may be counteracted under irrigation, however, by the use of soil amendments: sulfuric acid, sulfur and gypsum.

Rairdent soils are "Cambic Gypsiorthids," a gypsic horizon (basically high amounts of calcium sulfate in the C horizon), an asset for leaching excess sodium when Uffens-Rairdent soils are irrigated. When cultivated under irrigation, this skeletal B horizon is destroyed and soil pH values and SAR values decrease. Many USBR laboratory analyses of soil samples of presently irrigated fields in the Westside Project area confirm this observation, especially after full irrigation for 3-5 years.

(The other major soil, Griffy, is classified as a "Typic Haplargid," comprising about 10 percent of the Uffens-Rairdent Complex.)

Leaching the sodium increases the effective depth of rooting, thus increasing the amount of soil which can be eroded without impacting productivity, and raising the T factor. This is also evident on the lands next to the Westside Project which were irrigated when classified as Lost Wells and Youngston, and have T factors of 5.

Depending on the crop, estimated soil losses due to wind and water erosion would be between 0.1-10.4 tons per year in the project area (see Chapter 5). Field measurements have not been made to verify estimated soil losses.

Since it is anticipated that under irrigation the tolerance factor for Uffens-Rairdent complex would be increased from 1 to 5, the soils should not be considered "highly erodible lands" under the Food Security Act.

Institutional

Congressional authorization is necessary for the transfer of public land into the private ownership. Land would be transferred according to the strictures of the Federal Land Policy and Management Act of 1976.

Big Horn River water is allocated by the Yellowstone River Compact, which allocates 80 percent of water to Wyoming. The Compact would not affect the project since Wyoming's allocation is in excess of diversion requirements.

Physical

Land classification has identified arable land with soils containing moderate to high concentrations of salt and sodium. These areas might require soil amendments or drainage.

Environmental

The development alternative would require plowing up crucial winter habitat for antelope. A mitigation plan, developed with the help of the U.S. Fish and Wildlife Service, Bureau of Land Management and WGFD, is included as part of the Preferred Plan. Since "off-site" mitigation would be necessary, grazing allotments would have to be changed or eliminated. Without modifying grazing allotments based on the recommendations of professional wildlife managers, the mitigation plan would be inadequate and the resident antelope herd reduced. This would be unacceptable; therefore, mitigation for crucial winter habitat will be complete before construction of project facilities.

CHAPTER 4

ALTERNATIVES AND SELECTED PLAN

Initial studies in the Westside Irrigation Project area were based on soil surveys by the U.S. Soil Conservation Service, which indicated at least 21,000 irrigable acres. The Bureau of Reclamation (Reclamation) completed a semi-detailed sprinkler land classification in 1986, funding only about 7,000 arable acres within the project area. Alternatives were reformulated on this arable acreage.

Arable lands in the Westside area are not in a compact block, so dispersed blocks that could be irrigated with 50-foot or 110-foot lifts were located. A total of 10 parcels of land were identified, with acreages ranging from 157 to 734 acres.

Annual costs and benefits of various size plans were figured using Federal criteria: the fiscal year 1986 interest rate and the use of the latest "market clearing" prices of U.S. Water Resource Council's Principles and Guidelines (P&G), reflecting inclusion of support programs as applicable. Federal guidelines also require that a plan to maximize net "National Economic Development" (NED) benefits be developed, referred to as the NED Plan.

As can be seen from Figure 4.1, there was essentially no plan in which benefits would exceed costs, as almost all acreage increments would incur negative net benefits. With Federal criteria there was no reasonable plan for which incremental costs would equal incremental NED benefits. Thus, all costs for a project in the Westside area would have to be borne by a non-Federal entity.

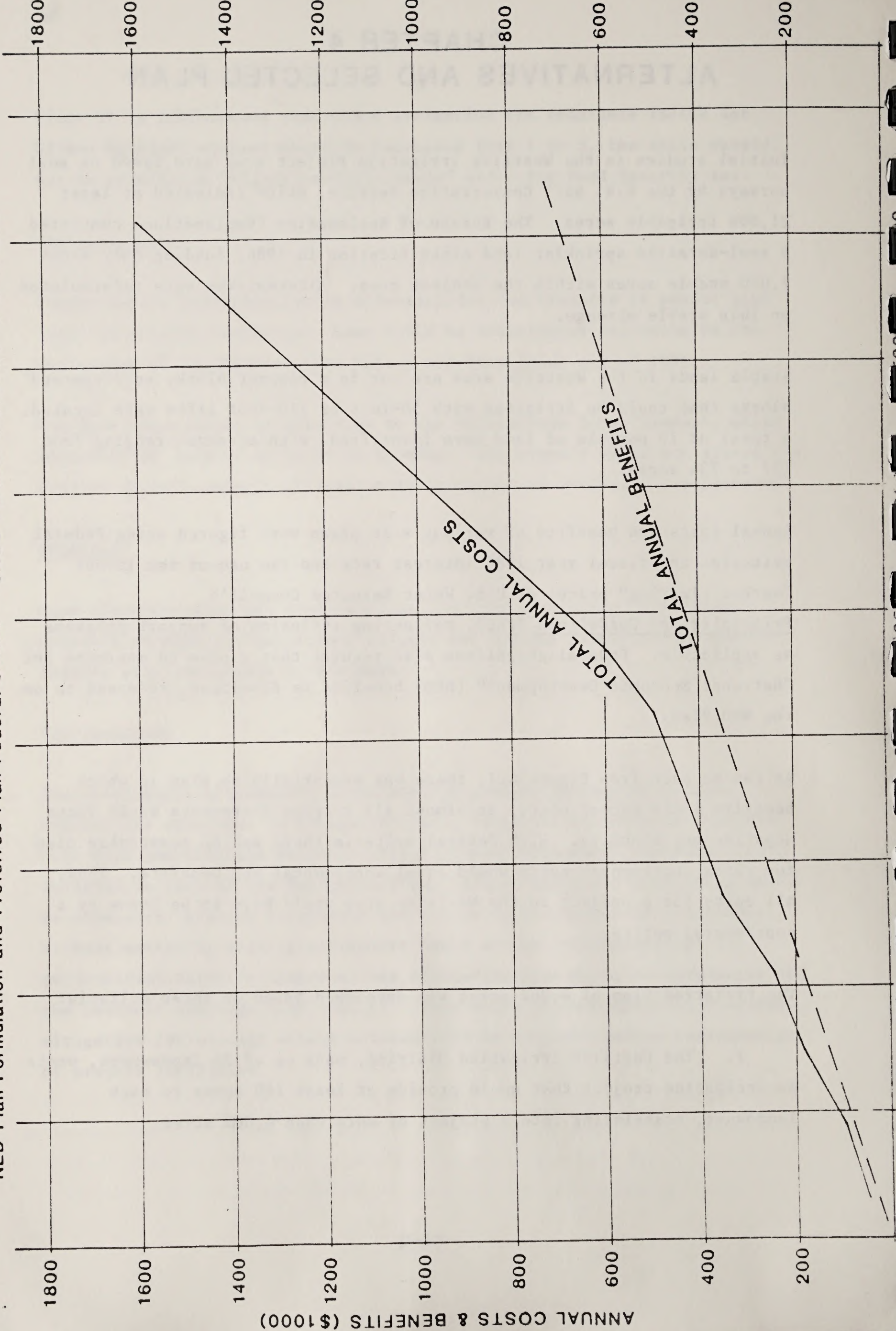
The Preferred Plan of 4,068 acres was developed based on three criteria:

1. The Westside Irrigation District, made up of 26 landowners, wants an irrigation project that would provide at least 160 acres to each landowner, translating into a project of more than 4,000 acres

FOUR

Figure 4.1

NED Plan Formulation and Preferred Plan Federal Criteria -- 8.625 Percent Interest, P & G Prices



2. Areas of antelope crucial winter range, identified by an interagency team (Wyoming Game and Fish Department, U.S. Fish and Wildlife Service, Bureau of Land Management, and Reclamation) were to be avoided if at all possible.

3. The State of Wyoming would totally fund the project, requiring the irrigators be financially capable of repaying the loan portion of costs with interest.

To develop an alternative meeting the first two criteria was difficult: land most suited for irrigation is also antelope crucial winter range. It proved impossible to formulate a plan of at least 4,000 acres while avoiding all crucial winter range. Formulation concentrated therefore on avoiding as much crucial winter range as possible, and on avoiding riparian habitat along the two main natural drainages in the area. (Mitigation for the lost habitat was included in the project cost.)

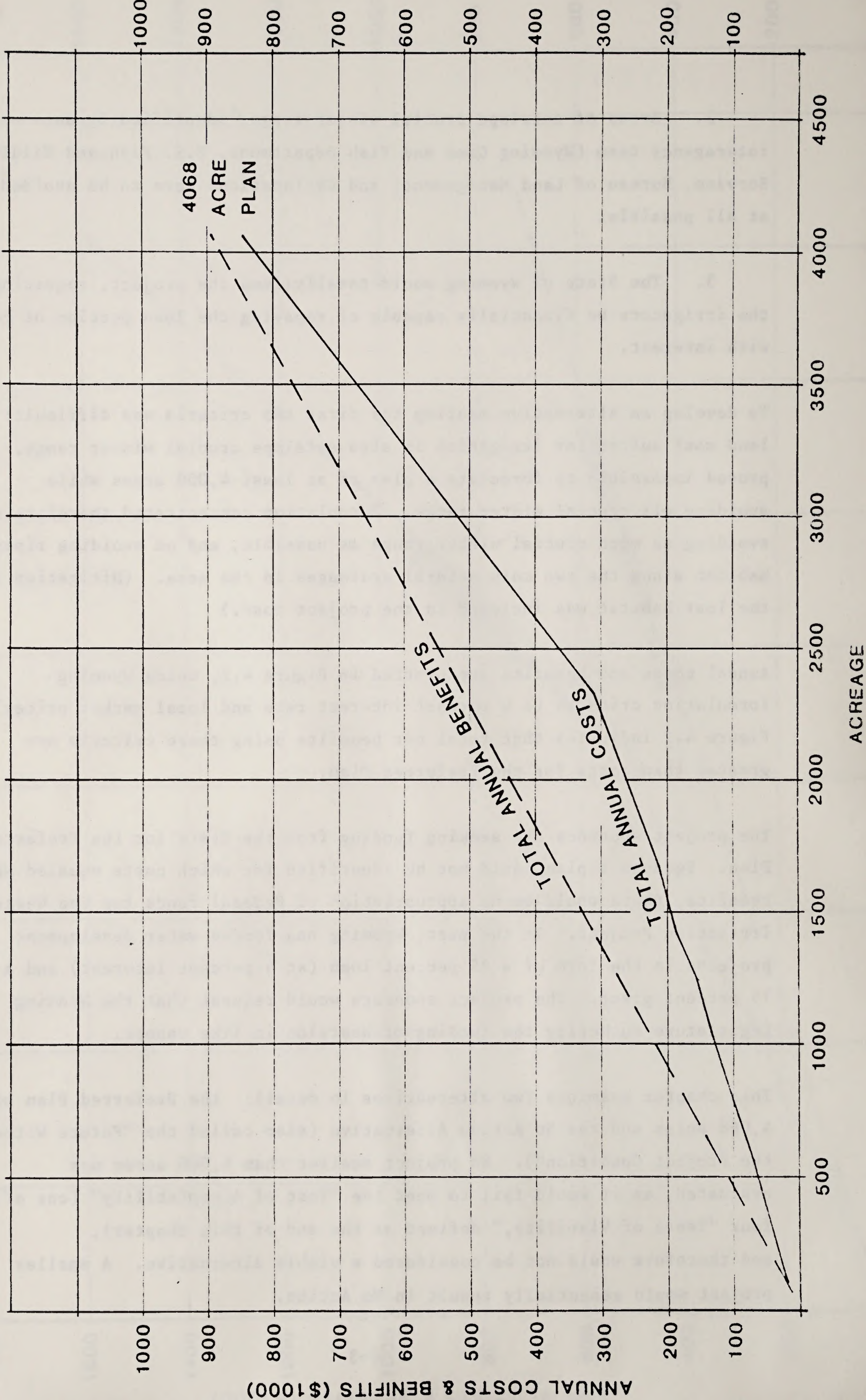
Annual costs and benefits are plotted in Figure 4.2, using Wyoming formulation criteria (a 4 percent interest rate and local market prices). Figure 4.2 indicates that total net benefits using these criteria are greater than costs for the Preferred Plan.

The project sponsors are seeking funding from the State for the Preferred Plan. Because a plan could not be identified for which costs equaled NED benefits, there would be no appropriation of Federal funds for the Westside Irrigation Project. In the past, Wyoming has funded water development projects in the form of a 25 percent loan (at 4 percent interest) and a 75 percent grant. The project sponsors would request that the Wyoming Legislature authorize the funding of Westside in like manner.

This chapter examines two alternatives in detail: the Preferred Plan of 4,068 acres and the No Action Alternative (also called the "Future Without the Project Condition"). No project smaller than 4,000 acres was evaluated, as it would fail to meet the "Test of Acceptability" (one of the four "Tests of Viability," defined at the end of this chapter), and therefore would not be considered a viable alternative. A smaller project would essentially result in No Action.

Figure 4.2

Plan Formulation (Including Preferred Plan) Using State Criteria -- 4.0 Percent Interest, Market Prices



Chapter 4 concludes with an evaluation of the Preferred Plan and the No Action Alternative, and selection of the Preferred Plan to recommend to Congress for authorization and to Wyoming for funding. Evaluation is by means of a "Four Account" Analysis (defined at the end of the chapter), selection by means of the Tests of Viability. Plans considered but dropped during plan formulation round out the chapter.

Development would require that Congress authorize the Westside Irrigation Project as part of the Pick-Sloan Missouri Basin Program (P-S MBP). Specific language in the legislation would be required to assure that the landowners in the area would have preference for purchase of the land. The sponsors would repay the Federal Government the assigned cost for storage in Boysen Reservoir, assigned costs for power, and the annual energy cost of project pumping. Wyoming would authorize the project and provide funding. Project land would be transferred from public (managed by the Bureau of Land Management) to private ownership.

Summary of Alternatives

The Preferred Plan and the No-Action Alternative are summarized in Table 4.1 and detailed in the pages to follow.

TABLE 4.1: SUMMARY OF THE ALTERNATIVES

	<u>Preferred Plan</u> (4,068 Acres)	<u>No-Action</u> (Alternative)
<u>Acres Irrigated</u>	4,068	0
<u>Water Source</u>		
Big Horn River (acre-feet) (Boysen Reservoir)	15,400	0
<u>Major Facilities</u>		
Pumping Plants	3	
Distribution System (mi)	11.2	
Subsurface Drains (mi)	34	
Big Horn Canal Capacity (ft ³ /s)	87	
<u>Energy Required</u>		
Average Annual (kWh)	4,600,000	
Peak (kW)	2,611	
<u>Economic/Financial Factors</u>		
Total Project Costs	\$14,100,000 ^{1/}	0
Reimbursable Project Costs (25%)	3,525,000	
Annual Project Costs	178,100	
Deferred Costs	56,900	
Assigned Costs	54,700	
Annual OM&R	117,800	
Total Annual Financial Requirement	\$ 407,500 ^{2/}	
Annual Requirement Per Acre	100	
Payment Capacity/Acre	183	
<u>Social Factors</u>		
Number of Farms	26	26
Increased Farm Income	\$ 875,000	0
Increased Irrigated Lands Lost to Light Recreational Purposes	4,693	0

^{1/} Construction cost minus the cost of deferred drains.

^{2/} Based on amortized costs over 40 years at 4 percent interest. See Table 4.8 for derivation of costs.

Preferred Plan (4,068 Acres)

The Preferred Plan would sprinkler irrigate fields averaging 156 acres each as add-on units to 26 farms already irrigated in the area. Total acreage within the project boundaries would be 4,950 acres of which 4,068 acres would be irrigated (Figure 4.3).

The Preferred Plan would divert water from the Big Horn River (unappropriated flows and water stored in Boysen Reservoir), conveying it 25-30 miles through the Big Horn Canal to three pumping plants (see "Surface Water Quantity: Preferred Plan" in Chapter 5).

Land

A semidetalled land classification in 1985 of the Westside Project area determined suitability of project land for sustained sprinkler irrigation. Land classification separated arable lands (Classes 1, 2, and 3) from nonarable lands (Class 6) on an economic basis, in which the physical differences in land reflect dollar differences in net income. Land classes are based on payment capacity, with the better lands (Class 1) having higher payment capacity.

Arable land is that which, when farmed in adequately sized units for the prevailing climatic and economic setting and provided with essential onfarm improvements of removing vegetation and other cover, leveling, soil reclamation, drainage, and irrigation-related facilities, will generate sufficient income under irrigation to pay all farm production expenses; provide a reasonable return to the farm's labor, management, and capital; and at least pay the operation, maintenance, and replacement costs of project irrigation and drainage facilities. The arable area comprises all land delineated in the land classification that will provide sufficient income to warrant consideration for irrigation development.

Sprinkler land classification specifications used in the 1985 survey are shown in Table 4.2.

TABLE 4.2

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
UPPER MISSOURI REGION

SPRINKLER IRRIGATION LAND CLASSIFICATION SPECIFICATIONS
WESTSIDE PROJECT, WYOMING

July 1985
Revised October 1985
Revised March 1985

LAND CHARACTERISTICS	Symbols	CLASS 1 - ARABLE	CLASS 2 - ARABLE	CLASS 3 - ARABLE
SOILS s				
Texture		Sandy loams to clay loams.	Loamy sand to very permeable clays.	Loamy sands to permeable clays.
Coarse	v	Loamy coarse sand or sand permitted below 36 inches with available water holding capacity of 6 inches or greater in the upper 48 inches.	Loamy coarse sand or sand permitted below 24 inches with available water holding capacity of 4.5 inches or greater in the upper 48 inches.	Loamy coarse sand or sand permitted below 18 inches with available water holding capacity of 3 inches or greater in the upper 48 inches.
Fine	h	No clay, silty clay, or sandy clay in upper 36 inches.	Permeable clay permitted below 18 inches.	Entire profile may be permeable clay if infiltration rate is adequate for plant moisture requirements.
Depth to coarse sand, gravel, or cobble	k	Greater than 36 inches.	Greater than 24 inches.	Greater than 18 inches.
Sodicity at equilibrium with irrigation water	a	SAR should be less than 10 in fine (clay) textured soils but may range to 20 in coarse (sandy) textured soils with adequate drainage.	Same as Class 1.	Same as Class 1.
Salinity at equilibrium with irrigation water	a	Less than 4 millimhos per centimeter with adequate drainage.	Less than 6 millimhos per centimeter with adequate drainage.	Less than 8 millimhos per centimeter with adequate drainage.
Depth to sandstone, siltstone, shale, or other impervious strata	b	60 inches plus.	Same as Class 1.	Same as Class 1.
TOPOGRAPHY t				
Gradient	g	General gradient not to exceed 6 percent, but may include small escarpments or other topographic features which exceed this slope limitation when land use considerations would dictate their inclusion.	Same as Class 1.	Same as Class 1.
Irrigation pattern	j	Minimum size of 20 acres in regular shaped fields suitable for center pivot or side-roll systems.	Same as Class 1.	Same as Class 1.
Grading and shaping for suitable movement of sprinkler systems. ^{1/}	u	Can be accomplished with \$650 or less per acre.	Can be accomplished with \$1,475 or less per acre.	Can be accomplished with \$1,800 or less per acre.
Cover (Brush or trees)	c	Can be removed with \$650 or less per acre.	Can be removed with \$1,475 or less per acre.	Can be removed with \$1,800 or less per acre.
Cobbles & stones	r	Can be removed with \$650 or less per acre.	Can be removed with \$1,475 or less per acre.	Can be removed with \$1,800 or less per acre.
DRAINAGE d				
Surface (onfarm) ^{1/}	o	Can be provided with \$650 or less per acre. Surface outlet excavation.	Can be provided with \$1,475 or less per acre. Surface outlet excavation.	Can be provided with \$1,800 or less per acre. Surface outlet excavation.
Surface-Subsurface		Major surface outlets for each farm over \$1,800 per acre cost and all subsurface drainage will be provided as a project expense. Lands potentially arable, but nondrainable within cost limitations, will be designated by a 6D preceding the symbol.		
Permissible Development Cost ^{2/}		\$650 or less per acre. ^{3/}	\$1,475 or less per acre. ^{3/}	\$1,800 or less per acre. ^{3/}



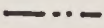
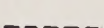

^{1/} Based on \$438 initial cost plus \$0.93 per cubic yard.

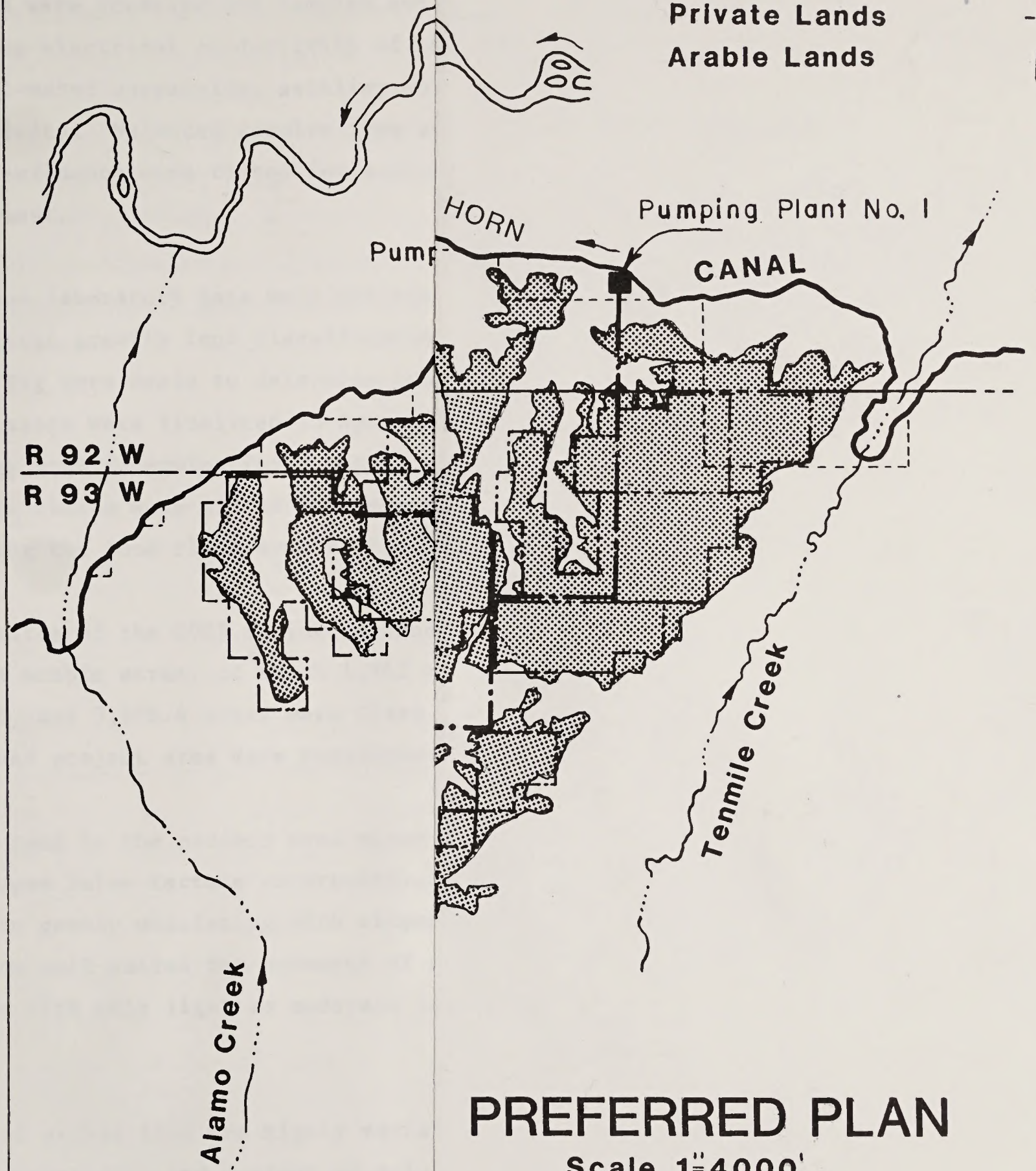
^{2/} Cost of aprinkler equipment not considered as a development cost.

^{3/} Based on Class 1 productivity (5.4 tons alfalfa, 115 bushels barley, 155 bushels corn grain, 25 tons sugar beets).

CLASS 6 - Nonarable - Lands which do not meet the minimum requirements for arable land.

LEGEND

- Proposed Pipeline 
- Proposed Pump Plant 
- Project and Farm Boundary 
- Private Lands 
- Arable Lands 



PREFERRED PLAN

Scale 1"=4000'



Fig. 4.3

4068 IRRIGABLE Acres

4950 FARM Acres, 26 FARMS

TABLE 4.2

 UNITED STATES
 DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 UPPER MISSOURI REGION

 SPRINKLER IRRIGATION LAND CLASSIFICATION SPECIFICATIONS
 WESTSIDE PROJECT, WYOMING

 July 1985
 Revised October 1985
 Revised March 1985

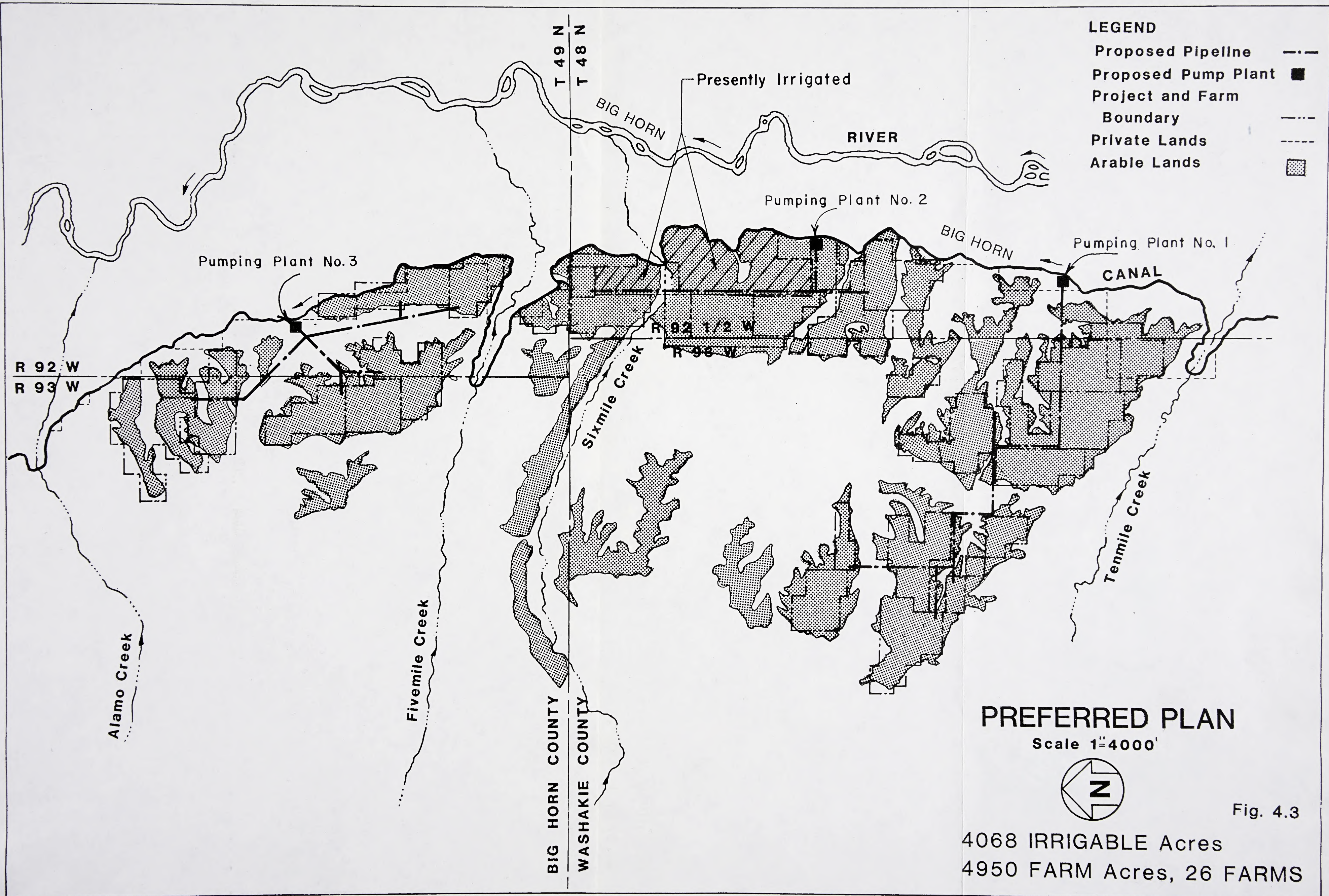
LAND CHARACTERISTICS	Symbols	CLASS 1 - ARABLE	CLASS 2 - ARABLE	CLASS 3 - ARABLE
SOILS				
Texture		Sandy loams to clay loams.	Loamy sand to very permeable clays.	Loamy sands to permeable clays.
Coarseness	v	Loamy coarse sand or sand permitted below 36 inches with available water holding capacity of 6 inches or greater in the upper 48 inches.	Loamy coarse sand or sand permitted below 24 inches with available water holding capacity of 4.5 inches or greater in the upper 48 inches.	Loamy coarse sand or sand permitted below 18 inches with available water holding capacity of 3 inches or greater in the upper 48 inches.
Fine	h	No clay, silty clay, or sandy clay in upper 36 inches.	Permeable clay permitted below 18 inches.	Entire profile may be permeable clay if infiltration rate is adequate for plant moisture requirements.
Depth to coarse sand, gravel, or cobble	k	Greater than 36 inches.	Greater than 24 inches.	Greater than 18 inches.
Sodicity at equilibrium with irrigation water	a	SAR should be less than 10 in fine (clay) textured soils but may range to 20 in coarse (sandy) textured soils with adequate drainage.	Same as Class 1.	Same as Class 1.
Salinity at equilibrium with irrigation water	e	Less than 4 millimhos per centimeter with adequate drainage.	Less than 6 millimhos per centimeter with adequate drainage.	Less than 8 millimhos per centimeter with adequate drainage.
Depth to sandstone, siltstone, shale, or other impervious strata	b	60 inches plus.	Same as Class 1.	Same as Class 1.
TOPOGRAPHY				
Gradient	g	General gradient not to exceed 6 percent, but may include small escarpments or other topographic features which exceed this slope limitation when land use considerations would dictate their inclusion.	Same as Class 1.	Same as Class 1.
Irrigation pattern	j	Minimum size of 20 acres in regular shaped fields suitable for center pivot or side-roll systems.	Same as Class 1.	Same as Class 1.
Grading and shaping for suitable movement of sprinkler systems. ^{1/}	u	Can be accomplished with \$650 or less per acre.	Can be accomplished with \$1,475 or less per acre.	Can be accomplished with \$1,800 or less per acre.
Cover (Brush or trees)	c	Can be removed with \$650 or less per acre.	Can be removed with \$1,475 or less per acre.	Can be removed with \$1,800 or less per acre.
Cobbles & stones	r	Can be removed with \$650 or less per acre.	Can be removed with \$1,475 or less per acre.	Can be removed with \$1,800 or less per acre.
DRAINAGE				
Surface (onfarm) ^{1/}	o	Can be provided with \$650 or less per acre. Surface outlet excavation.	Can be provided with \$1,475 or less per acre. Surface outlet excavation.	Can be provided with \$1,800 or less per acre. Surface outlet excavation.
Surface-Subsurface		Major surface outlets for each farm over \$1,800 per acre cost and all subsurface drainage will be provided as a project expense. Lands potentially arable, but nondrainable within cost limitations, will be designated by a 6D preceding the symbol.		
Permissible Development Cost ^{2/}		\$650 or less per acre. ^{3/}	\$1,475 or less per acre. ^{3/}	\$1,800 or less per acre. ^{3/}

^{1/} Based on \$438 initial cost plus \$0.93 per cubic yard.

^{2/} Cost of sprinkler equipment not considered as a development cost.

^{3/} Based on Class 1 productivity (5.4 tons alfalfa, 115 bushels barley, 155 bushels corn grain, 25 tons sugar beets).

CLASS 6 - Nonarable - Lands which do not meet the minimum requirements for arable land.



Field mapping using 1:12,000-scale aerial photographs was carried out first. One hundred twenty-two soil borings were then augered to a depth of 5 feet (unless coarse gravel/cobble or bedrock was encountered). Soil profiles were recorded and samples collected for routine soil analyses, including electrical conductivity of the saturation extract, pH of 1:5 soil-water suspension, settling volume, and disturbed hydraulic conductivity. Selected samples from areas of suspected saline and/or sodium influence were tested for sodium adsorption ratio and gypsum requirement.

Field and laboratory data were correlated with information from previous Reclamation gravity land classification surveys conducted between 1948-50 in the Big Horn Basin to determine tentative sprinkler land classes. The land classes were finalized in Spring 1986 after an evaluation of project drainage cost determinations. Land considered nondrainable within current economic limits were placed in a nonarable status and indicated by a 6D preceding the land class symbol, i.e., 6D(3s/3las).

The results of the 1985 sprinkler land classification showed a total of 7,524.4 arable acres, of which 1,962 acres were Class 1, 2,286 acres were Class 2, and 3,276.4 acres were Class 3. The remaining 24,418.4 acres in the gross project area were considered nonarable and placed in Class 6.

Arable land in the project area occur mainly on terraces, fans, swales, and footslopes below terrace escarpments. In general, these lands are nearly level to gently undulating with slopes predominantly less than 6 percent. They are well suited for movement of side-roll or center pivot irrigation systems with only light to moderate land grading necessary on a local basis.

Soils of arable land are highly variable, particularly in texture, depth to coarse materials, and content of soluble salts and sodium. These factors (singly or in combination) caused a significant percentage of the arable land to be placed in Class 2 or 3 since soil productivity was considered less than optimal. Depth to underlying shale or sandstone is also highly variable on the arable land, but generally occurs at 5-10 feet on swales, fans, and footslopes and 10-30 feet on most of the terrace land.

Nonarable lands consist primarily of steep terrace escarpments and drainage sideslopes associated with shallow soils and heavy surface gravel and cobble cover. Other lands considered nonarable include narrow, incised tributary drainages and hilly uplands with soil depths less than 60 inches.

The irrigable area is that part of the arable area provided with a water supply and necessary drainage facilities by development of the project. The irrigable area is determined by considering limitations imposed by the water supply, cost of facilities and service to specific tracts, and land required for rights-of-way and other nonproductive purposes. There are 4,068 acres of irrigable land in the project area.

Water Requirements

Climate.--The Big Horn Mountains to the east, the Absaroka Mountains to the west and the Owl Creek Mountains to the southwest divert many storms around the Big Horn Basin. Also, as moisture-laden clouds move up over the mountains, most of the moisture drops out on the upwind flank.

Consequently, the climate in the Westside Project area is arid, with a mean annual precipitation of 6.6 inches at Basin, 6.3 inches at Worland (U.S. National Oceanic and Atmospheric Administration 1985). About 60 percent of the precipitation occurs during April-August.

At Worland in the south end of the project area, mean daily temperature of 40 °F occurs between March 31-October 27. The last normal frost-free date is May 13, with the first normal occurrence September 23. Thus, the average growing season is 135 days. The north end of the project area, at Basin, experiences a 136-day growing season.

Basin has one of the widest fluctuations in temperatures in Wyoming; it has the highest Wyoming temperature of 114 °F, and a low of -51 °F, a range of 165°.

Crop Irrigation Requirement - The crop irrigation requirement (CIR) was computed as the average of CIRs at Worland and Basin, Wyoming. This approach was taken because these two locations lie upstream and downstream of the project area, and their elevations and latitudes approximate the

Westside. The Worland and Basin CIR's were calculated by the modified Jensen-Haise method, using the computer program CIR77. Data for the period 1952-1978 required for the program included monthly temperature, precipitation, and solar radiation. Solar radiation was computed from the mean of the percent possible sunshine at Sheridan and Lander, the two closest stations. Temperature and precipitation values were actual.

Planting, cover, harvest dates, and cropping patterns used to determine the CIR of the Westside area are as follows. (Plant and harvest dates using the U.S. Soil Conservation Service's Irrigation Guide are shown in parentheses for comparison purposes.)

	<u>Plant Date</u>	<u>Cover Date</u>	<u>Harvest Date</u>
Alfalfa 47 percent	Apr. 20 (Apr. 20)	May 25	June 20, Aug. 15, Oct. 5 (Oct. 5)
Beets 24 percent	Apr. 15 (Apr. 9)	July 25	Oct. 15 (Oct. 5)
Barley 24 percent	Apr. 5 (March 30)	June 20	Aug. 10 (Aug. 15)
Pasture 5 percent	Apr. 10 (Apr. 15)	May 25	Oct. 20 (Oct. 22)

This is the initial crop pattern expected on completion of the project, determined from agricultural economic analyses of the area with information from the project sponsors.

The average crop consumptive use for the above cropping pattern is 30.81 inches (2.57 feet). Average annual effective precipitation (precipitation that can be used by a crop and can fill the soil profile) would supply 5.40 inches (0.45 feet), with irrigation supplying an average of 25.47 inches (2.12 feet). The crop irrigation requirement would range from 21.39 inches in the wettest year to 28.73 inches in the driest.

Farm Delivery Requirement -- The farm delivery requirement is the water needed at the farm turnout. The farm delivery requirement, the sum of the CIR plus onfarm losses, is about 38 percent of the water diverted. The onfarm efficiency of 62 percent is based on use of side-roll systems in accordance with the respective layout for the Preferred Plan. Onfarm losses are made up of deep percolation, surface runoff, nonbeneficial consumptive use and evaporation (Table 4.3). Insignificant losses were assumed for the onfarm distribution system.

Thus the average farm delivery requirement is 41.08 inches (3.42 feet).

Canal Losses -- Big Horn Canal seepage and evapotranspiration losses were projected from actual seepage studies. These studies showed unit seepage losses as a function of depth. The Preferred Plan would lose an average of about 1,426 acre-feet annually over the 30-mile length of canal.

Annual Diversion Rate -- The average annual diversion rate is the water that must be supplied to the Big Horn Canal at the headgate to meet the project CIR, along with canal and onfarm losses. This value was calculated to be 3.78 acre-feet per acre. The diversion requirement would range from 12,957 to 17,303 acre-feet (depending on climatic conditions), with the annual average being 15,400 acre-feet.

Table 4.3 shows the water budget for the Preferred Plan.

Peak Rate -- Enlargement of the distribution system and Big Horn Canal were based on the peak rate, the rate at which water must be applied to a crop during a critical period to avoid plant stress. The peak rate was calculated using the Jensen-Haise method (with elevation correction). The pumping plants were sized to supply the project at the rate of 9.05 gallons-per-minute-per-acre ($82 \text{ ft}^3/\text{s}$) at the pumping plant during the critical period. The Big Horn Canal was sized to supply the peak rate, taking into account also an estimated $5 \text{ ft}^3/\text{s}$ seepage and evapotranspiration losses. The canal would be enlarged by a capacity of $87 \text{ ft}^3/\text{s}$.

Table 4.3
 WESTSIDE WATER BUDGET
 (Average Year)

	<u>Acre-Feet Per Acre</u>
Annual Crop Consumptive Use	2.57
Effective Precipitation (used by crop)	.45
Crop Irrigation Requirement	2.12
Onfarm Losses - 38 Percent of Farm Delivery Requirement	
15 Percent Nonbeneficial Consumptive Use and Evaporation	= .51
5 Percent Surface Runoff	= .17
18 Percent Deep Percolation	= .62 <u>1/</u>
Farm Delivery Requirement	3.42
Bighorn Canal Conveyance Loss (4,068 Acres)	.36
Annual Diversion Rate	3.78
	<u>Acre-Feet</u>
Annual Diversion Requirement (4,068 Acres)	15,400

1/ 0.11 acre-feet of the 0.62 acre-feet deep percolation is assumed not capturable by project drains.

Return Flows -- Surface runoff would be directed to present cross-drainage structures under the Big Horn Canal, eventually entering the Big Horn River. On the average, 0.17 acre-feet per acre would be surface runoff. This would equate to about 697 acre-feet per year.

Deep percolation (drain water) would initially be picked up by relief and interceptor drains, and then conveyed to several east-west drainages which drain to the Big Horn River. Average annual deep percolation return flows total 0.51 acre-feet per acre, or about 2,090 acre-feet per year. About 83 percent of deep percolation would be intercepted by project drains.

Canal seepage attributable to the Preferred Plan would enter the ground water system and eventually the Big Horn River. Seepage volumes along the approximately 30-mile-long route would total about 1,426 acre-feet per year.

Seepage and deep percolation annual volumes were distributed by month (lagged) according to the following percentage distribution (adapted from Reclamation's 1985 Lake Andes-Wagner Unit Hydrology Appendix):

<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>
8	6	6	5	8	8	9	10	10	11	10	9

Surface runoff was not lagged.

Table 4.4 shows the total onfarm losses and return flows.

Project Water Rights -- Water sources for the Westside Project would include unappropriated Big Horn River flows, and Boysen Reservoir storage. For this PR/DES, only adjudicated rights were assumed to be satisfied (see "Surface Water Quantity: Preferred Plan" in Chapter 5).

Big Horn River unappropriated flows would be available during the spring and early summer of an average year. After about June, river flows would be diverted by senior appropriators, leaving Boysen storage as the major

Table 4.4
Total Onfarm Losses and Return Flows (acre-feet)

			<u>Accrues to River</u>
Average Farm Delivery	13,932	13,932	
Nonbeneficial Consumptive			
Use and Evaporation	2,090		
Surface Runoff	697		697
Deep Percolation	2,508		2,090 <u>1/</u>
Total Losses	5,295	-5,295	
Crop Irrigation Requirement		8,637	
Big Horn Canal Seepage	1,426		1,426
Total Diversion Requirement	15,400	Total to River	4,213

1/ 418 acre-feet would not be captured by project drains and enter the groundwater.

source for the project. Approximately 57,000 acre-feet of water is available for new projects (see "Surface Water Quantity: Preferred Plan" in Chapter 5).

The project sponsors would obtain a permit for an original water right for river flows, and a secondary permit to divert and appropriate Boysen storage, both through the Wyoming State Engineer's Office. They would also sign a contract with Reclamation for Boysen storage, the amount of water to be negotiated (probably equal to the maximum amount of storage used in a dry year, which would about equal their annual diversion requirement of 15,400 acre-feet, as little or no natural flows would be available for use in dry years).

The Preferred Plan's diversion rate would exceed Wyoming's "duty of water" value of 1 ft³/s per 70 acres during peak use in July and August. During this period, the project's supply normally would be from Boysen storage, which is not governed by this criterion. If river flows were great enough to meet all senior water rights, the project could also divert in excess of the criterion. This apparent constraint thus would not apply to the Westside Project.

Land Costs

Public land would be transferred according to the special provisions of the Congressional authorization. The most cost-effective means would be through a single transaction to the Westside Irrigation District for subsequent distribution to individual farm interests, an avenue unavailable to the Bureau of Land Management under the Federal Land Policy and Management Act (FLPMA - which regulates public land transfers). Therefore, special authorization would be necessary.

Land cost was considered as a farm development cost to the landowner (rather than a project cost), even though the initial transfer of public land would be to the irrigation district. Wyoming statutes do not provide for land acquisition, so financing must be supplied by the irrigation district membership. Appraised fair-market value of public land would probably be less in a single transaction than it would be for the sale of individual parcels (due to the scale), but net receipts to the Federal Government would be greater, since there would be only one transaction.

In the event the project were approved but authorization for the single-transaction disposal rejected by Congress, public land would be sold under FLPMA as parcels. Even though individual parcels would be well under the FLPMA acreage limit, the entire action would exceed 2,500 acres, requiring Congressional review. Thus, selling individual parcels would also require the approval of Congress, or, at least, the decision not to act.

Lands identified for "Cooperative Management Areas" (or otherwise to be managed by BLM) would not be included in the disposal. Regardless of the way disposal were conducted, public land would only be transferred by aliquot parts along subdivision lines of the rectangular survey system. For this reason, 4,950 acres of public land are needed to provide 4,068 acres of irrigable land.

Facilities

Major facilities of the Preferred Plan would be improvements to the Big Horn Canal, construction of three pumping plants, an irrigation distribution system, access roads and a drainage system. Nelson Engineering, Inc., consultant for the WWDC, estimated all features except drainage.

Big Horn Canal.--The capacity of the Big Horn Canal would be increased from 520 ft³/s to 607 ft³/s and an additional slide gate would be required at the diversion. Work on the canal itself would be required to provide adequate freeboard. Reconstruction of the approach transition, improving air relief, head walls, safety devices, and erosion protection would be required at Fifteenmile siphon, while raising the embankment height and improving safety devices and erosion protection would be required at Tenmile Siphon. Erosion protection would be added at Fivemile flume. Twenty farm bridges, twenty turnout structures, four wasteways and other miscellaneous checks and drop structures would be modified or replaced. The canal would be lined with concrete under a highway bridge.

Pumping Plants, Pipelines and Roads.--There would be three pumping plants pumping from the Big Horn Canal for the Westside Project (see Figure 4.3). The plants would consist of two constant-speed pumps and two variable-speed drive pumps. The plants could deliver 100 percent demand at full sprinkler

pressure, assuming low-pressure sprinklers operating at 30 pounds-per-square-inch. Traveling water screens at the pumping plant intakes would remove moss and sediment.

Pumping Plant No. 1 would be in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 25, T48N, R92 $\frac{1}{2}$ W. It would have a capacity of 37 ft³/s and a total dynamic head (TDH) of 458 feet. Water would be pumped into about 3,200 feet of pipeline to serve 1,827 acres. Pipe sizes would range from 8-36 inches.

Pumping Plant No. 2 would be in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 18, T48N, R92W, with a capacity of 25 ft³/s and a TDH of 239 feet. Water would be pumped into about 14,900 feet of pipeline to serve 1,212 acres. Pipe sizes would range from 15-27 inches.

Pumping Plant No. 3 would be in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 19, T49N, R92W. It would have a capacity of 21 ft³/s and a TDH of 274 feet. Water would be pumped into about 20,100 feet of pipeline to serve about 1,029 acres. Pipe sizes would range from 15-27 inches.

In the pipe distribution systems, larger diameter pipe would be coated steel, ductile iron, or polyvinyl chloride, while smaller pipe would be polyvinyl chloride. Pipe would be buried to a depth of 3 feet and include drain-to-waste valves so that the system could be drained in the off-season. Onfarm facilities would consist of a tee, valve, and flow meter, with each farm having at least one service point.

Sprinkler pressure (1,684,000 kWh) would be supplied by Pacific Power and Light at the commercial rate of 55 mills and project pumping (4,600,000 kWh) at the P-S MBP rate of 2.5 mills, plus .5 mills wheeling and assigned costs (see the "Economic Analysis" in this chapter). Powerlines would be constructed in accordance with Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1981 (Olendorf 1981).

Access and maintenance roads 18-feet wide would be constructed paralleling main pipelines and interconnecting with present public roads (including the Tenmile Creek road). About 10 miles of gravel roads would be necessary.

Costs of facilities for the Preferred Plan can be found in Table 4.5.

Mitigation Costs.--Mitigation costs (Table 4.5) for the Preferred Plan were estimated from data supplied by the Wyoming Game and Fish Department and include three components: establishment of "Cooperative Management Areas;" ten water catchments located outside project land to disperse the antelope in the area; and an estimated cost to replace antelope crucial winter and winter/year-long range by altering grazing leases. This cost was prepared by converting the amount of forage assumed to be lost to an equivalent number of "animal unit months" (AUM's - the forage necessary to support one mature cow, with or without calf, for one month). This number, multiplied by a range improvement and an allotment adjustment factor, produced the number of AUM's that would have to be purchased. The AUM's, times the government market value of an AUM, resulted in a total estimated cost for replacing antelope crucial winter and winter/year-long range.

Assigned Costs.--Assigned costs for the Preferred Plan (Table 4.5) were included for both P-SMBP project power and Boysen Reservoir storage. P-SMBP project power costs (\$503/kW) were based on a pro-rata share of P-SMBP power facilities capital costs according to project peak capacity requirements of 2,611 kW.

Boysen Reservoir assigned costs were based on a pro-rata share of reservoir capital costs allocated to irrigation on a per acre basis, a figure of \$215/acre.

Drainage.--Reclamation completed a drainage system layout of the entire project. A sample part of the system (2.58-miles) was sized and estimated. The sample included 6-, 8-, 10- and 12-inch lines, concrete outlet, manholes, petroleum line crossings, excavation and backfill. A cost-per-mile was derived from the sample area and applied to the entire drainage system (Table 4.5).

The drainage system would be made up of 34 miles of relief and interceptor drains, with discharge to natural tributaries. Construction of drains would be deferred until years 10 and 11 of project life, based on experience on similarly lying lands in the Riverton Unit, Wyoming. Five

TABLE 4.5: PREFERRED PLAN COST SUMMARY
(December 1985 Prices)

CONSTRUCTION COST

<u>ITEMS</u>	<u>COST</u>
Big Horn Canal Earthwork	\$ 352,000
Big Horn Canal Structures	536,000
Pump Plants	2,395,000
Distribution System	2,759,000
Access Roads	542,000
Farm Services	192,000
Electrical Transmission, Substation	2,422,000
Right-of-Way Acquisition Costs	50,000
Subtotal	<u>\$ 9,248,000</u>
Contingency @25%	2,352,000
Total Field Cost	<u>\$ 11,600,000</u>
Engineering Design and Inspection Costs @15%	\$ 1,740,000
Drains	1,700,000
Mitigation Costs <u>1/</u>	284,525
Archeology Historical Preservation Studies	132,000 350,000
Total Project Cost (Rounded)	<u>\$ 15,800,000</u>
Project Cost Per Acre	\$ 3,880

ASSIGNED COSTS

Pick-Sloan Project Power @ \$503/kW x 2,611 kW	\$ 1,313,000
Boysen Reservoir @ \$215/acre x 4,068 acres	875,000
Total Assigned Costs	<u>\$ 2,188,000</u>
Assigned Cost/Acre	\$ 538

OM&R

Project OM&R (pump plants, roads, canal improvements, pipelines, etc.)	\$ 61,300
Project Power (4,600,000 kWh @3.0 mills/kWh Pick-Sloan @2.5 mills and wheeling .5 mills)	13,800
Boysen OM&R (\$0.30 acre)	1,200
Depredation Fund <u>3/</u>	3,000
Mitigation	1,500
Administrative	37,000
TOTAL	<u>\$ 117,800</u>
	(Rounded)
OM&R Cost/Acre	\$ 118,000 \$ 29

1/ (1,088,300 lbs. of forage divided by 0.60 [sagebrush biomass needed from sheep grazing allotments @ 60 percent overlap] = 1,813,833 lbs.; divide by 780 lb./AUM = 2,325 AUM's; x 1.77 permitted AUM's/AUM grazed = 4,115 AUM's x \$35/AUM = \$144,025.) Water catchments: \$20,000; CMA's: \$58,500 (shelterbelts), \$12,000 (fences) and \$50,000 for design and implementation.

2/ Drains would be deferred until years 10 and 11 of the project.

3/ Maximum fund accumulation would be \$10,000.

and one-half miles of channel stabilization on the ephemeral Sixmile, Fivemile, and Alamo Creeks would also be required. Stabilization would require minimal armoring of banks and beds and small flow-control structures to handle the anticipated 7 ft³/s maximum total project return flows. Present cross drainage is adequate.

The need for channel stabilization would be determined during construction. After identification, the Wyoming Game and Fish Department (WGFD) and the U.S. Fish and Wildlife Service (USFWS) would be contacted to see if further mitigation measures were needed.

Operation, Maintenance and Replacement Plan

Operation, maintenance and replacement (OM&R) costs were based on similar irrigation projects. The Westside Irrigation District would operate the Westside Project. A plant manager would be employed full-time during the April 1 - November 1 irrigation season to monitor operation of the pumping plants and distribution system, as well as perform preventative maintenance and minor repairs. Major repairs would be contracted for. A part-time secretary would help in billing annual assessments.

The OM&R costs listed in Table 4.5 include a crop depredation fund. Irrigators would be assessed an annual amount to create a fund to pay claims for wildlife damage to crops. It is proposed that the irrigation district pay \$3,000 per year to the WGFD to use for depredation claims on Westside Project land, provided that at no time should the depredation fund exceed \$10,000.

Wildlife Habitat Mitigation Plan

Mitigation for the Westside Project was developed by Reclamation from recommendations made by WGFD and USFWS. (These recommendations, along with Reclamation's responses, can be found in Chapter 6.)

The Preferred Plan would cause the loss of 4,302 acres of antelope crucial winter range and 648 acres of winter/year-long range. Replacement of this habitat in-kind would be done by altering winter sheep grazing on allotments containing crucial winter range to improve habitat quality. Mitigation computations would be based on sagebrush biomass, as sagebrush constitutes most of the antelope winter diet. The WGFD recommended the necessary habitat be supplied first by mitigation inside the Westside Project area, second by mitigation within the range of the Fifteenmile antelope herd unit, and thirdly by mitigation outside the herd unit. If these areas could not provide the mitigation necessary (equivalent to 4,115 AUM's), the WGFD recommended the purchase of private land and necessary habitat improvements to replace crucial winter range.

Farm boundaries would be fenced with 4-strand fences to keep sheep out but allow antelope to pass. Irrigators would pay into a sinking fund that would cover depredation claims. The fund would be established at \$3,000 for the first year, then adjusted according to claims thereafter. It would be allowed to build to a maximum of \$10,000.

Farm development would be prohibited within $\frac{1}{4}$ -mile of either side of Fivemile and Sixmile Creeks to ensure that wildlife had access to water and to maintain a small riparian zone. This land would not be fenced. Additionally, ten water catchments would be built outside the project area to provide more water sources to wildlife and to disperse antelope over the area.

To avoid effects on the Big Horn River fishery, Reclamation would release water for Westside demands from Boysen Reservoir when flows in the river dropped below 380 ft³/s at Worland (see Chapter 5, "Fisheries"). These releases would not affect the fishery in the reservoir itself during average years; in dry years the recommended 350,000 acre-feet minimum reservoir level for fisheries cannot be maintained, even without the Westside Project. Westside would worsen low reservoir contents about 0.5 -1.75 percent, depending on the month of occurrence.

To compensate for lost recreation and small and nongame habitat, 406 acres--10 percent--of the project area (with attendant water rights) would be kept in public ownership as "Cooperative Management Areas" (CMA's). An interagency team identified areas for CMA's, varying in size from 20-120 acres. The sharecropping lease to the CMA's would specify costs to be borne by BLM and the lessee, with stipulations concerning crops to be grown and farming operations allowed in the CMA's. The CMA's would include shelterbelts on the nonirrigated tracts within the farm boundaries also. These shelterbelts would be part of the project cost: \$2,000/20-acre plot for each of 15 plots, a \$100/year maintenance fee and a \$500 replacement fee for the first 5 years. The sharecropping lease would remain in effect for 10 years, and could be renewed on satisfactory performance.

The CMA's would be designed to provide habitat suitable for pheasants and other upland game birds. BLM could manage land next to the CMA (but outside of the project area) as feed plots to block together enough wildlife habitat for hunting. The feed plots would be separate from the project.

Threatened or endangered species would not be affected because of safeguards incorporated in the Preferred Plan (see Chapter 5).

Cultural Resources Mitigation Plan

None of the 234 cultural resource sites discovered in the Westside Project area have been formally determined eligible for the National Register of Historic Places. About 800 acres remain to be inventoried during preconstruction. After this inventory were completed, Reclamation, BLM, the Wyoming Office of the State Archeologist, the Wyoming State Historical Office, and the Advisory Council on Historic Preservation would jointly determine National Register eligibility, and plan test excavations and subsequent mitigation. Procedures would comply with the requirements of Reclamation Instructions 376.11, 36 CFR 800, the National Historic Preservation Act of 1966, and other laws and regulations.

Effects on eligible sites where construction takes place (the distribution system, drains, pumping plants, uncultivated lands) could be mitigated

for by a variety of means: avoidance, excavation, mapping and further recording, and photo-recording.

Economic Analysis

Economic analysis of the Westside Project was based on typical conditions of a representative farm budget "with" and "without" the project. The difference in net income between the farm budgets provided the estimates of payment capacity and benefits.

Wyoming would finance construction of the Preferred Plan. As a joint Federal/State project, water would be provided from Boysen Reservoir and project pumping by P-S MBP.

Although benefits were computed for the Preferred Plan, neither a benefit-cost ratio nor an NED account were done because the benefit-cost analysis used State criteria (a 4 percent interest rate and market prices). Emphasis is placed on financial feasibility.

The State, in financing irrigation projects, usually fund up to 75 percent of project costs as a grant, the percentage used in this analysis. This would leave 25 percent of project costs to be repaid by the irrigators. For similar projects, Wyoming has charged 4 percent interest, the rate used here.

Irrigation Benefits.--Benefits from the Westside Project were derived from typical farm budgets with and without the project (see "Farm Budgets," Attachment 1). The increased farm income due to the additional irrigated land, minus the increased costs of farm investment, labor, management and operation, equals the NED benefit. The farm budgets were based on alfalfa, malt barley, sugar beets, and a background cattle feeding operation.

The U.S. Water Resource Council's Principles and Guidelines were followed in assessing project benefits. Current P&G policy

requires use of market clearing price estimates with support programs as applicable.

Census data for Washakie and Big Horn Counties show that livestock sales account for 60 percent of total agricultural sales, with cattle accounting for 60-70 percent of those sales. Cattle therefore were used to represent a livestock enterprise for the typical farm.

Using representative farm income and expenses with and without the project, NED irrigation benefits were derived as shown in Table 4.6. The cost of increased farm investment from the project is included in the farm budgets where it is charged off at 8.625 percent. A return to operator's increase labor was charged off at \$5 per hour. Since all project land would be newly irrigated, a 4-year development period was used to discount the benefits.

Adjusted NED irrigation benefits were figured to be \$173 per irrigable acre. The benefit budget process is summarized in Table 4.6.

Irrigation Benefits - State Criteria.--Although no NED Plan could be formulated using current pricing policy related to P&G criteria, irrigation benefits were computed for the Preferred Plan using State criteria, which included the use of a 4 percent interest rate, and local market prices. Benefits for the Preferred Plan exceeded costs with these criteria.

Benefit computations using State criteria are summarized in Table 4.6. A summary of the farm budget using State criteria can be found in the Economic Appendix.

TABLE 4.6: NED IRRIGATION BENEFITS 1/

Benefit Computations

Net Income with Project <u>2/</u>	\$ 93,617
Net Income without Project <u>2/</u>	<u>61,449</u>
Increased Net Farm Income	\$ 32,168
Less: Adjustment for 4-year Development Period	3,538
Less: Opportunity Cost of Increased Operator Labor <u>3/</u>	<u>1,671</u>
NED Crop Benefits Per Farm	\$ 26,959
NED Crop Benefits Per Newly Irrigated Acre	\$ 173

1/ Benefit analysis used an interest rate of 8.625 percent throughout.

2/ Net income figured using current market clearing prices reflecting inclusion of support programs where applicable.

3/ Based on average market costs plus social security contribution for supervisory labor in Wyoming. Source: Farm Labor, USDA Crop Reporting Board Statistical Reporting Service, August 21, 1984.

Irrigation Benefits Using State Criteria

Benefit Computation

Net Income with Project <u>2/</u>	\$134,011
Net Income without Project <u>2/</u>	95,633
Increased Net Farm Income	38,378
Less: Adjustment for 4-Year Development Period	2,188
Less: Opportunity Cost of Increased Operator Labor <u>3/</u>	<u>1,671</u>
Crop Benefits Per Farm Using State Criteria	\$ 34,519
Crop Benefits Per Newly Irrigated Acre	\$ 221

1/ Benefit analysis used an interest rate of 4 percent throughout.

2/ Net income reflects use of local market prices.

3/ Based on average market costs plus social security contribution for supervisory labor in Wyoming. Source: Farm Labor, USDA Crop Reporting Board Statistical Reporting Service, August 21, 1984

Fish and Wildlife and Recreation Benefits.--There would be no fish and wildlife or recreation benefits associated with the Westside Project.

Economic Costs.--Economic costs include all resources used in constructing, operating and maintaining features of the Westside Project throughout the period of analysis, plus any external costs attributable to the project. Investment costs are costs incurred to construct and place the project in operation. These costs for the Preferred Plan (adjusted for time of occurrence where appropriate) were converted to annual equivalents using an interest rate of 4 percent, with a 100-year period of analysis. The annual equivalent is displayed as the annual investment cost.

Annual investment costs, annual economic cost of power, annual cost of drains, and OM&R costs were added to determine total annual equivalent costs. The derivation of annual economic costs is presented in Table 4.7.

Financial Analysis

A summary of the financial analysis of the Preferred Plan is shown in Table 4.8. Westside would be a single-purpose project, so all costs were allocated to irrigation.

TABLE 4.7: SUMMARY OF ADVERSE EFFECTS

Investment Costs

Initial Construction Costs <u>1/</u>	\$14,100,000	
Interest During Construction	<u>570,000</u>	<u>2/</u>
Total Investment Costs	\$14,670,000	
Annual Equivalent Costs		
Annual Equivalent Investment	\$ 598,700	<u>3/</u>
Annual OM&R Costs	117,800	
Annual Economic Cost of Power	88,300	<u>4/</u>
Annual Cost of Drains	<u>46,000</u>	<u>5/</u>
Total Annual Equivalent Costs	\$ 850,800	

-
- 1/ This is the total construction cost less the cost of deferred drains.
- 2/ Based on 2-year construction period and 4 percent interest.
- 3/ Based on amortization of investment costs over 100 years at 4 percent interest.
- 4/ Based on annual power usage of 4,600,000 kWh at 22.2 mills/kWh, minus 3 mills/kWh included in OM&R. This rate is based on the marginal cost of generation, which is the economic cost of supplying power due to the prevailing condition of excess capacity.
- 5/ Based on deferral of drains to years 10 and 11. Annual cost is derived by present-worthing expected investments in those 2 years, and annualizing the PW value over 100 years at 4 percent interest.

Table 4.8: Investment and Repayment Summary for the Preferred Plan:
Wyoming Guidelines
(75 Percent Grant/25 Percent Loan)

ITEM	AMOUNT	ANNUAL FINANCIAL REQUIREMENTS W/AMORTIZATION OF COSTS - 40 YEARS, 4%		ANNUAL FINANCIAL REQUIREMENTS W/AMORTIZATION OF COSTS OVER 14 YEARS, 4%	
		PROJECT ASSIGNED	DEFERRED OM&R	PROJECT ASSIGNED	DEFERRED OM&R
Projects Cost Less Deferred Costs	\$14,100,000				
Reimbursable Project Costs (25%)	(3,525,000)	\$178,100		\$333,700	
Deferred Costs (Drains)	1,700,000		\$ 56,900 1/	\$106,600 1/	
Assigned Costs					
Boysen Storage (\$215/acre)	875,000				
Pick-Sloan Power 2/ (\$503/kw x 2,611 kw)	1,313,000				
Total Assigned Costs	\$ 2,188,000	\$ 54,700		\$156,300	
Interest During Construction					
Project Assigned	\$ 570,000		nonreimbursable	nonreimbursable	
Boysen Storage (\$11/acre)	45,000				
Pick-Sloan Power (\$31.39/kw)	82,000				
Total Assigned IDC	\$ 127,000		nonreimbursable	nonreimbursable	
Annual OM&R					
Project	\$ 61,300				
Project Power - 4,249,000 kwh @ 3.0 mills (Pick-Sloan @ 2.5 mills & wheeling .5 mills)	13,800				
Boysen OM&R (\$.30/acre)	1,200				
Administrative	37,000				
Depredation Fund	3,000				
Mitigation	1,500				
Total Annual OM&R	\$ 117,800	\$117,800		\$117,800	
Annual Payment on Loan During Repayment Period	\$178,100 (\$44)			\$333,700 (\$82)	
Annual Payment Per Acre					
Annual Payment on Assigned Costs During Repayment Period	\$ 54,700			\$156,300	
Annual Payment on Deferred Costs During Repayment Period	\$ 56,900			\$106,600	
Annual OM&R		\$117,800		\$117,800	
Total Annual Financial Requirement		\$407,500		\$714,400	

1/ Annual costs of drains determined by present-worth equal annual expenditures (\$850,000) during years 10 and 11, and annualizing the present worth value over 40 years and 14 years, respectively, at 4 percent interest.

2/ Assigned costs apply only to project power, not to onfarm power.

The financial analysis was conducted using Wyoming's guidelines, where only 25 percent of the construction costs must be repaid with interest. The State would consider the 25 percent as a loan, on which it has been charging 4 percent interest. This rate was used in the financial analysis.

The financial analysis also includes assigned Boysen storage and P-S MBP power costs, treated as annual costs since the State would not include them in the loan/grant. The summary is in Table 4.8.

Repayment.--The estimated repayment capacity of the newly irrigated land was based on typical farm budgets with and without the project as explained previously. The "with" analysis converted 156 acres to irrigation and increased the farm size by 190 acres compared to the "without" project condition.

The computed payment capacity would come to \$183 per acre. This figure was arrived at by subtracting an allowance for increased management and equity from net farm income. The return to management would be 10 percent of increased net income, while the return to equity would be 3.4 percent of the increased farm investment with the project. Calculations are shown below:

	<u>Per Farm</u>
Net Farm Income With Project	\$101,279
Net Farm Income Without Project	<u>67,621</u>
Change in Net Farm Income Due to Project	\$ 33,658
Less 10 Percent for Increased Management	\$ -3,366
Less Return to Increased Operator Equity	\$ -1,710
Annual Payment Capacity	\$ 28,582
Annual Payment Capacity/Acre	\$ 183
Westside Project Payment Capacity (4,068 Acres)	\$744,400
Less Annual OM&R	<u>117,800</u>
Available for Repayment Annually	\$626,600

The estimated annual payment capacity as shown above is \$744,400. After subtracting annual OM&R costs of \$117,800, the amount available for repaying reimbursable project costs and assigned costs, and for paying into a fund for deferred drainage costs, is \$626,600 annually. Note that the irrigation district's repayment obligation to the Federal Government for assigned costs would take precedence over its loan obligations. The P-SMBP would pick up no project costs. At the time the repayment contract were signed, an agreement would also be signed regarding management of the deferred drainage cost fund.

The actual amount to be repaid is subject to negotiations between Wyoming and the project sponsors. However, based on a standard 40-year repayment period, the total annual financial requirement would be as follows:

Reimbursable project costs (\$3,525,000)	\$ 178,100
Assigned Costs	54,700
Deferred Costs (\$1,700,000 for drains)	56,900
OM&R	<u>117,800</u>
Total Annual Requirement	\$ 407,500

The earliest the project costs could be paid off with 4 percent interest is 14 years, based on the following total annual financial requirement:

Reimbursable project costs (\$3,525,000)	\$ 333,700
Assigned Costs	156,300
Deferred Costs	106,600
OM&R	<u>117,800</u>
Total Annual Requirement	\$ 714,400

Calculations of financial requirements for these repayment schedules are shown in Table 4.8.

Environmental Acceptability

The Preferred Plan would be environmentally acceptable if adequate mitigation for the crucial winter range for antelope were identified, proved

to have the appropriate vegetation composition and productivity, and met the other standards established by WGFD biologists. Furthermore, the mitigation plan would have to be in place before construction of the project.

Actions and Permits Required

Before the Westside Project were constructed, these acts would have to take place in the order described:

1. Congress would have to authorize the project as a unit of the P-S MBP, and the Wyoming Legislature would have to commit funds for the project. The Legislature would have to specify the establishment of a sinking fund to pay wildlife depredation claims, relieving WGFD of the responsibility.

2. Sheep winter grazing allotments would have to be changed in other public land to mitigate for the loss of antelope crucial winter range to the project. Compensation to grazing permittee's for lost grazing privileges would have to be negotiated by the project sponsors. An agreement specifying the irrigation district's responsibility for paying wildlife depredation costs would have to be negotiated between the project sponsors and WGFD.

3. The BLM would be responsible for disposing of public land in accordance with FLPMA.

The sponsors would also obtain a permit for an original water right for river flows and a secondary permit to appropriate and divert Boysen storage (see "Project Water Rights," above).

The Wyoming State Engineer's Office would adjudicate water rights, as the office does now. The addition of Westside would add a call on storage in Boysen Reservoir, which would be handled by Reclamation.

Necessary Federal and State permits would be acquired before construction of the project.

No-Action Alternative (Future Without the Project Condition)

The No-Action Alternative assumes that no irrigation project of any size would be built in the Westside Project area. Without development of a Westside Project, the area would continue to be managed as rangeland by BLM. The present poor-to-fair range condition would be improved by BLM within the limitations of that agency's budget.

The No-Action Alternative also assumes no further demand would be made on the water resources of the area. The flows and quality of the Big Horn River would not change. Irrigators in the area could cultivate private upslope land, if they could get a water right (the Big Horn Canal Company would not allow irrigation of upslope land without one).

Irrigation water would have to come from shallow wells or drain ditches that pick up seepage from the Big Horn Canal. Water (direct appropriation or stored) not used for the project would remain available for future development downstream.

Exploration for oil and gas on public land would continue and gravel pits in the project area would continue to operate. No coal mining in the area is expected.

Overall net income for the two counties increased by about 4.4 percent annually from 1979-1983. Farm income dropped about 75 percent during that same period. In 1984 and 1985 total income remained about constant (about \$200 million) and is not expected to vary much in the near future due to depressed agriculture and energy sectors.

In the last 5 years, the two counties have had a declining labor force and an unemployment rate which has jumped from about 5 percent to 13 percent. Without improved agricultural and energy sectors in the local economy, relatively high unemployment could be expected to continue in the near future.

Although total population for the two counties has shown a long-term upward trend, the farm population has generally declined since 1960, in line with national trends toward larger farms and a decline in total operators. With the additional effect of lowered oil prices in the energy sector, the population is projected to decrease slightly in the near future.

The No-Action Alternative assumes that wildlife species and habitat would remain as at present. Crucial antelope winter range and mule deer habitat would be unaffected in this alternative. The Big Horn River fishery would continue to range from excellent at Boysen Reservoir and Thermopolis to poor at Worland because of turbidity and temperature increases from irrigation return flows.

No appreciable change would occur to cultural resources in the No-Action Alternative. They would remain as at present, with some sites being affected by natural forces.

Evaluation and Plan Selection

Reclamation compares alternatives by means of the "four accounts," that is, the economic, social, and environmental effects of a plan. The accounts for the Preferred Plan are defined below and detailed in the pages to follow.

National Economic Development (NED) and Regional Development (RD):

The NED account measures beneficial and adverse effects on the national economy from a plan. Since the Westside Project would be State funded, and the Preferred Plan does not meet P&G requirements for NED benefit/cost analysis, no NED account was included in this report. The RD account measures not only the direct benefits/costs but also secondary economic impacts as a result of a plan. The RD account for this report was based on economic benefits reflecting State criteria, as discussed above.

Social Account: This account considered local values such as population distribution, employment opportunities, public facilities, and the effects of government action on the local populace.

Environmental Quality (EQ): The EQ account compared the major effects and physical changes from a plan on the ecological, aesthetic and cultural values of the human environment inexpressible in monetary terms.

Regional Development (RD) Account

For purposes of the RD Account, the local impact or planning area would consist of the two counties in which the project would be constructed; Big Horn and Washakie Counties. Since it is a small project, most of the project impacts would occur in this area.

The RD Account registers changes in the distribution of regional economic activity resulting from the Preferred Plan. Note that the RD account in this report is based on direct benefits using State economic criteria. The positive effects of a plan on a region's income are equal to the sum of the direct benefits that accrue to that region, plus transfers from outside the region. The adverse effects to the region are the annual equivalents of project cost, interest during construction, deferred drainage, annual economic cost of power, and annual OM&R cost. The RD Account for the Preferred Plan is displayed in Table 4.9.

Regional monetary beneficial impacts were estimated for both direct and induced segments. Direct irrigation crop benefits are multiplied by a factor of .83 to obtain induced irrigation impacts, which are principally a reflection of the increased economic activity generated by the inputs to crop production, and the processing of those crops. Regional impact from construction is the annualized value of the estimated cost of onsite labor during the 2-year construction period. The OM&R employment benefit reflects wages paid to OM&R employment based on 70 percent of the nonpower OM&R costs.

Indirect irrigation benefits would amount to \$746,000, and annual employment benefits from construction are estimated at \$225,000. The OM&R employment impacts would be \$70,000. Note that impacts for the Preferred Plan were accounted for under the category of State and area

Table 4.9: Planning Area and Wyoming Monetary Impacts
Preferred Plan
Regional Development Based on State Criteria

	<u>Planning Area</u>	<u>Rest of State</u>	<u>Total</u>
Beneficial Direct (Irrigation)	\$ 899,000	0	\$ 899,000
Induced:			
Irrigation	746,000	-746,000	0
Construction	225,000	-225,000	0
OM&R Employment	<u>70,000</u>	<u>- 70,000</u>	<u>0</u>
Total Annual Benefit	\$1,940,000	\$-1,041,000	\$ 899,000
Adverse:			
Annual Project <u>1/</u>	143,800	431,600	575,400
Annual O&M	117,800	0	117,800
IDC	0	23,300	23,300
Deferred Drainage	46,000	0	46,000
Economic Cost of Power	<u>88,300</u>	<u>0</u>	<u>88,300</u>
Total Adverse	\$ 395,900	\$ 454,900	\$ 850,800

1/ Annual project costs are based on 4 percent interest, 75 percent grant and October 1985 price level.

monetary impacts, as used for State planning purposes. While the impacts would not coincide exactly with those boundaries, they would, in each case, encompass most of the impacts.

Social Account

The social account considers local values concerning factors such as employment, income, population density, housing, recreation, and general quality of life. Social impacts were evaluated in the local impact or planning area, comprised of Big Horn and Washakie Counties.

The Social Account analyses significant beneficial and adverse consequences of the project. Anticipated future social conditions without the project provide a baseline for comparison to the impacts of the Preferred Plan.

The most significant social benefits of the project would be stimulation of the local economy by increased agricultural output, and the increased employment opportunities provided during the 2-year project construction period. Total onsite employment during the 2-year construction period is estimated to be about 43 person-years for each year, with 40 percent of the jobs filled by local workers. Earnings during construction would peak at about \$1.3 million. After construction, the extra irrigated acres would generate increased annual net farm personnel income of about \$875,000. The equivalent of 12 full-time employees would result from the completed project.

Due to the influx of outside workers, total population would increase by about 60 people in the peak construction year, with commensurate impacts on housing and public facilities (see Table 4.10).

The principal negative impact of the Preferred Plan would be that 4,693 acres of public land would be lost to recreational purposes. Although use is not usually extensive, the project area is used year-round for hunting, trapping, horseback riding, hiking, rockhounding, and other activities. In addition to these recreational losses, some further economic impacts would result from the loss of spending by out-of-area

Table 4.10: Comparison of Social Impacts

FACTOR	FUTURE WITHOUT CONDITION	PREFERRED PLAN
Employment	Continued relatively high unemployment levels in near future due to depressed agriculture and oil industries.	Additional 86 person-years of employment during 2-year construction period. Equivalent of 12 full-time employees as a result of project.
Income	Total personal income is currently about \$200 million. Due to the depressed economy, not expected to increase much in near future.	Earnings during construction period would increase by \$2.6 million. Additional project irrigated acreage would generate \$875,000 net farm personal income annually.
Population	Overall population of two counties projected to decrease slightly in near future.	Population increase only during construction period. Increase estimated at 60 in peak construction year.
Housing	Relatively high vacancy rates projected at least into near future.	Nine housing units would be required during the construction period. No residual increased requirement.
Public Facilities and Services	Quite adequate education facilities will continue, with favorable student/teacher ratios. Social and medical facilities typical of rural area. Adequate facilities and inadequate medical facilities.	Additional 20 students would have to be accommodated during construction. Condition of inadequate medical facilities slightly exacerbated during construction period. Slight increase in tax revenues and thus funding for public services.

Table 4.10: Comparison of Social Impacts
(continued)

FACTOR	FUTURE WITHOUT CONDITION	ACRE PREFERRED PLAN
Resources	<p>Project lands would remain unchanged from present grazing, wildlife habitat, and gravel production. Little additional irrigation expected.</p> <p>Lands would continue to serve a variety of recreational purposes.</p> <p>Appropriation of Big Horn River flows would remain relatively unchanged.</p>	<p>4,950 <u>1/</u> acres of grazing and wildlife habitat would be converted to irrigated agriculture.</p> <p>4,693 <u>1/</u> acres of public land would be lost for recreational purposes.</p> <p>Big Horn River flows of 15,400 acre-feet would be appropriated for irrigation purposes.</p>
Quality of Life	Unchanged from present.	Slight improvement due to stabilization of income on 4,068 acres of agricultural lands.

1/ Includes total lands inside project fences.

and out-of-state hunters. Further negative impacts would accrue during the construction period in the form of increased pressures on public facilities and services.

Environmental Quality (EQ) Account

Surface Water Quantity and Quality.--Big Horn River flows would be sufficient in many years to meet the annual needs of the Preferred Plan (Table 4.11). In years where this were not the case, releases would be made from Boysen Reservoir. These releases would be to replace Westside diversions whenever flows in the river were 580 ft³/s or less at the Big Horn Canal headgate.

Water quality constituents (TDS, trace constituents/metallic elements, and pesticides) in the Big Horn River were determined to increase slightly with the project but would pose no threat to human or aquatic species, based on published standards. Sediment reaching the Big Horn River from the project area is estimated to increase by 16 tons/year based on the Universal Soil Loss Equation, with no field measurements (9 percent higher than present). This increase is judged to be insignificant on turbidity and aquatic species in comparison to the present condition (see Table 4.11).

Ground Water Quantity and Quality.--Ground water in the project area is of limited quantity (up to 15 gpm) and poor quality (up to 1,590 ppm TDS). The Preferred Plan would add approximately 3,600 acre-feet of ground water inflow until project drains were installed, after which time the quantity per year would be approximately 1,500 acre-feet (Table 4.11). This quantity increase would have no significant effect on the area.

The only anticipated significant project effect on ground water quality is an increase in iron levels (mean concentration of 1,492 parts-per-billion) which presently exceeds the Federal Primary or Secondary Drinking Water Standards of 300 ppb (Table 4.11). At these projected concentrations, water would be unappealing and unpalatable. As little use is presently made of ground water due to poor quality no significant effects are anticipated and no mitigation planned.

TABLE 4.11: ENVIRONMENTAL QUALITY ACCOUNT

ENVIRONMENTAL FACTOR	PRESENT CONDITION	FUTURE W/O PROJECT (NO-ACTION ALTERNATIVE)	PREFERRED PLAN 1/	SIGNIFICANCE 2/
<u>Surface Water Quantity:</u> (Big Horn River)	Unappropriated flows available through early summer in average years.	Same as present.	Unappropriated flows used to meet project needs when available (15,400 acre-feet). When flows are 580 ft ³ /s or less at the Bighorn Canal headgate releases would be made from Boysen Reservoir to replace Westside diversions.	0
<u>Surface Water Quality:</u> (Big Horn River)				
TDS	649 ppm	649 ppm	653 ppm	0
Arsenic	8.55 ppb	8.55 ppb	8.55 ppb	0
Cadmium	0.24 ppb	0.24 ppb	0.24 ppb	0
Iron	72.5 ppb	72.5 ppb	72.7 ppb	0
Selenium	2.20 ppb	2.20 ppb	2.20 ppb	0
<u>Pesticides:</u>				
Carbaryl	Not Known ^{3/}	Not Known ^{3/}	0.00 ppm ^{4/}	0
Dicamba	Not Known ^{3/}	Not Known ^{3/}	0.00 ppm ^{4/}	0
Aldicarb	Not Known ^{3/}	Not Known ^{3/}	0.03 ppm ^{4/}	0
<u>Sediment Load</u>	156 tons/year	156 tons/year	172 tons/year	0
Phosphorus	1.80 ppm	1.80 ppm	1.80 ppm	0
Nitrates/Nitrites	4.80 ppm	4.80 ppm	4.81 ppm	0
<u>Ground Water Quantity:</u>	Existing wells downslope of project area have limited capacity (up to 15 gpm)	Same as present.	No change except seepage and deep percolation will add to ground water supplies.	0
<u>Ground Water Quality:</u>	Generally of poor quality (up to 1,590 ppm TDS)	Same as present.	Projected levels for iron (mean value of 1,492 ppb) would exceed Federal Primary or Secondary Drinking Water Standard of 300 ppb, causing water to be unappealing and unpalatable.	-
<u>Fisheries:</u>	Being maintained by present flows and/or reservoir elevations/storage.	Same as present.	No change. Westside diversions will be replaced by releases from Boysen Reservoir, when necessary.	0
<u>Wildlife:</u>				
Crucial Winter Range - Acres	Approximately 94,100 acres of crucial winter range occur within the range of the Fifteemile Antelope Herd unit.	Same as present.	Development of Preferred Plan would result in loss of 4,302 acres of antelope crucial winter range.	-
Crucial Winter Range - Sagebrush biomass	An estimated 909,450 pounds of forage exist on lands that would be irrigated.	Same as present.	The forage (sagebrush) on lands to be irrigated would be lost, but would be replaced through changes in grazing allotments.	0
Depredation	N/A - Public rangeland	Same as present.	Depredation claims would be paid from a fund established by irrigators.	0
<u>Land Use:</u>				
Acreage	4,693 acres of 4,950 acres in project boundaries are public rangeland. Over 2,000,000 acres of public land occur in two-county area.	Same as present.	4,693 acres of public rangeland would be converted to privately owned irrigated cropland.	0
Public Access	Unlimited access to public land.	Same as present.	OMA's to mitigate for loss of recreation.	0
<u>Livestock Grazing:</u>	Predominant use of public land in the area is grazing of cattle and sheep.	Same as present.	Project development would eliminate four grazing allotments for 2,309 AUMs. Additional allotments would be modified to provide antelope crucial winter range mitigation.	-
<u>Cultural Resources:</u>	234 archeological sites in project boundaries with 800 acres yet to be surveyed.	Sites would continue to exist with some degradation due to natural forces.	At least 20 sites would be disturbed by project construction but would be mitigated by excavation and/or data recording.	-
<u>Total EQ Effect 1/</u>		0	-	
<u>Rank Order of Plan</u>		1	2	

1/ Compared to the Future Condition.
 2/ - Minor adverse 0 No significant effect - Moderate adverse +++ Highly beneficial
 - - - Highly adverse + + Moderately beneficial + Slightly beneficial
 3/ Field data has not been collected: Present Condition and Future W/O Project were estimated based on model projections.
 4/ Resultant values estimated from model projections.

Fisheries.--Based on the surface water quantity analyses, there would be no effects on the Big Horn River fishery. Water quality changes would be minor and therefore would not significantly affect the fishery.

Wildlife.--The land proposed for irrigation development presently support stands of sagebrush, classified as crucial antelope winter range by the WGFD. Crucial winter range is highly valued for its high productivity, the fact that it stays snow-free and the excellent cover it provides for fawning. A mitigation plan to compensate for losses of 4,302 acres of crucial winter range has been developed. The basic concept of the winter range mitigation plan is to increase forage production on areas outside the project through the adjustment or modification of existing grazing leases. With the project, the total amount of forage available would be the same as at present, albeit on a smaller total acreage. Mitigation would be in place before construction.

The WGFD has expressed concern over potential game animal depredation claims for which, by law, they are responsible. A fund would be established and funded by the irrigators to pay any claims on project land.

Land Use.--The Westside Project would change land ownership of 4,693 acres of public rangeland; 4,068 of these acres would be converted to irrigated cropland. The land is mainly used for grazing, wildlife, recreation, and petroleum exploration. Also, permitted grazing uses would be modified on other allotments (the number and acreages as yet undetermined) to provide the necessary improvements in forage (sagebrush) production to mitigate for antelope crucial winter range.

To compensate for lost recreation and small and nongame habitat in the project area, 406 acres would be retained in public ownership to be managed as CMA's.

Livestock Grazing.--The project includes parts of four grazing allotments leased by BLM, with a total of 2,309 AUM's.

The Preferred Plan would cause the loss of grazing on 4,693 acres of public rangeland, which could lead to the loss of grazing over an entire allotment, even though only a part of the allotment were affected. Range improvements and cattle watering access points would be lost along with the allotment.

Further reductions in grazing would occur on non-project allotments to achieve mitigation for antelope crucial winter range. Grazing allotments would be changed to provide 4,115 AUM's.

Allotments affected as a result of antelope winter range mitigation, and associated negotiations, would be the responsibility of the irrigation district.

Cultural Resources.--There are 234 archeological sites in the project area which could be eligible for the National Register of Historic Places. At least 20 sites would be affected by the project. About 800 acres remain to be surveyed.

Final surveys, testing, and any required mitigation, would be completed before construction under 36 CFR 800, the National Historic Preservation Act of 1966 (as amended), and Reclamation Instructions 376.11.

Miscellaneous Impacts.--Other factors were evaluated, but determined to not be significantly affected, were mineral resources, soil erosion, air quality, prime or unique farmlands, and energy (see "Miscellaneous Impacts," Chapter 5).

Selected Plan

The Plan recommended for further consideration in this report generally must pass the tests of viability, as mentioned at the beginning of this chapter. The four tests are:

Completeness: This tests whether all necessary investments were included to achieve a plan's objectives.

Efficiency: Efficiency tests whether or not a plan is economically and financially feasible.

Effectiveness: This measures whether or not a plan fulfills the objective to develop the water resources of the area and nation.

Acceptability: This measures the acceptability of a plan to all segments of the public.

The Preferred Plan of 4,068 acres meets the tests of: completeness, since all necessary investments to achieve the plan's objectives have been made; effectiveness, because the plan fulfills the objective to develop water resources of the area; and acceptability, as the Preferred Plan is the one the State of Wyoming, the irrigation district, and the project sponsors support. Although the Preferred Plan does not meet the test of NED efficiency, it would meet the efficiency test of the State of Wyoming, which would fund all project costs, either through grant or loan.

Plans Considered but Dropped

Reclamation's September 1983 report for the WWDC examined irrigation plans of 9,026 acres, 4,986 acres, and 2,181 acres in the Westside area. Big Horn River water would have been diverted into the canal to be relifted to project land for sprinkler irrigation. This report recommended the largest of the three plans for further investigation.

With a few minor additions in November 1985, Reclamation's report became the "preliminary findings report" of the present study (with the recommendation unchanged). Detailed land classification surveys, however, showed no more than 7,000 irrigable, widely-dispersed acres in the Westside area, necessitating reformulation of the project (see the beginning of this chapter). Two new plans were developed in the next report, the "plan formulation working document" (PFWD), one of 450 acres and the other of 4,068 acres (Nelson Engineering, Inc. 1985).

Reclamation guidelines require that a plan be formulated that reasonably maximizes net NED benefits. The NED Plan in the PFWD was the smaller, of 450 acres, with a benefit/cost ratio of unity. Later benefits were changed to reflect market clearing prices where applicable. With these prices it was impossible to formulate a plan for which NED benefits were greater than costs for Federal development. A plan smaller than 4,068 acres was not studied in more detail, because it is not acceptable to the project sponsors and would thus result in No Action.

Surface Water Quantity and Quality

This section considers the effects of diverting water from the Big Horn River, or releasing it from Boyton Reservoir, for the Westside Project, and the consequent effects of irrigation on surface water quality. (Effects of ground water are in the section to follow.)

Average flows in the Big Horn River below Boyton Reservoir are 1,343 ft³/s, or 1,043,760 acre-feet per year. The Big Horn River flows are about one year's demand for the amount needs of the Preferred Plan of 11,460 acre-feet. To avoid impacts to the river habitat, water would be released from Boyton Reservoir to replace the Westside diversions when flows were 180 ft³/s or less at the Big Horn Canal headgate. The Preferred Plan would result in no water quantity impacts on the river.

CHAPTER 5

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the environmental consequences of the Preferred Plan and No-Action Alternative. Water quantity and quality, fisheries, wildlife, land use, social and economic conditions, and cultural resources were considered the most important environmental factors in this study, so they are treated separately. Other impacts -- air quality, prime or unique farmlands, mineral resources, soil erosion, and energy -- are combined in a "Miscellaneous Impacts" Section at the end of this chapter.

Impacts for each environmental factor are summarized below first. The present condition follows the summary, followed in turn by the No-Action Alternative (called the "Future Without the Project") and the impacts of the Preferred Plan of 4,068 acres. Where the present and future without conditions would be the same, they are combined under a single subheading.

Chapter 5 ends with consideration of short/long-term environmental uses, irreversible and irretrievable commitments of resources, and unavoidable adverse effects.

Surface Water Quantity and Quality

This section considers the effects of diverting water from the Big Horn River, or releasing it from Boysen Reservoir, for the Westside Project, and the consequent effects of irrigation on surface water quality. (Effects on ground water are in the section to follow.)

Summary

Average flows in the Big Horn River below Boysen Reservoir are 1,443 ft³/s, or 1,045,000 acre-feet per year. Big Horn River flows are enough many years to meet the annual needs of the Preferred Plan of 15,400 acre-feet. To avoid impacts to the river fishery, water would be released from Boysen Reservoir to replace the Westside diversions when flows were 580 ft³/s or less at the Big Horn Canal headgate. The Preferred Plan would result in no water quantity impacts on the river.

It is estimated that about 1,557 tons/year of soil are lost to water erosion in the Westside Project area annually in the Present and Future Without, 156 tons/year ending in the Big Horn River. With the Preferred Plan the sediment load would increase about 16 tons to 172 tons/year. The effect on the town of Basin's water treatment operation would be insignificant. (Water erosion estimates were made by the Universal Soil Loss Equation: no field measurements were made to verify the results.)

Cadmium, arsenic, iron, and selenium levels in the project area are presently below the standard and would remain so in the Preferred Plan. Pesticides would be used in the Preferred Plan: typically carbaryl (Sevin) levels would increase by .00016 parts-per-million (ppm), dicamba (Banvel) .002 ppm, and aldicarb (Temik) 0.025 ppm. None would pose a threat to humans or aquatic species. Average total dissolved solids (TDS) would increase 5 ppm in comparison to the Future Without, "worst case" TDS 9 ppm; either change would be insignificant. Phosphorus levels would increase by 0.01 ppm in the Preferred Plan in the worst case, nitrates/nitrites by 0.015 ppm. These extra concentrations would cause no algal blooms or other water quality problems downstream.

Present and Future Without Conditions

Surface Water Quantity.--The Big Horn River below Boysen has an average discharge of 1,443 ft³/s, or 1,045,000 acre-feet per year. This discharge would not change in the future without condition. Boysen Reservoir has 57,000 acre-feet of storage available for future use.

Surface Water Quality.--The surface water quality analysis considered effects on erosion/sedimentation, trace constituents/metallic elements, pesticides (which includes both herbicides and insecticides), TDS, and nutrients. Sampling and laboratory tests were used to estimate the impacts discussed in this section. (The analyses and methodologies are described in detail in the Hydrology Appendix.)

(Erosion/Sedimentation).--Present soil loss from the undisturbed Westside Project area (figuring an area of 4,068 acres) is estimated as 1,557 tons/year using the Universal Soil Loss Equation (USLE), a model used to predict farm soil losses to water erosion. (See "Soil Erosion" in Chapter 5 and the Hydrology Appendix.) The sediment yielded to a downslope tributary stream (and eventually the Big Horn River) is an estimated 156 tons/year, based on results of the USLE.

(Trace Constituents/Metallic Elements).--Project area soil samples were examined for 29 elements. Laboratory analysis (using water extract procedures) indicated only five in significant concentrations - arsenic, cadmium, iron, selenium, and boron. The concentrations were as follows:

<u>Range of Concentration (parts-per-billion-ppb)</u>		<u>U.S. EPA Standard (ppb)</u>
Arsenic	Below detection - 533	50 (drinking) 190 (aquatic)
Cadmium	7.0 - 48	10 (drinking) 1,638 (aquatic species)
Iron	470 - 4,975	300 (drinking)
Selenium	Below detection - 25.9	10 (drinking)
Boron	300 - 1,800	No standard

Boron concentrations should be harmless to alfalfa, sugar beets and malt barley. This finding is substantiated by the fact that irrigated crops in the Westside Project area show no apparent symptoms of boron toxicity.

Water quality data collected at Basin indicates present average concentrations of arsenic are 8.55 parts-per-billion (ppb), cadmium .24 ppb, and iron 72.49 ppb. No data on selenium at Kane was available, so a single "grab" sample was taken in January 1987 above the Big Horn Canal Diversion. (The sample is representative of base-flow conditions from Boysen Reservoir and irrigation return flows from lands in the Hanover, Bluff and Owl Creek irrigated areas.) The selenium concentration at the diversion was 2.2 ppb, which is within health standards.

Concentrations in the Future Without the Project would be the same as at present.

(Pesticides).--The project area is presently uncultivated and thus receives no insecticide-herbicide treatment.

The local Weed and Pest Control District uses 2,4-D, Banvel, and Tordon in their weed control program. This condition would continue in the Future Without.

(Total Dissolved Solids).--Total dissolved solid constituents are calcium, magnesium, sodium, bicarbonate, sulfate and chloride. Historic average TDS (in parts-per-million--ppm) in the Big Horn River at Kane, Wyoming are:

May	599
June	425
July	635
August	745
September	743
October	681
November	662
December	703

River water is adequate for irrigation. The TDS in the future without condition would be the same as at present.

(Nutrients).--Major nutrients are phosphorus and nitrates/nitrites. Historic nutrients (in ppm) in the Big Horn River at Kane, Wyoming, are:

	<u>Phosphorus</u>	Total N as <u>Nitrate-Nitrite</u>
May	0.34	3.30
June	1.20	2.40
July	0.31	1.85
August	1.80	3.57
September	0.61	4.80
October	0.62	1.80
November	0.19	1.20
December	0.13	1.55

Nutrient concentrations in the future without the project would be the same as at present.

Preferred Plan

Surface Water Quantity.--The average annual diversion requirement would be 15,400 acre-feet. Water for the Preferred Plan would be provided from unappropriated flows in the Big Horn River through early summer in an average year. During the peak months of July and August, water would be released from Boysen Reservoir. Dry years would necessitate more frequent releases.

Diverting available unappropriated flows from the river would cause undetermined fishery impacts downstream from the Big Horn Canal during dry periods (see "Fisheries" in this chapter). Boysen Reservoir would therefore be used to meet project demands whenever those demands resulted in river flows less than 580 ft³/s directly below the canal diversion. The Westside Project would be responsible only for replacing project diversions. (See the Hydrology Appendix for a detailed analysis.)

An increase in Boysen releases would be needed to meet project demands 50 percent of the time. In April-June and September, greater releases would be needed less than 20 percent of the time.

Table 5.1 shows expected diversion requirements (including canal seepage) and Boysen releases, based on a historic period of 1952-1978. Minimum end-of-month (EOM) storage levels at Boysen can be found in the "Fisheries" Section. Releases for the Westside Project would reduce the storage by 0.5 percent in July and August, a drawdown of about 0.3 feet.

Average annual return flows of 2,785 acre-feet would enter the Big Horn River by natural drainages, preferred by the Wyoming Game and Fish Department for long-term habitat improvement.

Surface Water Quality --

(Erosion/Sedimentation).--Estimates were made of sediment losses based on a crop distribution of alfalfa (1,924 acres), malt barley (962 acres), sugar

Table 5.1: Diversion Requirements/Boysen Reservoir Releases for the Preferred Plan
(ft³/s)

	April	May	June	July	August	Sept.	Oct.
1952	0/0	26/0	68/0	72/72	49/49	46/0	10/0
1953	0/0	21/0	65/0	84/84	50/50	42/0	8/0
1954	4/0	30/0	58/0	85/0	55/55	45/0	9/0
1955	7/0	25/0	45/0	76/76	56/56	36/0	11/0
1956	5/0	31/0	76/0	70/70	44/38	45/0	8/0
1957	4/4	18/0	45/0	78/0	51/0	36/0	6/0
1958	1/0	45/0	53/0	56/56	55/55	42/0	10/0
1959	0/0	24/24	58/0	82/82	54/54	26/3	5/0
1960	4/4	42/42	60/0	79/79	50/50	33/33	6/6
1961	2/2	22/22	73/73	76/76	58/58	21/21	3/0
1962	0/0	14/0	59/0	66/44	46/0	40/0	11/0
1963	0/0	35/35	44/0	76/0	51/51	35/12	9/0
1964	0/0	28/0	39/0	90/0	46/0	41/0	10/0
1965	6/0	21/0	48/0	69/0	44/0	15/0	11/0
1966	2/2	46/46	56/56	81/81	49/49	38/38	10/0
1967	0/0	26/0	26/0	78/0	57/0	25/0	10/0
1968	1/0	24/0	47/0	78/0	26/0	35/0	9/0
1969	0/0	38/38	32/0	79/0	60/60	47/7	5/0
1970	0/0	34/0	72/0	79/79	61/61	32/32	8/0
1971	0/0	24/0	70/0	73/0	56/0	35/0	0/0
1972	1/0	29/0	61/0	58/0	41/0	37/0	5/0
1973	0/0	39/0	58/0	68/0	52/0	20/0	9/0
1974	10/0	27/0	76/0	74/0	46/0	34/0	6/0
1975	0/0	5/0	52/0	74/0	52/0	39/0	3/0
1976	0/0	37/0	52/0	85/85	48/0	32/0	8/0
1977	0/0	36/36	73/1	71/71	41/41	38/38	10/10
1978	0/0	3/0	63/0	66/0	45/0	28/0	10/0

beets (962 acres) and pasture (208 acres each). Estimated total sediment losses and yield to a down-gradient receiving stream would be 1,719 tons/year and 172 tons/year, respectively. (If sugar beet or barley acreage were increased in the crop distribution, soil losses would be greater.) When compared to the Present (or Future Without) this is an increase of 16 tons/year of sediment reaching the stream. All sediment loss estimates were made from the USLE. No field measurements were done to verify estimates.

Increased sediment concentration in the Big Horn River would have an insignificant effect on the municipal water supply at Basin. Preferred Plan effects on turbidity would be unnoticeable, and aquatic species would not be affected.

(Trace Constituents/Metallic Elements).--Arsenic, cadmium, iron, and selenium concentrations in soil samples were determined by direct measurement (see "Present Condition"). A U.S. Environmental Protection Agency (EPA) procedure was used to assess solid phase chemical loading from rural runoff of the Preferred Plan on the Big Horn River at Basin (EPA 1985a). (The methodology used is discussed in the Hydrology Appendix on page 46, 50, and Table 32.) This point in the river was selected because of potential effects on Basin's municipal water supply. All return flows would reach the Big Horn River via natural drainage upstream of Basin. Leading functions for the solid-phase chemicals are associated with sediment and dissolved-phase chemicals with runoff.

For drinking water purposes, arsenic should be no greater than 50 ppb (EPA 1986). For freshwater organisms, the 4-day average concentration should not exceed 0.19 ppb more than once every 3 years (EPA 1984a). Reclamation's water quality studies show that these levels would not be exceeded with the Preferred Plan (Table 5.2).

Iron is an essential element in the metabolism of animals and plants. In excessive amounts in water, however, it stains laundry and plumbing, making it objectionable in domestic and industrial water supplies. A recommended upper limit for iron in public water supplies is 300 ppb (EPA 1986). An

Table 5.2: Concentrations in Bighorn River Water (in ppb) From Solid-Phase/Dissolved-Phase With Preferred Plan (at Basin)

<u>Arsenic</u>	
Dissolved Phase	.0010
Solid Phase	.0000437
Preferred Plan Induced	.001
Present//Future Without Concentration	8.55
Resultant Concentration	8.55
<u>Cadmium</u>	
Dissolved Phase	.00002
Solid Phase	.00003
Preferred Plan Induced	.00005
Present/Future Without Concentration	<u>0.24</u>
Resultant Concentration	0.24
<u>Iron</u>	
Dissolved Phase	.01
Solid Phase	0.16
Preferred Plan Induced	0.17
Present/Future Without Concentration	<u>72.49</u>
Resultant Concentration	72.66
<u>Selenium</u>	
Dissolved Phase	.0000104
Solid Phase	.0000048
Preferred Plan Induced	.0000152
*Present/Future Without Concentration	<u>2.2</u>
Resultant Concentration	2.2

* No selenium data available at Kane. Therefore, data presented is a single grab sample (January 1987) from the river along the Big Horn diversion.

abnormally high concentration of iron is found in the Westside Project area (Table 5.2), but there are no harmful health impacts associated with it.

Cadmium in toxic concentrations is usually confined to industrialized areas. Acute toxicity to brown trout has been reported at 1.639 ppm (EPA 1984b). The predicted cadmium level in the Big Horn River with the Preferred Plan would be below this level (Table 5.2). The drinking water standard of 10 ppb would not be exceeded by Preferred Plan return flows.

Since Westside Project land contains soluble selenium (see "Present Condition"), the Preferred Plan would probably add selenium to the Big Horn River. The potential for leaching selenium can also be observed by the concentrations in water samples taken from Fivemile and Tenmile Creeks, which had concentrations of 9.5 and 4.7 ppb, respectively, and samples from field drains, with concentrations of 12.9 and 8.1 ppb.

These samples by themselves do not mean that concentrations in the river could approach the 10 ppb level set for human health but do indicate the potential for further accumulation of selenium in the Big Horn. The Preferred Plan would add to the levels of selenium in the Big Horn River but not to the point of detriment to humans, livestock or aquatic species (Table 5.2).

The U.S. Geological Survey (USGS) gauging station at Kane is being upgraded to collect trace element samples year-round. The monitoring program will provide baseline information to confirm estimated project effects. Should the monitoring program reveal contaminants beyond health or biological standards (i.e., organo-chemicals, arsenic or selenium), remedial measures would be developed and implemented by Reclamation and the State.

Realistically, 100 percent of the naturally occurring elements in the soil would not be found in irrigation return flows in dissolved form. Ions in solution would likely be adsorbed onto clay surfaces or other mineral compounds in deep percolation water at low pH, or form insoluble complexes at high pH, depending on other constituents in the soil. The adsorption of ions onto precipitated complexes or other activated surfaces (such as organic particles) would also be an important factor limiting solubility.

(Pesticides).--Conversion of the Westside Project area to cropland would necessitate the use of pesticides, with consequent effects on water quality. According to the farm budget analysis, three pesticides -- carbaryl (Sevin), dicamba (Banvel), and aldicarb (Temik), -- would be applied to the malt barley, sugar beets and alfalfa grown in the Westside area. Carbaryl controls worm and beetle infestation in sugar beets and dicamba controls weeds. Aldicarb is used on sugar beet nematodes and maggots.

Dicamba is very toxic but rapidly degrades in soil. It is reported to be acutely toxic (96 hr LC50) to rainbow trout at a concentration of 28 ppm. Aldicarb readily decomposes under common use, but, with permeable soils under irrigation, it tends to move to ground water. Carbaryl acts as a nerve inhibitor and is toxic to freshwater fish at concentrations of 0.33-4.6 ppm.

Herbicides are also used for brush and weed control under Wyoming's Weed and Pest Control Program. Each Weed and Pest Control District controls certain types of weeds. The USGS helps the State conduct water quality tests to monitor effects of the weed program. The USGS has monitored the Big Horn River intermittently since 1979 for 2,4-D, Banvel and Tordon.

Some chemicals have short half-lives and pose no threat to water quality if properly applied. Others, however, are water soluble, and, aldicarb (Temik) in particular, migrate through the soil. Pesticide residues generally occur in the top 6 inches of soil; therefore, overland transport in eroded sediment of the less soluble pesticides to the Big Horn River would be likely. Accordingly, pesticide impacts to surface water quality from the Preferred Plan have been correlated to soil loss through surface runoff.

A summary of runoff losses and resultant concentrations in the river at Basin of each pesticide are shown in Table 5.3. None of the pesticides would pose a threat to human or aquatic life. Approved pesticides properly applied would pose no threat to waterways and fish and wildlife resources.

As part of the district irrigation plan, chemical types used in the Westside Project would be reviewed every 5 years and the usage of less hazardous chemicals encouraged.

Table 5.3: Losses of Sediment Adsorbed Pesticides in Runoff

Type	Dicamba Applied to Malt Barley (Dimethylamine salts)	Aldicarb Applied to Sugar Beets (Propionaldehyde)	Carbaryl Applied to Alfalfa (Carbamates)
Project area (acres)	962	962	1,924
Solid-phase (lb/acre)	0.336	0.113	0.004
Dissolved (lb/acre)	0.016	3.607	0.008
Total (lbs/acre)	0.352	3.720	0.012
Total load to river (lb)	339	3,571	23
Predicted concentration in river at Basin (ppm) <u>1/</u>	.002	.025	.00016

1/ There is no information on current pesticide concentrations used in the analysis in the Big Horn River. This table shows the effects of the Preferred Plan assuming the river is pesticide free. Collection of pesticide data at the USGS gauging station at Kane began October 1987.

(Total Dissolved Solids).--Estimates of TDS from the Preferred Plan are shown in Table 5.4 (average TDS) and Table 5.5 ("worst-case TDS" - a condition described in the Hydrology Appendix). The worst average increase would occur in October, with an increase of 5 ppm. The change would be insignificant compared to the absolute value of the TDS concentration in the river and would not affect the fishery or the municipal water supply at Basin.

Table 5.4: Total Dissolved Solids Concentrations
in the Big Horn River at Kane, Wyoming:
Average Conditions (PPM)

	<u>Future Without Project</u>	<u>Preferred Plan</u>
May	599	599
June	425	425
July	635	635
August	745	749
September	743	748
October	681	686
November	662	666
December	703	705

Return Concentration = = 1,780 ppm (Dobie Creek, March 1986)

Table 5.5: Worst-Case TDS in the Big Horn River at Kane 1/
(ppm)

	<u>Future Without Project</u>	<u>Preferred Plan</u>
May	725	725
June	585	586
July	1,033	1,036
August	999	1,005
September	966	973
October	899	905
November	830	835
December	1,008	1,011

Return Concentration = 1,780 ppm (Dobie Creek, March 1986)

1/ Monthly concentrations are assumed to be maximum values.

(Nutrients).--Nutrient concentration changes in the Big Horn from the Preferred Plan would be less than detectable levels (Table 5.6). These changes would not cause algae blooms in the river nor create water quality problems for downstream municipal water users.

Only under unusual circumstances would nitrates be reduced to highly toxic nitrites. Conversion of nitrates into nitrites rarely occurs outside the human body (in nitrate-containing food or water before ingestion) or inside the body (by the action of intestinal bacteria on ingested nitrates). The form of nitrate/nitrite conversion more likely to occur is mainly present only in infants. This sometimes fatal nitrate-induced condition is known as methemoglobinemia.

The nitrate/nitrogen concentrations from the Preferred Plan would not cause adverse human health effects.

Table 5.6: Phosphorus and Nitrate/Nitrite Concentrations at Kane (Worst Case - ppm)

	<u>Future Without Project</u>		<u>Preferred Plan</u>	
	<u>Phosphorus</u>	<u>Total N Nitrate-Nitrite</u>	<u>Phosphorus</u>	<u>Total N as Nitrate-Nitrite</u>
May	0.34	3.30	0.34	3.30
June	1.20	2.40	1.20	2.40
July	0.31	1.85	0.31	1.87
August	1.80	3.57	1.80	3.59
September	0.61	4.80	0.61	4.81
October	0.62	1.80	0.62	1.83
November	0.19	1.20	0.19	1.22
December	0.13	1.55	0.13	1.57

Recorded return flow concentration from existing drains is 1.90 ppm of phosphorus [PO₄-P] (Tenmile Creek, December 1985), and 5.69 ppm nitrate/nitrite [NO₃-4] (Dobie Creek, October 1985).

Ground Water Quantity and Quality

Summary

Ground water in the project area is of limited quantity (yielding up to 15 gallons-per-minute) and of poor quality (up to 1,590 ppm TDS). Samples

from domestic wells showed nitrate concentrations of 0.05-14.1 ppm, selenium concentrations of 0.004-0.027 ppm, iron from 0.241-0.508 ppm, arsenic 0.001-0.002, and cadmium and 24 other constituents as either below detection or insignificant. These conditions would continue in the Future Without.

With the Preferred Plan, about 2,090 acre-feet of deep percolation and 1,426 acre-feet of additional canal seepage would be added to the ground water annually, until project drains were installed. Thereafter, ground water inflow would increase by only the extra canal seepage volume. The increase in volume would have no significant effect as ground water is not widely used.

The Preferred Plan would increase the iron concentrations in the ground water to 1.492 ppm, which exceeds Federal Primary and Secondary Drinking Water Standards, but arsenic, cadmium and selenium concentrations would remain below. Increased levels of the pesticide aldicarb in ground water as a result of the Preferred Plan appear to present no hazard, and there would be no hazard from the pesticides dicamba or carbaryl. The Preferred Plan would not significantly affect ground water quality.

Present and Future Without Conditions

Ground Water Quantity and Quality--Ground water is not widely used in the Westside area because of low yields and poor quality. The few wells yield up to 15 gallons-per-minute.

Ground water samples were collected August 12 from five domestic wells along the eastern boundary of the project area between the Big Horn Canal and the Big Horn River. Well depths ranged from 40-180 feet, with static water levels averaging 26 feet. Nitrate concentrations from these samples ranged from 0.05-14.1 ppm, selenium ranged from 0.004-0.027 ppm and iron from 0.241-0.508 ppm. Two arsenic samples were slightly above detection, at concentrations of 0.001 and 0.002 ppm respectively. All cadmium values were below detection. Twenty-four other constituents included in the analysis were either insignificant or below detection.

Samples in the past have shown TDS as high as 1,590 ppm.

Preferred Plan

Ground Water Quantity--Deep percolation was estimated from 6,895 acres of presently irrigated land below the Big Horn Canal between Tenmile and Alamo Creeks. Assuming crop irrigation requirements for the cropping patterns at present in the project area, 50 percent farm efficiency, and 15 percent of the farm delivery requirement going to deep percolation, the average annual volume from deep percolation totals 3,741 acre-feet.

A recent study showed the Big Horn Canal loses about 0.72 ft³/s of water per mile (Nelson Engineering, Inc., 1985). The length of canal along the east edge of the project area is about 15.5 miles. Canal losses thus total 4,369 acre-feet. This loss, added to the deep percolation from crops grown in the area, gives a total inflow volume to the ground water of 8,110 acre-feet in the Present Condition.

To determine effects of deep percolation and increased canal seepage due to the Preferred Plan, an estimate was made of the present and future inflow to ground water between the canal and the river boundary of the project. Before the drains were installed in years 10 and 100 of the project, the Preferred Plan would add 2,090 acre-feet of deep percolation and 1,426 acre-feet of increased canal seepage yearly, a total increase of 3,516 acre-feet (43.8 percent) over the Future Without.

After drains were installed, deep percolation would be intercepted. Ground water would be increased only the increased seepage volume. The total addition to ground water would be 9,536 acre-feet annually, an 18 percent increase over the Future Without.

Ground Water Quality

The ground water quality analysis for the Preferred Plan considered effects of trace constituents/metallic elements, pesticides and nitrate.

(Trace Constituents/Metallic Elements).--A mass balance approach was used to estimate increases in trace constituents/metallic elements (arsenic, cadmium, iron, and selenium) in the alluvial ground water system. Trace element data is not available for baseline levels for ground water. Therefore, present ground water quality was estimated on Big Horn River data (the USGS gauging station below Boysen).

Table 5.7 displays the mean resultant ground water quality from the Preferred Plan on land of concern between the Big Horn Canal and the Big Horn River. Before project construction, ground water samples would be taken to establish baseline conditions in the zone of concern. If adverse effects were detected from project operation, drains would be installed. The drains would intercept deep percolation before it moved down gradient to the saturated alluvium between the Big Horn Canal and river.

Note that the projection of iron would exceed Federal Primary or Secondary Drinking Water Standards. At this concentration of iron, water would be unappealing (taste, odor, staining of fixtures) from an aesthetic prospective.

Table 5.7: Trace Constituents/Metallic Elements Effects on Ground Water
(ppb)

<u>Resultant Quality</u>	<u>Mean</u>	<u>EPA Water Quality Standards</u>
Arsenic -----	19.0	50 Primary
Cadmium -----	3.0	10 Primary
Iron -----	1,492	300 Secondary
Selenium -----	5.0	10 Primary

(Pesticides).--Pesticide impacts to ground water from the Preferred Plan were assessed for three target farm chemicals: aldicarb, dicamba and carbaryl (see the Hydrology Appendix for the methodology).

The movement of a pesticide through soil from a farming application is a function of soil physical and chemical properties, pesticide properties, local watershed and meteorological conditions, and soil, water and pesticide management variables.

The first assessment in this study used assumptions for a given set of pesticide/soil/crop management circumstances expected from the Preferred Plan using aldicarb on sugar beets. Under any management practices, no more than 10 percent of the annually applied aldicarb would be leached past the crop root zone. Based on pesticide application rates, the concentration of aldicarb in deep percolation flows was estimated at 0.735 ppm. Estimates of present aldicarb concentrations in the alluvial ground system (based on presently irrigated lands east of the canal) was 0.253 ppm. A mass balance mix of the Preferred Plan deep percolation concentration and present ground water concentration was then done.

The resultant ground water concentrations east of the canal would be 0.337 ppm. The increment of Preferred Plan effects on the present aldicarb concentration would be 0.084 ppm. These results alone, because of the mass balance mixing, cannot be interpreted as an assessment of exposure to biological species (human health), or as data to compare to water quality criteria, because the fate and transport processes in ground and/or nearby

surface water have not been considered. From the literature available during this study, it appears that aldicarb in soil rapidly degrades to sulfide and sulfone products which are nontoxic. In the literature reviewed it was these by-products (not the parent material) that was detected in ground water. This appears to present no hazard.

The second assessment assumed the use of dicamba on malt barley. Regardless of management practices, there would be a 30 percent chance that a minimum of 8 percent (up to 50 percent) of dicamba would be leached. Estimated concentration of dicamba would be at 0.01 ppm. As long as dicamba remains in the soil profile (assuming proper application rates), there would be no hazard. Complete degradation occurs in 1 year, in considerably less time with organic matter and moisture present. Dicamba is moderately soluble in water and, therefore, could be detected in the shallow domestic and livestock wells in the area. Chronic toxicity is not believed to be significant for the chemical, and acute toxicity is rated at moderate with fatal dosage estimated between 1 ounce and 1 pound for humans. There is no evidence that dicamba or its metabolites bioaccumulate. At the low predicted concentrations (and assuming proper application), there would be no hazard to humans or livestock uses.

Land below the canal currently under irrigation has an estimated dicamba concentration of 0.005 ppm. The mass balance mix would result in an 0.006 ppm concentration in the zone of concern between the canal and river. Preferred Plan impacts would thus be a 0.001 ppm concentration increase.

A third analysis assumed the use of carbaryl on alfalfa. No significant leaching of carbaryl would occur under anticipated circumstances; in no year would more than 0.05 percent of the annually applied carbaryl be leached below the crop rooting zone. No adverse effects would occur in the ground water.

(Nitrate)--An analysis of the effects of nitrate on ground water from the Preferred Plan was not completed because nitrate data is unavailable on baseline levels. During advanced planning, a two-dimensional horizontal flow, with continuous solute line sources as developed by Wilson and

Miller (Wilson and Miller 1978) or similar methodology will be used when data is collected on existing nitrate concentrations in the ground water zone of alluvium saturation between the Big Horn Canal and the river. Preferred Plan effects from fertilization of 4,068 acres of previously undisturbed native rangeland will be further assessed using the Wilson and Miller simulation model (or similar methodology) that predicts the fate and transport of nitrate in ground water.

Fisheries

A distinction was made in this analysis between Boysen Reservoir and the Big Horn River because of their differences as fisheries. Impacts to Boysen are listed first below, followed by impacts to the river. The Big Horn River analysis is further subdivided into the segments of the river between Boysen Reservoir and the Big Horn Canal and from the canal to Bighorn Lake.

Summary

Boysen Reservoir is a well-known walleye fishery, while the Big Horn River has a rainbow trout fishery that varies from excellent at Boysen to poor at Worland. Downstream of the Big Horn Canal, the river fishery includes walleye, sauger, channel catfish, and ling, as well as trout. Conditions in the Future Without the Project would continue as at present in Boysen and the Big Horn.

Releases from Boysen for the Preferred Plan would not affect the reservoir fishery in average years. In dry years, the reservoir level could not be maintained, even without the project. Water would be released from Boysen for the Preferred Plan whenever flows at Big Horn Canal headgate were 580 ft³/s or less. No aquatic species--including the shovelnose sturgeon and the sturgeon chub, considered rare by the Wyoming Game and Fish Department (WGFD)--would be affected by the Preferred Plan.

Present and Future Without Conditions

Boysen Reservoir.--Boysen Reservoir is known for its walleye fishery. Rainbow and brown trout are also found in the reservoir, with carp the most abundant rough fish. Boysen Reservoir is classified as Resource Category 3 under the U.S. Fish and Wildlife Service's (USFWS) Mitigation Policy.

The future Boysen fishery without the Westside Project would remain unchanged or would improve slightly over the present.

Big Horn River.--Average daily releases from Boysen Reservoir are about 1,400 ft³/s. Peak flows in the river usually occur during June and July, with average releases the rest of the year fairly constant at about 1,200 ft³/s. Diversions at the Kirby Ditch, Bluff Diversion, Upper Hanover Canal and Lucerne Pump (see Figure 3.1) cause moderate reductions in these releases between Boysen and the Big Horn Canal.

The sport fishery in the Big Horn River between Boysen and Worland varies from excellent at the reservoir to relatively poor at Worland. This transition is largely due to increased temperature and turbidity of the river. Decreased flow caused by large diversions at the Upper and Lower Hanover diversions and the Big Horn Canal is also a major factor. There is at present no instream flow established for the Big Horn.

Rainbow trout is the river's dominant cold-water species. In the last 5 years, WGFD has stocked about 250,000 rainbow trout fingerlings between the Wedding of the Waters and Lucerne Bridge (upstream of the larger diversion structures) to increase angling success. Since this program started, a correlation has been noted between discharge and fingerling survival. Flows in 1982 and 1983 were abnormally high for part of each summer, and the survival of planted fish was relatively low. Runoff patterns (and release rates) in 1984 were more normal, so fingerling survival improved (Steve Yekel, WGFD, Personal Communication).

The fisheries maintenance flow recommendation for the river segment between Boysen and the canal is 580 ft³/s. Average low flows now exceed this level and are more than adequate to sustain the fishery in this segment of the river. The Big Horn River upstream of the canal is classified as Resource Category 2 under the USFWS mitigation policy.

The rest of this section applies only to the segment of the Big Horn River downstream from the canal which supports trout, walleye, sauger and channel catfish. Different instream flow recommendations apply.

Very few trout are found in the Big Horn River between the canal and the Greybull River, but sizable populations of channel catfish, sauger, and walleye can be found, increasing in numbers as flows increase. The river immediately downstream of the Lower Hanover diversion to the mouth of Nowater Creek (about 1 mile) is totally dry some months and, from the Nowater to about Tenmile Creek, river flows are often negligible, seriously limiting the fishery. Irrigation return flows supplement flows in the river through the rest of the segment, with consequent reduced water quality.

It is unknown if late summer conditions are limiting to fish. No recent data have been gathered on the river fishery downstream of the canal which would enable a quantitative assessment of species composition or water quality. Based on presently available information, the WGFD recommends that a flow of 550 ft³/s reach the mouth of the Greybull River to maintain the fishery. The average August low flow at present is 609 ft³/s at Worland (Nelson Engineering, Inc. 1985).

The river segment between the mouth of the Greybull River and Bighorn Lake supports a fishery like that mentioned; however, this fishery consists of more channel catfish, sauger, and walleye than upstream river segments. A wide variety of nongame fish can also be found. The WGFD recommends a flow of at least 690 ft³/s reaching the gauging station at Kane to maintain the fishery. The present late summer average low flow at Kane is 1,422 ft³/s.

Several small drainages enter the Big Horn River through the project area which might carry irrigation return flows. Only Tenmile Creek supports fish populations year-round, but there are no game fish and few nongame fish. All of the other small downstream drainages entering the Big Horn River from the west are intermittent and do not harbor fish.

The river fishery downstream from Boysen is expected to remain unchanged.

Rare Fish.--Two fish species may be found in the Big Horn River, which have a very limited distribution in Wyoming and thus are classified as rare (WGFD 1977). Shovelnose sturgeon once occurred in the North Platte and Powder River drainages as well as in the Big Horn River (Baxter and Simon 1970). Shovelnose can no longer be found in the North Platte, but several specimens were captured in the Powder River in 1983 and 1984. This species also has been reported unofficially in the Big Horn and Greybull Rivers, but none have been caught by WGFD since the closure of Yellowtail Dam.

The sturgeon chub was also once found in the North Platte, Powder and Big Horn River systems; today significant numbers in Wyoming are found only in the Powder River (Stewart 1981). This species prefers riffle areas of large turbid streams and it is believed that dams on the North Platte reduced turbidity enough to eliminate suitable habitat. Sturgeon chub were caught in the Big Horn River in 1981, just upstream of Bighorn Lake (see the map at the front). Populations in the Big Horn are apparently very small and any development of this river that would reduce turbidity could further reduce habitat suitability and survival of this species.

Preferred Plan

Boysen Reservoir.--End-of-month storage records from the USGS gauge on Boysen show water levels in the reservoir have been stable since 1963, after considerable fluctuation during the first 12 years of operation.

The minimum mean monthly storage for the period occurred in April, filling 57.5 percent of the reservoir's capacity. Boysen has a dead and inactive

pool of 252,137 acre-feet. Storage below 350,500 acre-feet has caused game fish losses (reduced recruitment and growth rates). Thus, a minimum pool at this level would be necessary to protect the fishery. Storage fell to 350,500 acre-feet (or below) 6.3 percent of the time since the reservoir filled but not since 1961.

During periods when the project were diverting water, releases would be made from Boysen to supply Westside when river flows at Worland were 380 ft³/s or less. To meet fishery needs, WGFD recommends a minimum pool level of 350,500 acre-feet, easily maintained during an average year (Table 5.8).

Pool levels in Boysen Reservoir should be enough to preserve the reservoir fishery if releases were made for the Preferred Plan. April is one of the most critical times for the fishery, since rapid drawdowns can reduce reproductive success of yellow perch (an important forage species for walleyes and a desirable game fish). April releases for Westside would probably not have an effect on the spawning success of yellow perch.

In a dry year, the reservoir level could not be maintained, even without releases for the Preferred Plan.

Big Horn River.--Impacts to the river fishery between Boysen Reservoir and the Big Horn Canal were based on a 1981 WGFD study in which the IFG-4 computer physical simulation model (Bovee and Milhous 1978; Annear and Conder 1983) quantified habitat for juvenile rainbow trout under a range of river flows. The effects of various late summer flows on adult trout habitat quality (and standing crop) were determined using the "Habitat Quality Index", or HQI (Binns and Eiserman 1979). Results from the model were expressed in "habitat units" or HU (the habitat quality necessary to produce a one-unit change in trout standing crop). In well-established fisheries, where trout are able to complete their life cycles unhindered, measured population density normally approximates the number of HU's in the stream. The model is used to estimate changes in HU's different flows by measuring various habitat attributes at a range of three or more river flows. The HQI for this report was measured at 350, 1,100, and 1,400 ft³/s. Estimates of HU dynamics outside these flows were impossible.

Table 5.8: Boysen Reservoir E.O.M. Content
(in 1,000's of acre-feet) and Stage (ft)

	J	F	M	A	M	J	J	A	S	O	N	D
1956 - Historical	341.9	273.1	262.5	259.5	419.1	754.7	810.2	785.3	718.7	651.5	584.8	531.8
	4694.2	4687.2	4686.1	4685.8	4700.9	4722.5	4725.4	4724.1	4720.6	4716.7	4712.6	4709.1
With Preferred Plan	341.9	273.1	262.5	259.5	419.1	754.7	805.9	778.7	712.1	644.9	578.2	525.2
	4694.2	4687.2	4686.1	4685.8	4700.9	4722.5	4725.2	4723.8	4720.2	4716.4	4712.2	4708.7
1960 - Historical	419.8	400.5	399.6	406.5	381.7	387.9	342.4	286.6	274.6	310.7	334.8	344.7
	4700.9	4699.3	4699.3	4699.8	4697.8	4698.3	4694.2	4689.7	4687.4	4691.1	4693.5	4694.5
With Preferred Plan	419.8	400.5	399.6	406.3	378.9	385.1	334.7	285.8	261.9	297.6	321.7	331.6
	4700.9	4699.4	4699.3	4699.8	4697.5	4698.1	4693.5	4688.6	4686.1	4689.7	4692.2	4693.2
Average (1953-1986)	563.0	536.1	509.9	483.3	536.8	716.6	722.9	697.3	677.5	665.6	638.1	600.0
	4711.2	4709.4	4707.6	4705.7	4709.5	4720.5	4720.8	4719.4	4718.3	4717.6	4715.9	4713.6
With Preferred Plan	563.0	536.1	509.9	483.3	536.2	716.3	720.7	695.6	677.1	665.6	638.1	600.0
	4711.2	4709.4	4707.6	4705.7	4709.4	4720.4	4720.7	4719.3	4718.2	4717.6	4715.9	4713.6

To avoid affecting the fishery in the Big Horn River, water from Boysen Reservoir would be released for Westside whenever flows at the Big Horn Canal headgate were 580 ft³/s or less. This occurred (with or without the project) in 47 out of the 324 months considered for this study, as is shown in Table 5.9.

There would be no adverse fishery effects from the Preferred Plan.

Rare Fish.--The Preferred Plan would not affect the shovelnose sturgeon or the sturgeon chub, considered rare by the State.

Table 5.9: Estimates of Flows at Worland - ft³/s
(Future Without Project Condition/Preferred Plan)

	April	May	June	July	August	Sept.	Oct.
1952	0/0	778/752	546/478	366/366	280/280	532/486	1,049/1,038
1953	1,053/1,053	993/972	578/513	0/0	147/147	588/546	1,110/1,101
1954	648/644	1,707/1,677	1,047/989	575/490	284/284	629/584	804/794
1955	1,246/1,239	442/417	651/606	0/0	256/256	512/476	599/587
1956	551/546	1,135/1,104	708/632	253/253	386/380	1,249/1,204	1,976/1,967
1957	333/333	1,728/1,710	3,233/3,188	5,616/5,538	922/871	875/839	2,075/2,068
1958	671/670	1,351/1,306	439/386	65/65	39/39	1,149/1,107	2,278/2,267
1959	626/626	0/0	534/476	69/69	164/164	403/380	722/716
1960	292/292	0/0	466/406	73/73	148/148	279/279	153/152
1961	139/139	0/0	352/352	0/0	42/42	287/287	781/777
1962	1,167/1,167	558/544	949/889	402/380	675/629	877/837	1,466/1,454
1963	353/353	180/180	3,941/3,897	2,001/1,925	134/134	403/380	1,244/1,234
1964	1,325/1,325	1,622/1,594	1,500/1,461	1,242/1,152	500/454	645/604	916/905
1965	1,283/1,277	562/541	2,944/2,896	6,769/6,700	1,396/1,352	655/640	2,160/2,148
1966	224/224	115/115	260/260	236/236	178/178	248/248	601/590
1967	921/921	570/544	6,010/5,984	8,620/8,542	969/912	889/864	1,158/1,147
1968	1,342/1,341	764/740	1,063/1,016	504/426	856/830	1,065/1,030	1,350/1,340
1969	1,212/1,212	290/290	872/840	944/865	235/235	420/380	1,201/1,195
1970	1,109/1,109	862/828	546/474	237/237	72/72	317/317	682/673
1971	1,617/1,617	1,869/1,845	4,120/4,050	3,841/3,768	1,101/1,045	1,131/1,096	1,464/1,463
1972	1,591/1,590	1,462/1,433	4,276/4,215	1,730/1,672	1,406/1,365	1,172/1,135	1,600/1,594
1973	846/846	1,813/1,774	1,151/1,093	685/617	957/905	1,968/1,948	2,282/2,272
1974	1,945/1,935	2,305/2,278	3,027/2,951	2,098/2,025	1,491/1,445	799/765	1,096/1,089
1975	981/981	1,212/1,207	2,036/1,984	3,633/3,560	1,377/1,325	825/786	1,316/1,312
1976	1,570/1,570	1,417/1,380	1,065/1,013	312/312	626/578	660/628	1,246/1,237
1977	92/92	282/282	452/380	1/1	282/282	252/252	251/240
1978	1,746/1,746	1,224/1,221	1,013/950	3,602/3,536	1,164/1,119	679/651	1,711/1,611

Wildlife

Summary

Sagebrush habitat provides crucial winter range for antelope in the Westside Project area, as well as important habitat for mule deer and nongame species. Sagebrush/saltbush is the most common habitat.

Big game and other mammals, upland game birds, native songbirds and raptors can be found in the project area: waterfowl are found in the Big Horn River and Boysen Reservoir.

Threatened and endangered species that could be in the project area include the black-footed ferret and bald eagle. No ferrets were found in a 1984-1985 winter survey of the two prairie dog towns in the area. No bald eagles nest in or near the project area. Peregrine falcons have been seen migrating through the project area, too, but there are no places suitable for nesting.

Conditions in the Future Without would remain as at present, except that antelope populations might increase. Canada geese populations could also increase as long as attractive nesting sites remained available in Boysen Reservoir and the river.

About 4,302 acres of crucial winter range for antelope and 648 acres of deer winter range are on land to be irrigated by the Preferred Plan. This loss of habitat would be mitigated for by reducing winter sheep grazing on grazing allotments before construction of the project.

A sage grouse flock in the project area would be reduced at least 50 percent by the Preferred Plan, perhaps 100 percent if the lek were plowed up. Populations of ring-necked pheasant and Hungarian partridge, on the other hand, might increase because of a larger food supply.

Some raptors (golden eagle, ferruginous hawk, etc.) might be reduced in the project area because of the loss of prey, while other raptors (like the

red-tailed hawk) might increase if nesting trees grew. Native songbirds would decline with the removal of vegetation.

Two prairie dog towns would be lost in the Preferred Plan. Bald eagles (as well as other raptors) would be in greater danger of electrocution and other injury from collision with project powerlines. Eagles would also be more vulnerable to people in the project area which could result in more illegal eagle killings.

Present Condition

Sagebrush habitat is found mostly on sandy and loamy soils. Restricted in the project area to a narrow band located primarily on land to be irrigated, sagebrush is of high value to antelope, mule deer and nongame species, including the golden eagle. It is considered crucial winter range to antelope in the project area.

Since sagebrush is scarce in this saltbush-dominated area of Big Horn and Washakie Counties, and it provides 90 percent of an antelope's diet, it is important to the antelope herd. Without sagebrush as a food supply, it is unlikely that the herd could retain its present numbers.

Due to its importance and scarcity, sagebrush habitat is classified as "Resource Category 2" under USFWS mitigation policy, which allows no net loss of in-kind habitat value.

Nuttall's saltbush is the most common vegetation in Washakie and Big Horn Counties, and although browsed by mule deer and antelope all year, it is not important crucial antelope or mule deer winter range because of its low growth form. Use by nongame species is light. Golden and bald eagles forage in the habitat, and both white-tailed prairie dog towns in the project area are located in saltbush habitat. This habitat type was classified as USFWS Resource Category 4.

Big game animals in the Westside Project area are antelope, mule and white-tailed deer. Upland game birds include partridge, pheasant, mourning

dove and sage grouse. Canada geese and various species of ducks inhabit the Big Horn River. Raptors are found in or near prairie dog towns in the project area, the most common being the golden eagle, red-tailed hawk, American Kestrel, and the great horned owl. White-tailed prairie dogs and other small mammals and reptiles provide a source of food for the raptors. Native songbirds include Brewer's, Vesper and savannah sparrows, yellow-headed blackbird, crow, magpie, nighthawk, swallow, horned lark, grey-crowned rosey finch, and black-crowned rosey finch.

Beaver, muskrat, mink, weasel, and badger are common furbearers found in the project area. Predators include the coyote, red fox and bobcat. Cottontail rabbits are common, as are many species of small nongame mammals.

The project area is outside the Fifteenmile wild horse herd range, but from 2-8 horses have been observed during past winters on project lands between Fifteenmile and Fivemile drainages. Recent activities of the Westside study have caused the horses to leave, however.

Federal threatened and endangered species that could be found in the project area include the black-footed ferret, although none were found in the prairie dog towns surveyed during the winter of 1984-1985. The Big Horn River is also an important wintering area for bald eagles. The January census during 1979-1984 spotted an average of 30 eagles between the Wind River Canyon and the town of Basin. An average of 14 bald eagles wintered along the Big Horn River during the same period, but none nest in or next to the project area.

Peregrine falcons migrate through the project area, but no eyries or critical falcon habitat have been spotted (Wyoming Game and Fish Department 1986).

Future Without Condition

The future without the Westside Irrigation Project assumes project land would remain in public ownership, with primary uses for wildlife and

grazing. The Bureau of Land Management (BLM) could dispose of small land tracts like the project area by "Desert Land Entry" or other means, which would convert native range to irrigated cropland. Current irrigation practices on private land along the Big Horn River with the resultant fluctuating river flows (including intermittent dewatering) would continue.

Populations and distributions would remain the same for most wildlife species in the future without condition. Antelope fawning and summering in the project area have risen at an annual rate of about 12 percent over the past 6 years. While it is unlikely that the population would continue to increase at this rate, the trend seems to be for more of the wintering herd to stay in the area throughout the summer.

The number of breeding pairs of Canada geese using Boysen Reservoir and the Big Horn River between Worland and Yellowtail Reservoir has increased since 1965 at an annual rate of 6-12 percent. As long as attractive nest sites (including islands and artificial nest structures in the reservoir and river) are available, and reservoir levels and/or river flows are enough to retain brood rearing areas and marshes, Canada geese would increase.

Threatened or endangered species in the project area would remain as at present.

Preferred Plan

The Preferred Plan would result in the loss of 4,068 acres of wildlife habitat, the acres that would be irrigated. Acres in the project boundaries (by habitat vegetation type) are as shown in Table 5.10.

Wildlife resources in the area have been monitored by WGFD and BLM personnel for years. Data from big game surveys for antelope in Hunt Area 77 and mule deer in Hunt Area 125 recorded on the WGFD computer-based "Wildlife Observation System" were used to summarize population numbers and distribution in the project area. Sage grouse leks and wintering areas were identified and mapped by biologists from WGFD and BLM. Waterfowl numbers and concentration areas on the Big Horn River were derived from

Table 5.10: Habitat Affected by the Preferred Plan

PRONGHORN HABITAT DESIGNATION	PREFERRED PLAN	VEGETATION TYPE	PREFERRED PLAN		
			Crucial Winter Range	Winter/ Year-long Range	Total
Crucial Winter Range	Irrigated: 3,595 Non-Irrigated: 707 <u> </u> Subtotal 4,302	Sagebrush	453	0	453
		Sagebrush/saltbush	3,132	624	3,756
		Saltbush	9	0	9
		Rock/Saltbush	76	24	100
		Grass/Saltbush	632	0	632
		Grass	0	0	0
		Russian Olive/Riparian	0	0	0
Winter/Year-long Range			4,302	648	4,950
Irrigated: Non-Irrigated: <u> </u> Subtotal	473 175 <u> </u> 648				
Total	4,950				

Source: Wyoming Game and Fish Department, 1984.

WGFD surveys. Lists of nongame birds and mammal species and the locations of prairie dog towns were compiled from BLM and WGFD survey information, also.

The Preferred Plan would develop 4,950 acres within the farm boundaries. Nineteen percent of all winter observations of antelope during 1978-1985 in the survey area (shown in Figure 5.1) occurred in the project area. Loss of 4,302 acres of sagebrush habitat within the project boundary would be the most significant impact, since all of the sagebrush is considered crucial antelope winter range, and another 648 acres is deer winter range.

Antelope use of the project area during spring and summer is as shown in Figure 5.2. Antelope tend to be more widely distributed and in smaller groups during the summer, so actual animal-days of use is relatively light. The number of antelope summering in the project area has been increasing. An estimated 10-15 fawns are currently born in sagebrush stands that would be eliminated by the Preferred Plan.

Mitigation would require the project sponsors to negotiate with grazing permittees to reduce or eliminate winter sheep grazing on crucial winter range.

Project irrigators would be assessed a fee to pay depredation claims on crops to relieve the WGFD of the responsibility, requiring action by the Wyoming State Legislature. Ten water catchments would be provided outside the project area, as a means to disperse the antelope herd, thus minimizing depredation, and farm boundaries would be fenced with 4-strand fences. If these measures failed, the farmers would then have the option of fencing irrigated lands to exclude antelope with an enclosure-type fence.

The estimated 80 sage grouse would be reduced at least 50 percent by the Preferred Plan (possibly by as much as 90 percent). The major flock uses sagebrush habitat on the edge of one project tract, half of which would be eliminated by farm development. If the flock's strutting ground also occurred on project land, the flock might be lost altogether.

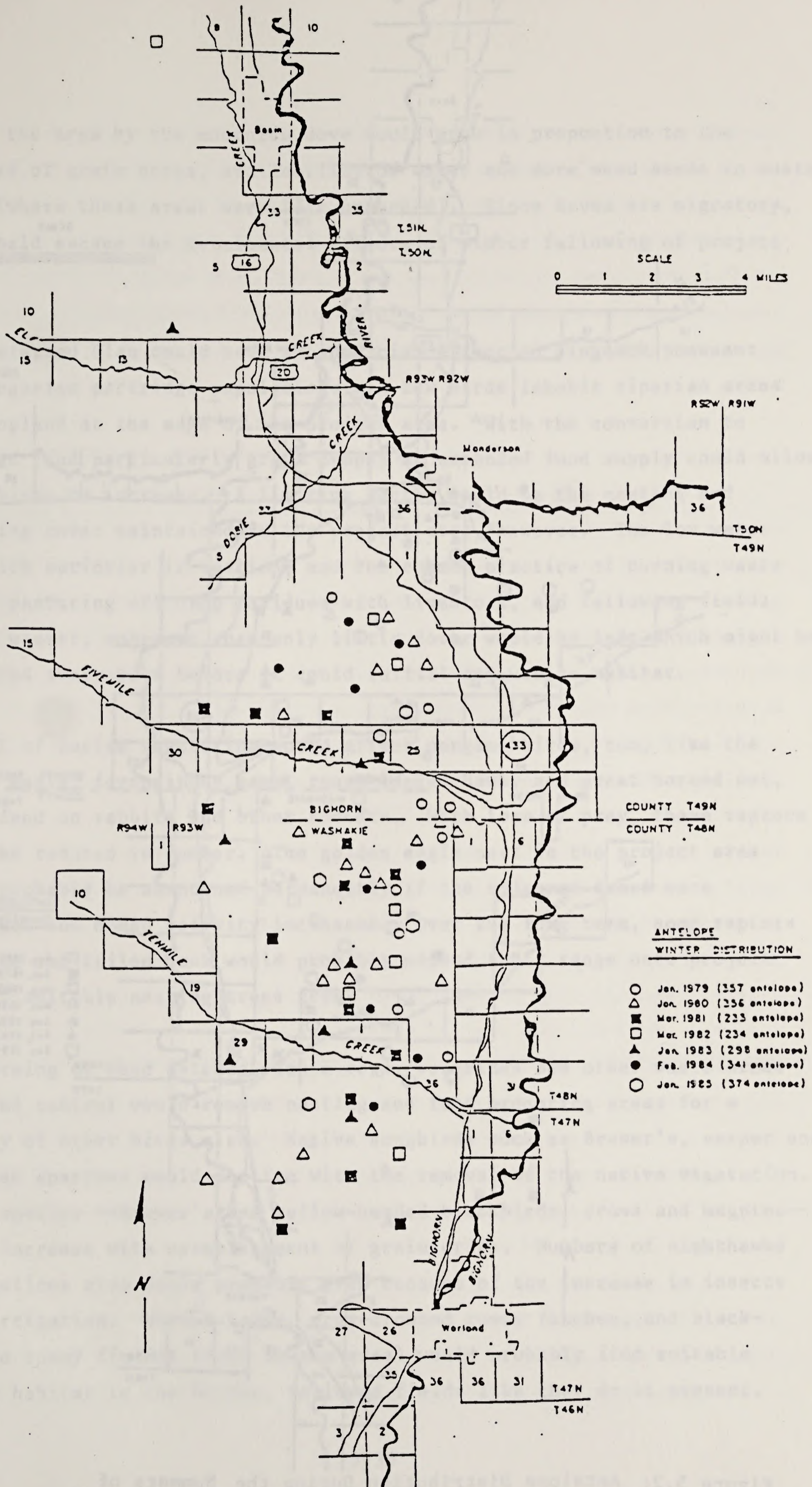


Figure 5.1: Antelope Distribution During the Winters of 1979-80 & 1984-85.

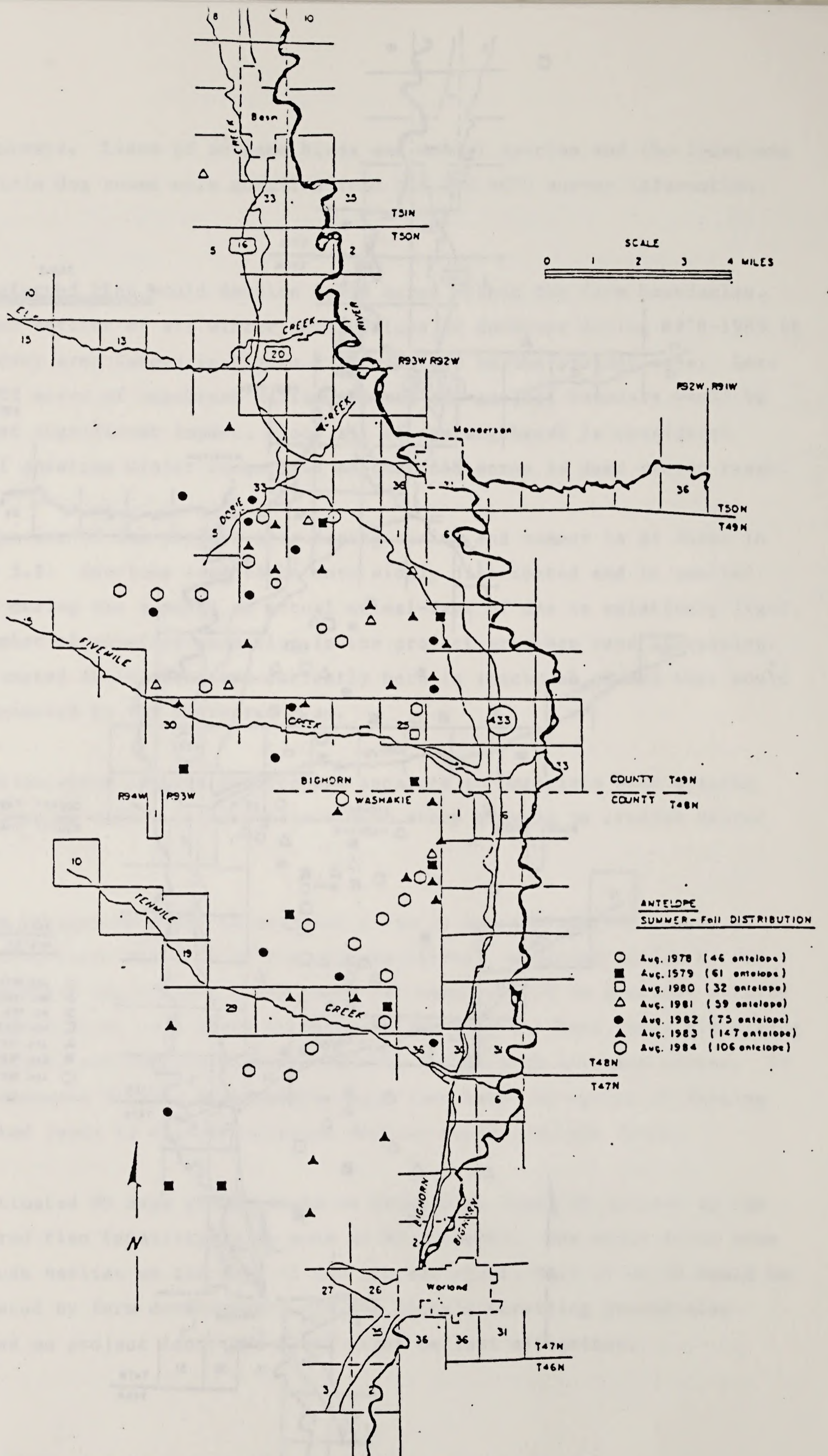


Figure 5.2: Antelope Distribution During the Summers of 1978-84.

Source: Wyoming Game and Fish Department

Use of the area by the mourning dove would grow in proportion to the increase of grain crops, availability of water and more weed seeds in waste areas (where these areas were left unburned). Since doves are migratory, they would escape the detrimental effects of winter fallowing of project land.

The Preferred Plan could have a beneficial effect on ringneck pheasant and Hungarian partridge populations. A few birds inhabit riparian areas and cropland at the edge of the project area. With the conversion to cropland (and particularly grain crops) an expanded food supply could allow these birds to increase. A limiting factor would be the nesting and wintering cover maintained in the project area, however. The low water loss with sprinkler irrigation, and the common practice of burning waste areas, pasturing off crop residues with livestock, and fallowing fields during winter, suggests that only little cover would be left which might be destroyed every year before it could fulfill any use as habitat.

Removal of native vegetation would affect nongame birds, too, like the golden eagle, ferruginous hawk, rough-legged hawk, and great horned owl, which feed on rabbits and other rodents. With loss of prey, these raptors would be reduced in number. The golden eagle nest in the project area would probably be abandoned permanently if the adjacent tract were developed and human activity increased. Over the long term, some raptors like the red-tailed hawk would probably expand their range onto project land if suitable nesting trees grew.

The burning of weed patches, fence rows, roadsides and other waste areas for weed control would remove nesting and food producing areas for a variety of other birds also. Native songbirds such as Brewer's, vesper and savannah sparrows would decline with the removal of the native vegetation. Other species --Brewer's and yellow-headed blackbirds, crows and magpies-- would increase with establishment of grain crops. Numbers of nighthawks and swallows also would probably grow because of the increase in insects from irrigation. Horned larks, grey-crowned rosey finches, and black-crowned rosey finches (rare in the area) would probably find suitable winter habitat in the barren, fallowed fields like they do at present.

The Preferred Plan would not affect bald eagle distribution or foraging habits in the project area, but powerlines for the pumping plants (if improperly constructed) could affect bald eagles and other raptors by increasing the danger of electrocution of birds perching on power poles, and the likelihood of collisions where powerlines cross movement routes. Any powerlines would be built in accordance with Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1981 (Olendorf 1981).

Burning for weed control would also reduce cover for predators and eliminate habitat for prey species. Greater human occupation and use of the area, coupled with reduced food and cover, would cause eventual elimination of resident coyote and bobcat populations. Badger populations would be reduced with destruction of prairie dog colonies. Red foxes, striped skunks and weasels (being more adaptable to civilization) might increase locally where project land bordered native range. Because of the distance from the river bottomlands, and because of the farming operations proposed, however, fox, skunk, and weasel populations would be reduced overall by the Preferred Plan.

Populations of cottontail rabbits, prairie dogs and other small mammals would be reduced on 4,068 acres where native vegetation were replaced by cropland and improvements, but these species might benefit along the peripheries of cultivated land and where seeps developed attractive vegetation. Improved habitat would not offset the habitat eliminated, however. Beet and small grain production, fallowing during critical winter months, prairie dog towns plowed under, and fence rows and waste areas burned for weed control would account for small mammal losses. Nearly the entire prairie dog population of 200-300 animals on project land would be lost. While no good estimate of the present cottontail population is available, it is periodically quite high. Total population reduction would be in the neighborhood of 75 percent.

About 1,600 acres of prairie dog towns would be eliminated in the Preferred Plan. While no endangered black-footed ferrets were found when these towns were surveyed during the winter of 1984-85 (Reclamation will

sponsor another survey in the year before construction to confirm these findings), destruction of the towns would rule out their use to re-introduce the ferret. The Preferred Plan would not affect the distribution or foraging habits in the project area of bald eagles, but eagles would be in greater danger of electrocution and other injury from project powerlines, as would other raptors. Bald eagles could also be affected indirectly by the improper use of pesticides and fertilizer on project land.

Land Use

Summary

Land use authorization and withdrawals have been made on 4,693 acres of public land inside the Westside Project boundaries. Without the project, authorization and withdrawals would be reviewed in the future, and retained or terminated as necessary. The project area includes parts of four grazing allotments, producing a total of 2,309 AUM's. In the future without the project, the area would remain public rangeland of about the same productivity.

The Preferred Plan would require more power and telephone lines, structures and roads. The Preferred Plan would mean the loss of grazing on 4,693 acres of public land, a loss of 388 AUM's. Livestock access to 3.5 miles of irrigation ditch as a water source would also be lost, as would 3/4 mile of fences.

Present Condition

Land-use authorizations and land withdrawals (Table 5.11) would remain as at present on the 4,950 acres inside project boundaries.

The Westside Project area includes parts of four grazing allotments permitted by BLM. Table 5.12 shows the allotments, the "animal units months," AUMS (the forage necessary to support one mature cow for 1 month), the allotments provide, kind of livestock on the allotments, range

improvements, and the percentage of the allotment inside the project boundary.

The vegetation in the project area has never fully recovered from overgrazing in the past. Range condition is poor to fair.

Table 5.11: Rights-of-Way and Roads in the Project Area

<u>Powerlines</u>			
<u>Serial No.</u>	<u>Name</u>	<u>Type</u>	<u>Total Width (feet)</u>
W-044411	Pacific Power & Light	Power Transmission Line	50
W-73002	Pacific Power & Light	Power Distribution Line	50
W-47872	Hot Springs REA, Inc.	Power Distribution Line	30
W-61490	Hot Springs REA, Inc.	Power Distribution Line	30
W-031231	Hot Springs REA, Inc.	Substation	1 acre
<u>Pipelines</u>			
W-01185	Montana-Dakota Util.	Burial Natural Gas Pipeline	50
W-66684	Marathon Pipeline Co.	Buried Oil Pipeline	50
B-013281	Marathon Pipeline Co.	Buried Oil Pipeline	50
W-0275301	Montana-Dakota Util.	Buried Natural Gas Pipeline	50
W-022960	Marathon Pipeline Co.	Buried Oil Pipeline	50
<u>Telephone Lines</u>			
W-47812	Mountain Bell	Buried Cable	16
W-79581	Mountain Bell	Buried Cable	16
<u>Canal</u>			
W-59856	Big Horn Canal Co.	Canal	150
<u>Material Site</u>			
W-0175675	Wyoming Highway Dept.	Gravel Material Site	30 acres
<u>Roads</u>			
W-81757	BLM Access Road	Tenmile Road	100
	Wyoming Secondary Highway No. 433		150

Table 5.12: Livestock Grazing in the Project Area

<u>Allotment</u> <u>Name & Number</u>	<u>AUMs</u>	<u>Livestock</u>	<u>Range</u> <u>Improvements</u>	<u>Percentage</u> <u>of Allotment</u> <u>in the</u> <u>Project Area</u> <u>(Farm Units)</u>
Buchanan 0539	125	cattle	fence	17
Five Mile 0559	400	cattle	fence	16
Six Mile 0528	134	sheep	fence	66
Ten Mile 1,650	1,650	sheep	fence	13

Future Without Condition

Without the project, present authorizations and withdrawals would be reviewed to determine if the original purpose were still being served and if there were a need to continue the designation. Unneeded designations would be terminated.

The project area would remain public rangeland without the project. The range condition of the grazing allotments could be improved by grazing during fall and winter, reseeding with desirable grasses, or by range improvements like stock water tanks, retention dams in gullies, or water spreaders. This last measure would retain surface runoff longer, allowing more grasses and forbs to take root in waterways.

The BLM is required to improve range condition, but the agency's budget has been a limiting factor.

Preferred Plan.--Development of the Preferred Plan would require more lines for electric power and telephone service, water-transporting structures, and access roads to provide for public land management, oil and gas exploration, gravel production and recreation. Land withdrawals would be modified or revoked to meet needs depending upon the outcome of this project. Patents for the transfer of land would be subject to the present rights-of-way.

Transfer of public land in the project area would be affected by the National Wildlife Federation versus Burford et. al. lawsuit (see Chapter 3, "Legal Constraints").

The Preferred Plan would mean the loss of all livestock grazing in the project area, which, in turn, could lead to loss of grazing over an entire allotment even though only part of the allotment were affected. The maximum loss would be 2,309 AUMs of grazing.

There would also be other losses as well. Livestock access to 3.5 miles of irrigation ditches for watering would be lost, as would 3/4 mile of fence (Table 5.13).

Table 5.13: Effects on Livestock Grazing of the Preferred Plan

<u>Allotment</u> <u>Number</u>	<u>Loss in AUMs</u>	<u>Lost</u> <u>Range Improvements</u>	<u>Loss of</u> <u>Access</u>
0539	21 - Spring/summer	Fence 1/2 mile	
0559	64 - Fall	Fence 1/2 mile	3 miles of ditch water + one reservoir
0528	88 - Winter		1/2 mile ditch water
0671	215 - Winter	Two long-term study enclosures set up in 1957.	1/2 mile ditch water

Grazing would be changed on other allotments to compensate for the loss of antelope crucial winter range. It is estimated that up to 4,115 AUM's would be changed.

Social and Economic Conditions

Summary

Big Horn and Washakie Counties are experiencing high unemployment at present. The population has remained steady. The housing vacancy rate is high and increasing. Ratios of population in the two counties to medical and dental services is above recommended standards, but the student-to-teacher ratio is low.

The population of the two counties is expected to decrease slightly in the Future Without Condition. A high housing vacancy rate would continue. Doctor, dentist and teacher ratios would remain as at present.

The 4,068 irrigated acres of the Preferred Plan would boost net farm income by \$875,000 annually. Further stimulus to the economy of the two counties would come from the 2-year construction period of the Preferred Plan, a peak of \$1.3 million. The equivalent of 12 full-time employees would result from the completed project. Total population of the two counties would increase by about 60 people, with the consequent demand on housing and services.

Present Condition

The local economy of the Westside area is currently experiencing high unemployment due to the depressed conditions within agriculture and the energy producing industries, with consequent stagnating effects on local income. Combined farm income for Washakie and Big Horn Counties, for example, decreased about 75 percent from 1979-1983.

The combined population of the two counties, although it has fluctuated, has maintained a level long-term trend, with Big Horn County declining slightly, and Washakie showing fairly constant increases.

Both Big Horn and Washakie Counties had housing vacancy rates of about 10 percent according to the 1980 census. Officials in the area say the

rate has increased as a result of families moving out of the area because of the depressed state of the energy producing industries.

The two counties have one medical doctor and one dentist for every 1,700 and 3,500 people, respectively. These ratios, below recommended standards, will continue. School facilities, which are adequate with low student-teacher ratios, are not expected to change.

Most of the project area is Federally owned, administered by BLM. Present uses are for grazing and petroleum exploration. The land is also used for hunting, hiking, trapping, dirt biking, and rock hunting.

Future Without Condition

Given the depressed state of the local economy, the combined population is expected to decrease slightly in the near future. This trend agrees with the demographic history of Big Horn County but runs slightly counter to the history of Washakie County, which has, for the most part, shown population increases since 1950.

The current relatively high (10 percent) housing vacancy rate in the area is expected to continue, at least in the foreseeable future.

Little change is expected in public facilities and services. Elementary school facilities are quite adequate, with student-teacher ratios under 15 to 1. Little change is anticipated. Also, dental facilities are adequate, and medical facilities inadequate. That status is expected to continue.

Preferred Plan

The most significant social impact of the Preferred Plan would be the stimulation given the local economy by greater agriculture output from

an extra 4,068 irrigated acres in the area. The acreage would generate additional direct income of \$875,000 annually.

Further short-term economic stimulus would be provided during the 2-year project construction period. On-site construction employment is estimated to be about 43 person-years, 40 percent of which would be supplied by local workers. Earnings during construction are estimated to peak at about \$1.3 million.

Total population would increase by about 60 people in the peak construction year, with commensurate increased demands on housing, public facilities and services.

The Preferred Plan would have the negative effect of removing 4,693 acres of public land from public use. Although use is not usually extensive, the project area sees year-round hunting, trapping, horseback riding, hiking, rockhounding, and other recreational activities. In addition to these recreational losses, some further economic impacts from the loss of spending by out-of-area and out-of-state hunters would result.

Cultural Resources

Summary

Two hundred and thirty-four prehistoric and historic cultural sites were discovered in a survey of 11,072 acres in and around the project area (see Attachment 4). Twenty of these sites could be damaged or destroyed by the Preferred Plan. It is likely that if avoidance were not possible, adverse effects could be mitigated through excavation or extensive recording.

The Willwood Formation, famous for its vertebrate fossils, occurs in the project area, but the extent of fossils is unknown.

Present Condition

Cultural sites in the project area vary from prehistoric lithic scatters (a surface distribution of culturally-modified stone), with concentrations of fire-cracked rock (fcr), to remnants of historic structures. Little can be determined at present on the cultural chronology of the prehistoric sites. Several Middle (5,500-2,000 BP - before present) and Late Archaic (2,500-1,500 BP) type projectile points have been found in the project area. During these periods, prehistoric people consumed animal as well as plant resources. Some of the lithic scatter sites could contain buried cultural deposits, also.

Stone circles, firepits, and grinding stones are common to the Middle Archaic Period. During the Late Plains Period, bison bone becomes more common in prehistoric sites, and the projectile style changes (Eckles and Scott 1986). It is possible that sites with grinding stones and fcr in the project area could date from the Middle Archaic, but only carbon samples for radiometric dating would verify the period of occupation.

Although considerable historic activity related to the Bridger Trail occurred in the project area, no physical remains have been found.

The Willwood Formation is nationally known for its early Eocene-period vertebrate fossils. These fossils are particularly abundant in the gray mudstones (Bown 1979), which occur throughout the project area. Five sites of paleontological interest have been discovered, but there is no way to determine the fossils without exposing the strata.

Future Without Condition

Without the project, cultural resources would remain as at present. Sites would be affected by natural forces, including deflation and redeposition.

Fossils would also remain as at present, subject to natural forces.

Preferred Plan

The Office of the Wyoming State Archeologist and Larson-Tibesar Associates inventoried cultural resources in the project area in 1985. A Class III inventory (intensive, on-the-ground) of 11,072 acres -- the original project area -- recorded 234 sites (223 unrecorded, 11 previously recorded). Of these, 54 are recommended by the contractor as eligible for listing on the National Register of Historic Places. About 800 acres of project land are presently unsurveyed but would be surveyed before construction.

Of the inventoried lands, about 20 sites would be affected by the project, either through direct construction or by delivery of water to arable lands. With the Preferred Plan, all sites in line of direct construction would be damaged or destroyed. Sites in irrigable fields would be damaged by cultivation, and bone and wood artifacts would be damaged by increased moisture.

The loss of access to fossils on public land would affect paleontological deposits. On the other hand, excavation of ditches, etc., would expose more fossil remains.

Any testing or mitigation program would be developed jointly by Reclamation, BLM, the State, and the Advisory Council on Historic Preservation. Test excavations would be conducted at lithic scatter sites to determine their significance. Since sites would no longer be protected by the Archeological Resources Protection Act of 1979 and the Antiquity Act of 1906, testing and mitigation of the impacts of the Preferred Plan would be completed before public land was transferred to private ownership.

Cultural resources correspondence can be found in Attachment 4.

Miscellaneous Impacts

Impacts of the Preferred Plan on the air quality, prime or unique farmlands, mineral resources, soil erosion, and energy are combined in this section.

Summary

The air is usually clear in the project area, although there are dusty periods when winds are strong. There are no prime or unique farmlands in the project area, and no mining claims or sand and gravel deposits. All Federal mineral estate is under gas and oil leases. These conditions would continue in the Future Without.

Air quality would remain as at present in the Preferred Plan, except for an increase of dust during construction. The Preferred Plan would not affect mining claims, sand and gravel deposits, or oil and gas leases. About 2.42 inches of project area topsoil would be lost to wind and water erosion over the 100-year life of the project. The project would consume 6,284,000 kWh of energy, 1,684,000 kWh for onfarm use. A further 14.9465 gigawatt-hours (GWh - 1,000,000 kWh) would be lost in energy potential downstream.

Present and Future Without Conditions

Air Quality.--Although air quality information for the project area is limited, the Wyoming Department of Environmental Quality has furnished sampling data for Riverton, some 100 miles to the south, and Meadowlark Ski Area in the Big Horn Mountains, about 60 miles southeast of the project area.

The average concentration of particulate matter at Riverton is 56 milligrams-per-cubic-meter and at Meadowlark, 14 milligrams. Concentrations in the project area are in this rather wide range, probably nearer to the Riverton level since it is similar to the project area.

The air is usually clear in the project area, although there is some dust in the spring when winds are stronger and fields are fallow before irrigation. This condition occurs about 10 times between late February through April, with each period lasting from 1-3 days. Dusty conditions also occur several times in the summer for periods of a few hours, caused by high winds from thunderstorms passing through the area.

Prime or Unique Farmlands.--As defined by the U.S. Soil Conservation Service, there are no prime or unique farmlands in the project area (Lebruska 1987).

Mineral Resources.--There are no mining claims in the project area, but there are two placer mines about 1½ miles northeast. All Federally-owned mineral estate is under oil and gas lease. Non-Federal parcels unleased in the project area are:

(From east to west in Township 48 N.:)

Range 92 W. ----- Portions in certain parts of the W½ of Sections 7, 18 and 19.

Range 92½ W. ----- Portions in the E½ E½ of Section 25, and in Section 36.

Range 93 W. ----- The portion in Section 16, and a portion in an eastern part of Section 36.

(And from east to west in Township 49 N.:)

Range 92 W. ----- Portions in certain parts of Section 18, in the E½ Section 19, in Section 29, and in eastern parts of Sections 30 and 31.

Range 93 W. ----- Portions in Section 36.

Producing oil and gas wells in the vicinity can be found in the Worland, Dobie Creek, Fivemile, Manderson, and Rattlesnake Fields.

There are no sand and gravel sites in the project area. Ten sites (four sale contracts, five free-use permits and a community pit area) are 2 miles south.

Soil Erosion.--Present soil losses to wind and water erosion on native rangeland should not increase in the future.

Energy.--Energy impacts include that required for project pumps, sprinklers and losses of energy potential at downstream powerplants caused by diversion of 15,400 acre-feet of water for the Westside Project.

Preferred Plan

Air Quality.--Higher concentrations of particulates would be caused by construction of project facilities but would subside after construction. Wind blown dust would be of concern for downwind residents who suffer from allergies or other respiratory ailments, as well as a nuisance to those who previously have been out of the path of excessive dust.

Prime or Unique Farmlands.--There are no prime or unique farmlands in the project area as defined by SCS.

Mineral Resources.--Changes are not anticipated in mining claims, oil and gas leases, or sand and gravel deposits from the Preferred Plan. Claims are unlikely because there are no known locatable minerals in the project area. Oil and gas leasing would probably continue because producing fields and "Known Geologic Structures" are in the project area and nearby. Oil and gas operators would have to gain access to project land to drill. A greater demand for sand and gravel is not anticipated because present sites and land nearby have enough close-by reserves to satisfy the need.

Soil Erosion.--Both wind and water erosion could change after the existing sagebrush and grass have been converted to irrigated farmland. To evaluate the potential change two equations acceptable to technical experts were used, the "Wind Erosion Equation" for wind erosion, and the "Universal Soil Loss Equation" for water erosion.

Information for the Wind Erosion Equation included local climate conditions, inherent erodibility of project area soils, degrees of roughness of the soil surface, kind and amount of cover and residues provided by plants, width of the area of soil exposed to direct action of the wind, and the assumed crop rotation of malt barley, sugar beets, alfalfa, and irrigated pasture. The Universal Soil Loss Equation uses a combination of crop systems, management practices, specified soil types, rainfall patterns, and area topography to predict water erosion losses.

Table 5.14 below shows soil losses from wind erosion at 0.6 and 14.8 tons/acre/year for malt barley and sugar beets, respectively. Using a bulk density of 1.5 for topsoil, it is estimated 2.42 inches of topsoil would be lost to both wind and water erosion during the 100-year life of the project. When the entire crop rotation of malt barley, sugar beets, alfalfa, and irrigated pasture is considered, the estimated average soil losses per acre per year would be about 4.1 tons.

TABLE 5.14: Soil Losses to Erosion

Crop	Annual Soil Loss (tons/year)		
	Wind Erosion	Water Erosion	Total Erosion
Malt Barley	0.6	1.0	1.6
Sugar Beets	14.8	0.7	15.5
Alfalfa	Insignificant	0.1	0.1
Pasture	Insignificant	0.1	0.1

No local measurements to verify the above projections have been made.

It is recommended that measures to decrease soil losses to wind and water be implemented to maintain long-term productivity of project area soils.

Conservation measures recommended by the SCS to decrease soil losses from wind are:

1. Spring plowing of crop residues, both stubble and beet tops.
2. Tillage at right angles to the prevailing winds.
3. Tillage at moisture levels which promote cloddiness.
4. Planting windbreaks to protect fields.
5. Minimum or no tillage.
6. Emergency tillage.
7. Reduction in the widths of fields.

Energy.--The project would require 6,284,000 kWh or energy, 1,684,000 kWh of which would be onfarm energy. Diversion of water for Westside would also cause losses in energy potential at powerplants downstream. A total of 14.9465 GWh would be lost annually as shown below.

Yellowtail	6.5464 GWh
Garrison	2.5384 GWh
Oahe	2.6386 GWh
Big Bend	0.9686 GWh
Fort Randall	1.6199 GWh
Gavins Point	<u>0.6346 GWh</u>
Total	14.9465 GWh

Short/Long-Term Environmental Uses

Disturbance of wildlife by construction would end upon completion of project facilities. While wildlife habitat losses would be compensated for, there would be a reduction in total habitat acreage available.

Irrigation facilities would have a long-term effect on the visual aspect of the project area but would become part of the setting over time. Short-term construction scare would revegetate, becoming unnoticeable.

Noise, odor, and particulates would increase during construction but these effects would subside afterwards.

CHAPTER 5
Irreversible/Irretrievable Commitments of Resources

Land use would change on 4,693 acres of public rangeland as it would be converted to private ownership; 4,068 acres would be converted to irrigated cropland. Row crop plantings would replace use of the land by the public for livestock grazing, wildlife, oil and gas exploration, and recreation.

Crucial winter range for antelope would be mitigated for, but the total acreage reduced.

The project would result in an annual soil loss of 16,245 tons/year, unless conservation measures were put into effect.

The project would consume 6,284,000 kWh of energy annually, with a peak demand of 2,611 kW. Other commitments of resources would be construction materials for pumping plants and transmission lines.

Unavoidable Adverse Effects

Loss of 4,693 acres of public land (which includes 4,302 acres of crucial winter range for antelope) would be caused by the project.

Changes in the visual aspect of the project area would be caused by the pumping plants and transmission line, lasting throughout the project's lifetime.

Archeological mitigation can be destructive. If a cultural site were excavated, the retrieval of information would be limited by present methods, techniques, and theories. Information could be lost to the future because of the less sophisticated recovery techniques available at present.

CHAPTER 6

CONSULTATION AND COORDINATION

Public Participation

A partnership of the Wyoming Water Development Commission (WWDC), Wyoming Game and Fish Department (WGFD), the U.S. Bureau's of Reclamation (Reclamation) and Land Management (BLM), and the U.S. Fish and Wildlife Service (USFWS) produced this Westside Irrigation Project Planning Report/Draft Environmental Statement. The Westside Irrigation District and the Big Horn Canal Company have helped in the study also.

Local people interested in irrigation formed the irrigation district in 1983, which became the driving force behind the study. The WWDC hired a consultant, Nelson Engineering, Inc., for canal-capacity and economic studies in 1984. The district asked for Reclamation's help to obtain Pick-Sloan Missouri Basin Program pumping power and water from Boysen Reservoir. In 1985 Reclamation obtained funding for the study.

Initial meetings among the participants decided study responsibilities. The BLM became involved because public land would have to be transferred to private ownership. It was agreed that a joint planning report/environmental statement could meet Reclamation's requirements for water-resource development and BLM's requirements for transfer of public land at the same time. A "Memorandum of Understanding" among BLM, WWDC, and Reclamation was signed July 2, 1985, which detailed this arrangement.

On February 21, 1985, the study participants held a meeting in Worland to garner concerns of the public. Major concerns centered around the effect of the project on operation of the Big Horn Canal, on water rights, and on irrigation assessment changes. Concern was also expressed about drainage and seepage problems.

The Westside Irrigation District wrote a proposal on the operation of the canal, water rights, and assessments if the Westside Irrigation Project should be developed. This proposal was presented to the Big Horn Canal Company in August 1985. Drainage and seepage concerns have been addressed in drainage investigations by Reclamation.

An official scoping session was held March 5, 1985, in Worland. Major issues raised were: loss of crucial antelope winter range, loss of recreation opportunities on public land, the possibility of worsening drainage problems on already irrigated land, the possibility of highly saline return flows entering the Big Horn Canal, further soil erosion, and effect on cultural resources. These concerns have been considered in the present report.

Meetings on January 9, 1985, and January 9, August 9 and December 5, 1986, among BLM, Reclamation, WWDC, WGFD, and USFWS discussed wildlife habitat mitigation, fishery impacts and water quality impacts.

A critical point in the Westside study occurred in April 1986. Reclamation completed a semidetalled sprinkler land classification in 1986 which showed, according to Reclamation standards, only about 7,000 acres suitable for sustained irrigation. This reduction in size necessitated reformulation of the plans, resulting in an NED Plan of only 450 acres. Unsatisfied with less than 4,000 acres, the project sponsors decided to seek non-Federal financing through the WWDC. An incremental analysis of the arable land, assuming non-Federal funding, resulted in the present project size of 4,068 acres.

On April 3, 1986, a meeting was held with the Westside Irrigation District. A vote of the attendees gave unanimous support to the proposition that the district continue to pursue a 4,068-acre project under a 75 percent grant/25 percent loan arrangement. The vote included 18 of the 26 people who had pledged money for the Westside Project.

Details of the wildlife habitat plan were explained to the irrigation district in February 1987. The district would have to negotiate the transfer of winter sheep grazing allotments on public land for the mitigation plan. (Grazing allotments could be changed from sheep to cattle or to wildlife to provide critical habitat for antelope. See USFWS Recommendations for details.)

In July 1987, BLM, Reclamation, WWDC, WGFD, and USFWS, and the project sponsors met to discuss details of the mitigation proposals for wildlife, depredation, recreation, and soil erosion. Agreement was reached on remaining unresolved issues.

This Planning Report/Draft Environmental Statement (PR/DES) will be filed with the U.S. Environmental Protection Agency, in compliance with the National Environmental Protection Act. The PR/DES will then be distributed to Federal, State, and local agencies and the interested public for a 90-day review period. A public hearing will be held in the Westside area during this period.

Cooperating Agencies

The USFWS and WGFD have been involved in the environmental end of the Westside Project study since its inception. The WGFD, with the assistance of the USFWS, produced the "Coordination Act" Report, the final being completed in December 1986. Information from the report was incorporated into Reclamation's environmental analysis in this PR/DES.

Reclamation asked the USFWS by letter dated February 15, 1985, to determine threatened or endangered species that could be in the project area (Attachment 4). The peregrine falcon, bald eagle, and black-footed ferret were identified.

The BLM also helped with the environmental study of the Westside Project. The Worland District provided much of the information on wildlife species in the area, and reviewed the Coordination Act Report. The BLM also helped supervise cultural resources surveys carried out under contract to the Wyoming State Historical Preservation Office (SHPO).

Finally, the WWDC provided both staff and funds for the study. It is the WWDC which contracted with Wyoming's SHPO.

Recommendations for Wildlife Habitat Mitigation

Eight general and six specific recommendations, described below, were propounded by the Wyoming Game and Fish Department and concurred in by the U.S. Fish and Wildlife Service. The recommendations were extracted from the report entitled Westside Irrigation Project, Fish and Wildlife Coordination Act Report and dated December 1986 and transmitted by WGFD letter of December 2, 1986. (Supplemented by letter dated January 26, 1987.)

Reclamation's response follows each recommendation, printed in capital letters and enclosed in parentheses for ease in locating them.

Terrestrial Wildlife

1. Because winter ranges for antelope in the Big Horn Basin, including the project area, occupy limited areas largely coincident with sagebrush vegetation, any losses of these habitats due to the project must be replaced in-kind. The three general mitigation options are listed below in order from most preferred to least preferred by the Wyoming Game and Fish Department.

1a. Onsite Mitigation - Avoid antelope concentration areas and large blocks of sagebrush in the project area. Fence antelope out of crop areas to minimize potential damage problems while providing access to water using gaps in fences, or through development of other water sources available to antelope. To mitigate for any antelope winter range lost because of the project by agriculture conversion or fencing, improve other antelope winter ranges in the project area through reduction in sheep grazing and other treatments designed to compensate for antelope habitat losses. The acreages to be improved would be greater than the amount lost due to the project, since improvements would only provide a fractional

increase in the mitigation site's potential to support wintering antelope over existing conditions. Reclamation, WWDC, and the Westside Irrigation District must initiate and get appropriate grazing permittees to agree to and complement the necessary changes in grazing practices and improvements on these sites prior to final project approval. Bureau of Land Management will process the necessary permit adjustments. The cost for changes should be included in the mitigation costs to be paid by the project sponsors. The sponsors would also be required to monitor for the effectiveness of these improvements and for remedial measures if needed. Public access should be provided to these areas.

(ANTELOPE CONCENTRATION AREAS AND LARGE BLOCKS OF SAGEBRUSH HAVE BEEN AVOIDED TO THE EXTENT POSSIBLE IN THE PROCESS OF FORMULATING A PLAN THAT IS ACCEPTABLE TO THE PROJECT SPONSORS. ADEQUATE ACCESS TO WATER WOULD EXIST THROUGH GAPS BETWEEN FARM UNITS AND THROUGH THE DEVELOPMENT OF WATER CATCHMENTS OUTSIDE THE PROJECT BOUNDARY.

AT THE JULY 21, 1987, MEETING AMONG WGF, USFWS, AND RECLAMATION, IT WAS AGREED THAT FARM BOUNDARY FENCES WOULD BE 4-STRAND, TO KEEP OUT SHEEP BUT ALLOW ANTELOPE TO PASS. DEPREDATION CLAIMS WOULD BE PAID FROM A FUND TO BE ESTABLISHED AND FINANCED BY THE IRRIGATORS. ADDITIONALLY, LANDOWNERS COULD TAKE OTHER MEASURES, SUCH AS FENCING FEED STORAGE AREAS, TO PREVENT DEPREDATION.

ONSITE MITIGATION WILL BE ACCOMPLISHED WHERE POSSIBLE THROUGH REDUCED SHEEP GRAZING. AT MEETINGS SUBSEQUENT TO THE PREPARATION OF THE RECOMMENDATIONS, IT WAS CLARIFIED THAT IT IS THE WESTSIDE IRRIGATION DISTRICT'S RESPONSIBILITY TO INITIATE AND GET AGREEMENT ON ANY GRAZING ALLOTMENT CHANGES FOR MITIGATION PURPOSES, AND THAT SUCH ADJUSTMENT MUST BE ACCOMPLISHED PRIOR TO CONSTRUCTION OF THE PROJECT. COSTS FOR MITIGATION ARE INCLUDED AS A PROJECT COST.)

1b. Offsite Mitigation within the Fifteenmile Antelope Herd Unit -
Should onsite mitigation not be feasible, the mitigation should occur on other antelope winter range sites within the same herd unit (Fifteenmile

antelope population) as the project area. Habitat improvements, such as reduced sheep grazing as described above for onsite mitigation, would be effected on selected offsite antelope winter ranges in the herd unit subject to the approval of the Wyoming Game and Fish Department and with the same conditions stated for onsite mitigation. In addition, any private lands within the selected areas should be purchased. These areas would be managed by Wyoming Game and Fish Department for wildlife habitat with public access.

(OFFSITE MITIGATION WOULD BE IMPLEMENTED FOR MITIGATION NEEDS NOT ACCOMPLISHED BY 1a. THIS MUST OCCUR BEFORE PROJECT CONSTRUCTION.)

1c. Offsite Mitigation outside the Fifteenmile Antelope Herd Unit - Should no acceptable sites for mitigation be available within the Fifteenmile Antelope Herd Unit, then mitigation should occur on antelope winter ranges in adjacent herd units identified by the Wyoming Game and Fish Department and consistent with the Department's management objectives for those herd units. Such mitigation would be subject to the same conditions stated above under 'Offsite Mitigation with the Fifteenmile Antelope Herd Unit.' This mitigation alternative is the least preferred by the Wyoming Game and Fish Department, as the impacted antelope population will be subjected to permanent habitat loss and will require revision of publically-consented management objectives.

(THESE RECOMMENDATIONS WOULD BE IMPLEMENTED IF THE PREVIOUS RECOMMENDATIONS COULD NOT BE IMPLEMENTED.)

2. Since unlimited public access and use of project lands will be lost forever as a result of the project, compensation to the public for this loss should be planned. It is anticipated that project lands will provide some pheasant habitat and the opportunity for the public to hunt pheasants. However, since farm management practices preclude optimum management for wildlife and landowners frequently will not allow public access for hunting, the maximum public benefit will not be achieved unless some cropland and water rights are retained in public ownership. These mitigation areas should include 10 percent of the project lands. Nearby

unfarmed lands which are retained in public ownership and planted to grasses and shelterbelts or developed for small wetlands will provide the other habitat components needed for optimum pheasant habitat. Other game animals, including mule deer, white-tailed deer and cottontail rabbit, will also use these areas.

A wildlife management plan for the Westside Project area should be jointly prepared by WGFD, BR and BLM. Management objectives should be established to achieve maximum wildlife benefits on the project area in conjunction with farming. The BLM-Idaho Fish and Game Cooperative Wildlife Management Program provides excellent guidelines on establishment of such a program (Kotter 1977, Rath 1976, Bureau of Land Management 1969, and Green 1978).

(PUBLIC ACCESS THROUGH THE PROJECT TO THE REMAINING PUBLIC LANDS WOULD BE GUARANTEED. ADDITIONALLY, THE ABOVE MEASURES WOULD BE IMPLEMENTED. [SEE ALSO RESPONSE TO SPECIFIC RECOMMENDATION NO. 5.]).

3. Powerline should be buried or poles should be built in accordance to Raptor Research Foundation Guidelines to prevent electrocution of bald eagles and raptors (Olendorf 1981). Powerlines in riparian areas or across bald eagle movement routes should be marked with colored markers.

(THE RECOMMENDATION WOULD BE IMPLEMENTED.)

4. Rock outcrops on nonirrigated lands should be retained as golden eagle and raptor perches.

(THE RECOMMENDATION WOULD BE IMPLEMENTED.)

5. Field drains should be routed into natural drainages to create wetlands and/or provide water for tree and grass plantings.

(THE RECOMMENDATION WOULD BE IMPLEMENTED.)

6. Fences to contain livestock should be designed to reduce antelope and mule deer fence mortalities.

(THE RECOMMENDATION WOULD BE IMPLEMENTED.)

7. Loss of the critical habitat is sure to cause a population decline in the Fifteenmile herd; therefore, WGF D has recommended that the mitigation plan be in place prior to construction. (Letter of January 26, 1987.)

(THE RECOMMENDATION WOULD BE IMPLEMENTED.)

Fishery

8. This anticipated fishery impact may be mitigated or avoided by stabilizing instream flow conditions downstream from the Bighorn Canal. To mitigate fishery impacts associated with the project, WGF D recommends release of all water for Westside from Boysen storage whenever flows in the Big Horn River fall below 380 ft³/s immediately upstream from the Bighorn Canal, 550 ft³/s at Greybull or 690 ft³/s at Kane.

Note that this recommendation was revised at a joint meeting on December 5, 1986, to read: To avoid fishery impacts, water would be released for Westside whenever flows passing beyond the Big Horn Canal diversion were equal to or less than 580 ft³/s (580 ft³/s based on the desired flow of 380 ft³/s at Worland plus the appropriated flows between the Big Horn Canal gate and Worland of 200 ft³/s). This should not be construed to mean that a flow of 580 ft³/s would be maintained in the river by the Westside Project. The Westside Project would be responsible only for providing flow used by the project.

(THE RECOMMENDATION WAS AGREED TO AT AN INTERAGENCY MEETING.)

The following are recommendations that are specific to the Preferred Plan.

1. Avoid antelope concentration areas and large blocks of sagebrush when planning cropland development. Wherever this is not possible, mitigation should be as described in #4 below.

(ACCEPTED. SEE ALSO RESPONSE TO GENERAL RECOMMENDATION 1a. AND SPECIFIC RECOMMENDATION 4.)

2. No cropland development within $\frac{1}{2}$ mile on either side of Sixmile and Fivemile Creeks. Upland acres in Sections 14, 15, 16, 21, 22, 23 and 26, T48N, R93W (740 acres), in Sections 12, 13, T49N, R93W (256 acres), and in Section 18, T49N, R92W $\frac{1}{2}$ W and 20 acres in the riparian zone and within $\frac{1}{2}$ mile of Sixmile Creek should be excluded from development in accordance with recommendations from the interagency meeting in Worland in January 1986.

(ACCEPTED.)

3. Construct 10 water catchments at 1-mile intervals $\frac{1}{2}$ mile outside of the project boundary and/or plan corridors through cropland to allow antelope access to the Bighorn Canal for water. If sufficient access to water is retained through the project, this recommendation does not apply.

(ACCEPTED. EVEN IF SUFFICIENT ACCESS IS AVAILABLE THESE CATCHMENTS MAY BE A VALUABLE TOOL IN DISPERSING THE HERD OVER A BIGGER AREA. THE LOCATIONS/DISTANCES FOR LOCATING SHOULD BE EVALUATED IN MORE DETAIL PRIOR TO CONSTRUCTION.)

4. Inkind mitigation on at least 3,595 acres of crucial antelope winter range and at least 473 of antelope winter range through BLM grazing practice changes. This is most easily accomplished through reduction or elimination of sheep grazing on other crucial winter ranges for antelope in the Fifteenmile herd unit. The Westside PFWD (Nelson Engineering, Inc.

1986) indicates an additional 882 acres of crucial winter and winter/yearlong range will be lost due to fencing project boundaries and must be mitigated in kind if they are to be retained as part of the project.

(ACCEPTED. SEE ALSO RESPONSE TO GENERAL RECOMMENDATION 1a.)

5. It is recommended that at least 10 percent or 407 acres of the irrigated land and the water rights thereto and additional nonirrigated land in the project area to be retained in public ownership for upland wildlife habitat. Under a cooperative management agreement (CMA) between BLM and the Game and Fish Department, the irrigated land would be leased to a sharecrop farmer on a contract basis and the nonirrigated tracts would be planted to permanent cover and shelterbelts. These irrigable tracts should be selected from the areas designated by the interagency group. Nonirrigated tracts to be incorporated into the CMA were also designated by the interagency group. Areas to be retained in public ownership should be managed with the retained irrigated acreage as a unit under a CMA. Habitat areas should be fenced to prevent damage by livestock. All upland habitat development costs should be borne by the project.

(ACCEPTED, AS AGREED AT THE JULY 21, 1987, MEETING.)

6. If mitigation on BLM lands is not possible, private lands containing antelope crucial range should be purchased. This should be considered the last contingency for mitigation of the impacts of this project on antelope crucial winter range.

(ACCEPTED.)

Distribution of This Report

Reports will be distributed by the Commissioner of Reclamation for review and comment to the following:

Department of the Interior

Director, Bureau of Land Management

Assistant Secretary, Indian Affairs

Director, Bureau of Mines

Director, Fish and Wildlife Service

Director, National Park Service

Director, U.S. Geological Survey

Congressional Field Offices

Senator Wallop's Field Office, Cheyenne, Wyoming

Senator Simpson's Field Office, Cheyenne, Wyoming

Representative Cheney's Field Office, Cheyenne, Wyoming

Department of the Interior Offices

Special Assistant to the Secretary, Missouri Basin Region, Denver, CO

Regional Director, Fish and Wildlife Service, Denver, CO

Regional Hydrologist, Water Resources Division, Geological Survey,
Denver, CO

District Chief, Water Resources Division, Fish and Wildlife Service,
Casper, WY

Supervisor, Office of Ecological Services, Fish and Wildlife Service,
Cheyenne, WY

Chief, Intermountain Field Operation Center, Bureau of Mines,
Denver, CO

Regional Director, Rocky Mountain Region, National Park Service,
Denver, CO

Chief, Midwest Archeological Center, National Park Service, Lincoln, NE

Area Director, Bureau of Indian Affairs, Billings, MT

State Director, Bureau of Land Management, Casper, WY

Wyoming Reclamation Representative, Bureau of Reclamation, Cheyenne, WY

Other Federal Agencies

Director, Regional Technical Service Center, Soil Conservation Service,
Lincoln, NE

Director, Minneapolis Field Office, Bureau of Domestic Commerce,
Minneapolis, MN

Regional Director, Economic Development Administration, Denver, CO

State Conservationist, Soil Conservation Service, Casper, WY

Division Administrator, Federal Highway Administration, Cheyenne, WY

Director, Rocky Mountain Region, Federal Aviation Administration,
Aurora, CO

Advisory Council on Historic Preservation

Department of Agriculture

Department of the Army, Corps of Engineers

Department of Health and Human Services

Department of Transportation

Federal Energy Regulatory Commissioner

Environmental Protection Agency

Department of Housing and Urban Development

Missouri River Basin States

Governor of Colorado

Governor of Iowa

Governor of Kansas

Governor of Minnesota

Governor of Missouri

Governor of Montana

Governor of North Dakota

Governor of South Dakota

Governor of Wyoming

Members of Missouri Basin States Association

ATTACHMENTS

Reports will be distributed by the Commissioner of Reclamation for information to:

Senator Malcolm Wallop
Senator Alan Simpson
Representative Richard Cheney

Reports will be distributed by the Missouri River Basin Regional Director to:

Federal Offices

District Engineer, Omaha District, Corps of Engineers, Omaha, NE
Division Engineer, Missouri River Division, Corps of Engineers,
Omaha, NE
Office Coordinator, Fish and Wildlife Service, Billings, MT
Acting State Supervisor, Fish and Wildlife Service, Cheyenne, WY
Grass Creek Resource Area Manager, Bureau of Land Management,
Worland, WY

State Offices

Governor of Wyoming, Cheyenne, Wyoming
State Planning Coordinator, Cheyenne, Wyoming
Wyoming Game and Fish Department, Cheyenne, Wyoming
Wyoming Water Development Commission, Cheyenne, Wyoming
Wyoming State Historic Preservation Office, Cheyenne, Wyoming

Others

Westside Irrigation District
Wyoming Woolgrowers Association, Rock Springs, Wyoming
Pacific Power and Light Company, Worland, Wyoming
Regional Representative, Sierra Club, Lander, Wyoming
Wyoming Outdoor Council, Inc., Cheyenne, Wyoming
Big Horn County Commissioners, Basin, Wyoming
Washakie County Commissioners, Worland, Wyoming
Izaak Walton League, Laramie, Wyoming
National Wildlife Federation, Cheyenne, Wyoming
Branch President, Audubon Society, Lander, Wyoming

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Table A-11 Summary of Gross Farm Income (Benefit Analysis)

Major Product	Acres	Hay Tons	Production		Farm Use	Sales		Value
			Hay	Feed		Direct	Indirect	
Corn Crops	51	207	Tons	22.8	1,254			0
Alfalfa	121	86	Tons	5.1	617	60	431	28,660
Hay (Other)	131	80	Tons	101.9	12,218		12,218	31,570
Hay (Total)	131	1,363	Tons	26.8	1,329		2,729	114,940
Other	131		Tons	0.7	8	80		0
Hay (Total)	131			27.5	1,337		1,337	6,100
Unimproved Pasture	25	70	ACR	1.2	3	3		0
Grazing	25		ACR	0.2	8	8		0
Forewood	70							1
Total	300	1,277						181,241
Major Crops	76	1,552	ACR	7.12	1,840.9		1,840.9	181,139
Total		1,552						181,139

ATTACHMENT 1

FARM BUDGETS

FARM BUDGET									
Major Crops									
Major Product	Acres	Hay Tons	Production		Farm Use	Sales		Value	
			Hay	Feed		Direct	Indirect		
Corn Crops	51	207	Tons	22.8	1,254	1,254		0	
Alfalfa	121	86	Tons	5.1	617	80	537	28,660	
Hay (Other)	131	80	Tons	101.9	12,218		12,218	31,570	
Hay (Total)	131	1,363	Tons	26.8	1,329		2,729	114,940	
Other	131		Tons	0.7	8	80		0	
Hay (Total)	131			27.5	1,337		1,337	6,100	
Unimproved Pasture	25	70	ACR	1.2	3	3		0	
Grazing	25		ACR	0.2	8	8		0	
Forewood	70							0	
Total	300	1,787						181,740	
Major Crops	76	1,552	ACR	7.12	1,840.9		1,840.9	181,139	
Total		1,552						181,139	

Table A-1: Summary of Gross Farm Returns (Benefit Analysis)

Without Project	Production					Sales			
	Acres	Man Hours	Unit	Yield	Total	Farm Use	Amount	\$/Unit	Value
<u>Crops</u>									
Corn Silage	55	389	Tons	22.8	1,254				0
Alfalfa	120	864	Tons	5.1	612	160	452	65.62	29,660
Malt Barley	120	662	Bu	101.9	12,228		12,228	2.50	30,570
Sugar Beets	120	1,310	Tons	26.9	3,228		3,228	35.31	114,949
Straw	120		Tons	0.7	84	84			0
Beet Tops	120			26.9	3,228		3,228	2.50	8,070
Irrigated Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	40								0
Subtotal	800	3,295							183,249
Feeder Calves	399	1,425	cwt	7.12	2,840.9		2,840.9	65.31	185,539
TOTAL		4,720							368,788
<u>With Project</u>									
<u>Flooded Crops</u>									
Corn Silage	55	389	Tons	22.8	1,254	1,254			0
Alfalfa	120	864	Tons	5.1	612	160	452	65.62	29,660
Malt Barley	120	662	Bu	101.9	12,228		12,228	2.50	30,570
Sugar Beets	120	1,310	Tons	26.9	3,228		3,228	35.61	114,949
Straw	120		Tons	0.7	84	84			0
Beet Tops	120			26.9	3,228		3,228	2.50	8,070
Irrigated Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	74								0
<u>Sprinkler Crops</u>									
Alfalfa	74	372	Tons	5.1	377		377	65.62	24,739
Malt Barley	37	134	Bu	101.9	3,770		3,770	2.50	9,425
Sugar Beets	37	256	Tons	26.9	995		995	35.61	35,432
Beet Tops	37			26.9	995		995	2.50	2,487
Grazing	8								0
Subtotal	990	4,057							255,332
Feeder Calves	399	1,425	cwt	7.12	2,840.9		2,840.9	65.31	185,539
TOTAL		5,482							440,871

Table A-2: SUMMARY OF ANNUAL FARM EXPENSES (NED BENEFIT ANALYSIS)

<u>ITEM</u>	<u>WITHOUT TOTAL \$</u>	<u>WITH TOTAL \$</u>
<u>Crops</u>		
Fuel and Lube	19,655	25,468
Repair and Maintenance Equipment	16,963	19,287
Seed	8,899	12,147
Fertilizer	15,364	19,951
Chemicals	8,001	10,139
Twine	1,147	1,802
Custom	12,102	15,899
Interest, Operating Expense	5,225	6,603
<u>Livestock</u>		
Feed, Veterinarian and Medicine	1,978	1,978
Ins. Building and Imp.	111	111
Market Costs	2,538	2,538
Miscellaneous	407	407
Interest, Operating Exp.	5,685	5,685
Ins. Other Building and Imp.	514	514
Repairs, Building and Imp.	4,780	4,780
Hired Labor *	<u>6,100</u>	<u>10,012</u>
Subtotal	109,469	137,321
Overhead (5% of subtotal)	5,473	6,886
Depr. Building and Imp.	1,075	1,075
Depr. Equipment	28,616	29,696
Taxes, Real Estate	1,802	2,312
Taxes, Equip. and Imp.	3,375	3,375
Auto and Truck, License and Ins.	750	750
Irrigation, Fixed	4,950	7,622
Purchased Livestock	127,745	127,745
Interest on Debt	24,084	24,247
Onfarm-Power Cost (Sprinkler)	0	3,562
Onfarm Pipe Dist. Costs	<u>0</u>	<u>1,769</u>
Subtotal	307,339	346,360
Land Acquisition	<u>0</u>	<u>894</u>
TOTAL	307,337	347,254

 * A value for operator and family labor is not included in operating expenses.

Table A-3: A Financial Summary, Farm Investment and Farm Labor
(Benefit Analysis)

Financial Summary

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Sales	\$ 183,249	\$ 255,332
Livestock Sales	185,539	185,539
Gross Farm Income	368,788	440,871
Current Farm Expense	307,339	347,254
Net Farm Income	\$ 61,449	\$ 93,617

Farm Investment

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Land	\$ 749,440	\$ 765,490
Improvements	136,580	136,580
Equipment	469,595	503,973
Livestock	127,745	127,745
Feed	17,400	17,400
Total Investment	\$ 1,500,760	\$ 1,551,188

Farm Labor

<u>Item</u>	<u>Hours</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Labor	3,295	4,057
Livestock Labor	1,425	1,425
Total Labor	4,720	5,482
Family Labor	700	700
Operator Labor	2,800	2,800
Hired Labor	1,220	1,982

Table A-4: SUMMARY OF GROSS FARM RETURNS (BENEFIT ANALYSIS)
STATE CRITERIA: 4.0 PERCENT INTEREST, LOCAL MARKET PRICES

<u>Without Project</u>	<u>Production</u>					<u>Sales</u>			
	<u>Acres</u>	<u>Man Hours</u>	<u>Unit</u>	<u>Yield</u>	<u>Total</u>	<u>Farm Use</u>	<u>Amount</u>	<u>\$/Unit</u>	<u>Value</u>
<u>Crops</u>									
Corn Silage	55	389	Tons	22.8	1,254	1,254			0
Alfalfa	120	864	Tons	5.1	612	160	452	61.00	27,572
Malt Barley	120	662	Bu	101.9	12,228		12,228	3.25	39,741
Sugar Beets	120	1,310	Tons	26.9	3,228		3,228	40.00	129,120
Straw	120		Tons	0.7	84	84			0
Beet Tops	120			26.9	3,228		3,228	2.50	8,070
Irrigated									
Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	40								0
Subtotal	800	3,295							204,503
Feeder Calves	399	1,425	cwt	7.12	2840.9		2840.9	65.79	186,903
TOTAL		4,720							<u>391,406</u>
<u>With Project</u>									
<u>Flooded Crops</u>									
Corn Silage	55	389	Tons	22.8	1,254	1,254			0
Alfalfa	120	864	Tons	5.1	612	160	452	61.00	27,572
Malt Barley	120	662	Bu	101.9	12,228		12,228	3.25	39,741
Sugar Beets	120	1,310	Tons	26.9	3,228		3,228	40.00	129,120
Straw	120		Tons	0.7	84	84			0
Beet Tops	120			26.9	3,228		3,228	2.50	8,070
Irrigated									
Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	40								0
<u>Sprinkler Crops</u>									
Alfalfa	74	372	Tons	5.1	377		377	61.00	22,997
Malt Barley	37	134	Bu	101.9	3,770		3,770	3.25	12,253
Sugar Beets	37	256	Tons	26.9	995		995	40.00	39,800
Beet Tops	37			26.9	995		995	2.50	2,487
Grazing	8								0
Subtotal	990	4,057							282,040
Feeder Calves	399	1,425	cwt	7.12	2840.9		2840.9	65.79	186,903
TOTAL		5,482							<u>468,943</u>

Table A-5: SUMMARY OF ANNUAL FARM EXPENSES (BENEFIT ANALYSIS)
 STATE CRITERIA: 4.0 PERCENT INTEREST, LOCAL MARKET PRICES

<u>ITEM</u>	<u>WITHOUT TOTAL \$</u>	<u>WITH TOTAL \$</u>
<u>Crops</u>		
Fuel and Lube	19,655	25,468
Repair and Maintenance Equipment	16,963	19,287
Seed	8,899	12,147
Fertilizer	15,364	19,951
Chemicals	8,001	10,139
Twine	1,147	1,802
Custom	12,102	15,899
Interest, Operating Expense	2,423	3,062
<u>Livestock</u>		
Feed, Veterinarian and Medicine	1,978	1,978
Ins. Building and Imp.	111	111
Market Costs	2,538	2,538
Miscellaneous	407	407
Interest, Operating Exp.	2,637	2,637
Ins. Other Building and Imp.	514	514
Repairs, Building and Imp.	4,780	4,780
Hired Labor *	<u>6,100</u>	<u>10,012</u>
Subtotal	103,619	130,732
Overhead (5% of subtotal)	5,181	6,537
Depr. Building and Imp.	1,344	1,344
Depr. Equipment	35,770	37,120
Taxes, Real Estate	1,802	2,312
Taxes, Equip. and Imp.	3,375	3,375
Auto and Truck, License and Ins.	750	750
Irrigation, Fixed	4,950	7,622
Purchased Livestock	127,745	127,745
Interest on Debt	11,170	11,170
Onfarm-Power Cost (Sprinkler)	0	3,562
Onfarm Pipe Dist. Costs	<u>0</u>	<u>1,769</u>
Subtotal	295,706	334,038
Land Acquisition	<u>0</u>	<u>894</u>
TOTAL	295,706	334,932

 * A value for operator and family labor is not included in operating expenses.

Table A-6: A FINANCIAL SUMMARY, FARM INVESTMENT AND FARM LABOR
 (BENEFIT ANALYSIS)
 STATE CRITERIA: 4.0 PERCENT INTEREST, LOCAL MARKET PRICES

Financial Summary

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Sales	\$ 204,503	\$ 282,040
Livestock Sales	186,903	186,903
Gross Farm Income	\$ 391,406	\$ 468,943
Current Farm Expense	295,706	334,932
Net Farm Income	\$ 95,633	\$ 134,011

Farm Investment

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Land	\$ 749,440	\$ 765,490
Improvements	136,580	136,580
Equipment	469,595	503,973
Livestock	127,745	127,745
Feed	17,400	17,400
Total Investment	\$1,500,760	\$1,551,188

Farm Labor

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Labor	3,295	4,057
Livestock Labor	1,425	1,425
Total Labor	4,720	5,482
Family Labor	700	700
Operator Labor	2,800	2,800
Hired Labor	1,220	1,982

Table A-7: Summary of Gross Farm Returns (Repayment Analysis)

Output Project	Production					Sales			
	Acres	Man Hours	Unit	Yield	Total	Farm Use	Amount	\$/Unit	Value
<u>Crops</u>									
Corn Silage	55	389	Tons	20.4	1,122	1,122			0
Alfalfa	60	432	Tons	5.0	300	143	157	61.00	9,577
Malt Barley	150	828	Bu	95.0	14,250		14,250	3.25	46,312
Sugar Beets	150	1,638	Tons	25.3	3,795		3,795	40.00	151,800
Straw	150		Tons	0.7	105	77	28	25.00	700
Beet Tops	150			25.3	3,795		3,795	2.50	9,487
Irrigated Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	40								0
Subtotal	800	3,357							217,876
Feeder Calves	357	1,274	cwt		7.12	2,541.8	2,541.8	65.79	167,225
TOTAL		4,631							385,111
<u>With Project</u>									
<u>Flooded Crops</u>									
Corn Silage	55	389	Tons	20.4	1,122	1,122			0
Alfalfa	60	432	Tons	5.0	300	143	157	61.00	9,577
Malt Barley	150	828	Bu	95.0	14,250		14,250	3.25	46,312
Sugar Beets	150	1,638	Tons	25.3	3,795		3,795	40.00	151,800
Straw	150		Tons	0.7	105	77	28	25.00	700
Beet Tops	150			25.3	3,795		3,795	2.50	9,487
Irrigated Pasture	25	70	AUM	3.0	75	75			0
Grazing	320		AUM	0.2	64	64			0
Farmstead	74								0
<u>Sprinkler Crops</u>									
Alfalfa	74	372	Tons	5.0	370		370	61.00	22,570
Malt Barley	37	134	Bu	95.0	3,515		3,515	3.25	11,424
Sugar Beets	37	256	Tons	25.3	936		936	40.00	37,440
Beet Tops	37			25.3	936		936	2.50	2,340
Grazing	8								0
Subtotal	990	4,119							291,650
Feeder Calves	357	1,274	cwt		7.12	2,541.8	2,541.8	65.79	167,225
TOTAL		5,395							458,875

Table A-8: Summary of Annual Farm Expenses (Repayment Analysis)

<u>ITEM</u>	<u>WITHOUT TOTAL \$</u>	<u>WITH TOTAL \$</u>
<u>Crops</u>		
Fuel and Lube	21,018	26,646
Repair and Maintenance Equipment	17,574	19,427
Seed	8,575	11,820
Fertilizer	16,321	20,917
Chemicals	14,618	17,973
Twine	691	1,331
Custom	14,871	18,697
Interest, Operating Expense	10,115	12,400
<u>Livestock</u>		
Feed, Vet and Medicine	1,769	1,769
Ins. Bldg. and Imp.	100	100
Market Costs	2,270	2,270
Miscellaneous	364	364
Interest, Operating Expense	8,076	8,076
Ins. Other Bldg. & Imp.	514	514
Repairs, Bldg. & Imp.	4,655	4,655
Hired Labor *	<u>5,655</u>	<u>9,563</u>
Subtotal	127,186	155,982
Overhead (5% of subtotal)	6,359	7,826
Depr. Bldg. & Imp.	584	584
Depr. Equipment	22,130	22,130
Taxes, Real Estate	1,802	2,312
Taxes, Equip. & Imp.	3,355	3,355
Auto & Truck, License & Ins.	750	750
Irrigation, Fixed	4,950	7,869
Purchased Livestock	114,249	114,249
Interest on Debt	36,115	36,115
Onfarm Power Cost	0	3,562
Onfarm Pipe Dist. Costs	<u>0</u>	<u>1,769</u>
Subtotal	317,480	356,503
Land Acquisition	<u>0</u>	<u>1,093</u>
TOTAL	317,480	357,596

* A value for operator and family labor is not included in operating expenses.

Table A-9: A Financial Summary, Farm Investment and Farm Labor
(Repayment Analysis)

Financial Summary

	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Sales	\$ 217,876	\$ 291,650
Livestock Sales	167,225	167,225
Gross Farm Income	385,101	458,875
Current Farm Expense	317,480	357,596
Net Farm Income	\$ 67,621	\$ 101,279

Farm Investment

<u>Item</u>	<u>Amount</u>	
	<u>Without Project</u>	<u>With Project</u>
Land	\$ 749,440	\$ 765,490
Improvements	133,000	133,000
Equipment	469,590	503,970
Livestock	114,250	114,250
Feed	15,600	15,600
Total Investment	\$ 1,481,880	\$ 1,532,310

Farm Labor

<u>Item</u>	<u>Hours</u>	
	<u>Without Project</u>	<u>With Project</u>
Crop Labor	3,357	4,119
Livestock Labor	1,274	1,274
Total Labor	4,631	5,393
Family Labor	700	700
Operator Labor	2,800	2,800
Hired Labor	1,131	1,893

Environmental Commitments

1. Releases from the proposed project would affect project demands from 1994 and less than 300 1/2 of the maximum, resulting in the Big Horn River fishery.

2. The proposed plan would have environmental effects, which could be mitigated for.

3. The mitigation plan (including additional changes) would be accomplished before construction of project facilities.

ATTACHMENT 2

ENVIRONMENTAL COMMITMENTS

4. Mitigation for water quality issues would have to be completed for "in-kind" water quality issues to WQIP and the Big Horn River (see) program and the

5. Mitigation for the proposed project would be completed before construction of project facilities.

6. To ensure that a minimum of one acre of riparian area would be maintained in-kind to the Big Horn River, the proposed project would be required to maintain one acre of riparian area in-kind.

7. The proposed project would be required to maintain one acre of riparian area in-kind to the Big Horn River, the proposed project would be required to maintain one acre of riparian area in-kind.

8. After the initial review inventory is completed, the State of Montana, the Bureau of Land Management, the Wyoming Office of the State Archaeologist, the Wyoming State Historical Office, and the Advisory Council on Historic Preservation will jointly determine National Register eligibility and any other requirements for mitigation.

9. All wildlife mitigation would be paid from a fund to be established and managed by the Wyoming District. In order to receive

ATTACHMENT 2

ENVIRONMENTAL COMPLIANCE

Environmental Commitments

1. Releases from Boysen Reservoir would offset project demands when flows are less than 380 ft³/s at Worland, avoiding impacts on the Big Horn River fishery.
2. The Preferred Plan would have environmental effects, which would be mitigated for.
3. The mitigation plan (grazing allotment changes) would be accomplished before construction of project facilities.
4. Mitigation for antelope wintering habitat losses would have to be compensated for "in kind" and implemented in areas satisfactory to WGFD and BLM big game managers (estimated mitigation cost - \$144,025).^{1/}
5. Purchase of private lands should be considered only if mitigation on public lands proves impossible.
6. To ensure wildlife access and to maintain a small riparian zone, there would be no development within ¼-mile of either side of Sixmile and Fivemile Creeks. These lands would also be excluded from project fencing.
7. Ten water catchments would be constructed to disperse antelope and maintained by the project (estimated cost - \$20,000). ^{1/} Before installation, sites would be evaluated to ensure suitable water (both quantity and quality) would be available.
8. After the cultural resource inventory is completed, the Bureau of Reclamation, the Bureau of Land Management, the Wyoming Office of the State Archeologist, the Wyoming State Historical Office, and the Advisory Council on Historic Preservation will jointly determine National Registry eligibility and plan test excavations and subsequent mitigation.
9. All wildlife depredation claims would be paid from a fund to be established and financed by the Irrigation District. In order to relieve

WGFD from all responsibility for these costs, an agreement specifying that the Irrigation District is responsible for paying animal depredation costs would have to be part of the State Legislation authorizing the project.

10. Powerlines would be buried or built in accordance with Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1981. Powerlines in riparian areas or across bald eagle movement routes will be marked with colored markers.

11. All prairie dog towns affected by the project and all portions of the town which occur within one-half mile of the projected perimeter will be resurveyed using the current USFWS guidelines in the year prior to construction, to confirm that no endangered black-footed ferrets exist within the project area. Black-footed ferrets surveys and findings will be cleared through USFWS.

12. Should the water quality monitoring program reveal contaminants beyond health or biological standards (i.e., organo chemicals, arsenic or selenium), remedial measures would be developed and implemented by the Bureau of Reclamation and the State.

13. Public access through the project to adjacent public lands would be guaranteed.

14. Fences to contain livestock will be designed in accordance with BLM specifications to reduce antelope and mule deer fence mortalities.

15. Future drainage system plans will be coordinated with USFWS and WGFD to minimize wetland and riparian impacts and to determine if further mitigation measures are needed. Mitigation costs will be borne by the project.

16. Ten percent (407 acres) of the irrigated land and the water rights thereto will be retained in public ownership and managed for upland wildlife habitat to compensate for other wildlife losses. Under a cooperative management agreement between BLM and WGFD, these areas would be

leased to a sharecrop farmer on a contract basis, with the understanding that crops and cropping methods would be specified and portions of the management areas planted to permanent cover and shelterbelts. These irrigable tracts would be selected from the areas that were designated by the interagency group that met in Worland in January 1986. Other nonirrigated tracts designed by the interagency group will be also incorporated into the management area.

17. Surface and ground water monitoring will be continued into advance planning, construction and post-construction stages to ensure that the Westside Project does not degrade water quality. If water quality problems occur, appropriate mitigation measures will be implemented.

The following development costs will be borne by the project. 1/

- (1) Plan Development..... = \$50,000
- (2) Shelter Belts..... = \$58,500
- (3) Barrier Fencing, 3 Miles..... = \$12,000
- (4) Annual O&M Maintenance..... = \$ 4,000

In addition, to protect wildlife management areas from livestock damages, joint farm/CMA boundaries will be fenced and maintained by the adjacent farm-unit owner(s).

1/ Will be reindexed for changing economic conditions at time of construction or yearly for O&M costs.

Compliance with Executive Order 11990
Wetlands Protection

This area is within project boundaries.

ATTACHMENT 3

Compliance with Executive Order 11990
Flood Plain Management

**Federal Executive Orders
and Laws to be Met**

No project facilities would be located within floodplain boundaries.

Compliance with Clean Water Act

This document is not intended and does not need to satisfy the requirements for an exemption under Section 404(c) of the Clean Water Act.

Compliance with Executive Order 11990
(Wetlands Protection)

There are no wetlands within project boundaries.

Compliance with Executive Order 11988
Flood Plain Management

No project facilities would be located within floodplain boundaries.

Compliance with Clean Water Act

This statement is not intended nor does it need to satisfy the requirements for an exemption under Section 404(r) of the Clean Water Act.

007 11 1985

100-152

ATTACHMENT 4

Cultural Resources
Correspondence

Dr. Robert T. ...
Historic Preservation Division
State Historic Preservation Office
Archives, Museums and Historical Department
1301 Central Avenue, ...
Cheyenne, WY 82002

Dear Dr. T...:

As per the letter discussed with Richard Fryer of your office on October 7, 1985, the Bureau of Reclamation is currently working with the Wyoming Water Development Commission to develop the ... Irrigation Project. This letter is being sent to advise you of the current status of the archaeological investigations on this project.

The proposed project includes 12,135 acres of land west of the Big Horn River in ... and ... Counties. Of this acreage, 10,500 acres is presently occupied under Bureau of Land Management jurisdiction; the remaining acreage is privately owned. The State of Wyoming is providing the funding for the project, but state water for irrigation will be from a Bureau facility. We are working on the land agency for cultural compliance in close cooperation with the Bureau of Land Management.

Archaeological surveys of the 12,135 acres were conducted in July 1985 by the Wyoming Office of the State Archaeologist. The number and facts archaeological sites have been recorded on the project; these sites generally appear to represent a series of short term camps associated with the procurement of fire processed quartzite cobbles that are common in the area. All sites appear to be surface or near surface sites composed of light debris, the remains of pits and some occasional stone features.

Although the initial scope of work for this project called for the contractor to inventory the entire 12,135 acres, the Bureau has modified this by delimiting from the survey slightly over 600 acres of presently cultivated lands. We have chosen to do this for three reasons:

1. The delimited acreage represents 5 percent of the total project area and should not have a significant effect on final survey results;

2. Based on the present knowledge of the archaeological sites in the area, they will appear to be near-surface sites and any sites in the cultivated areas have already been affected by cultivation; and

OCT 11 1985

UM-153

Dr. Robert Bush
Historic Preservation Division
State Historic Preservation Office
Archives, Museums and Historical Department
2301 Central Avenue, Barrett Building
Cheyenne, WY 82002

Dear Dr. Bush:

As Marvin Keller discussed with Richard Bryant of your office on October 7, 1985, the Bureau of Reclamation is currently working with the Wyoming Water Development Commission in developing the Westside Irrigation Project. This letter is being sent to advise you of the current status of the archeological investigations on this project.

The proposed project includes 12,135 acres of land west of the Bighorn River in Bighorn and Washakie Counties. Of this acreage, 10,500 acres is presently rangeland under Bureau of Land Management jurisdiction; the remaining acreage is privately owned. The State of Wyoming is providing the funding for the project, but since water for irrigation will be from a Bureau facility, we are serving as the lead agency for cultural compliance in close cooperation with the Bureau of Land Management.

Archeological surveys of the 12,135 acres were initiated in July 1985 by the Wyoming Office of the State Archeologist. One hundred and forty archeological sites have been recorded on the project; these sites generally appear to represent a series of short term camps associated with the procurement of fine grained quartzite cobbles that are common in the area. All sites appear to be surface or near surface sites composed of lithic debris, fire-cracked rock and some occasional stone features.

Although the initial scope of work for this project called for the contractor to inventory the entire 12,135 acres, the Bureau has modified this by deleting from the survey slightly over 600 acres of presently cultivated lands. We have chosen to do this for three reasons:

1. The deleted acreage represents 5 percent of the total project area and should not have a significant effect on final survey results;
2. based on the present knowledge of the archeological sites in the area, they all appear to be near-surface sites and any sites in the cultivated areas have already been affected by cultivation; and

3. the use of irrigation on presently cultivated lands will not change the present land use or result in any additional significant impacts to these areas.

Please advise us if you have any problems with deleting this acreage from the survey.

We will submit the final report to your office for review when it is completed in early 1986 and we will continue with the consultation process as appropriate.

If you have any questions concerning this project, please feel free to contact Marvin Keller at (406) 657-6233 or FTS 585-6233.

Sincerely yours,

Robert Madsen

Robert H. Madsen
Regional Planning Officer

cc: Wyoming Water Development Commission, Cheyenne, WY
Bureau of Land Management, Worland, WY

MKeller:deb 10/9/85

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 1002
Billings, Montana 59103

SEARCHED	INDEXED
SERIALIZED	FILED
FEB 17 1981	
FBI - BILLINGS	
[Handwritten initials]	
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[Handwritten initials]	
[Handwritten initials]	

ATTACHMENT 5

MEMORANDUM

To: Regional Director, Missouri State Region,
Billings, MT

From: Acting Field Supervisor, Fish and Wildlife Service, Endangered
Species, Helena, MT

Subject: Westside Irrigation Project

**Threatened and Endangered
Species Correspondence**

Thank you for your January 22, 1981 letter regarding the Westside Irrigation
Project. Based upon the additional information provided in your letter,

1. All previous commitments will be held in accordance with Report
Research Report No. 1, and
2. Water from Dupont Dam will be released for Westside Project drainage
whenever the flow passing beyond the Highgate Canal is equal to or less
than 300 cubic feet per second;

We concur with your determination that the Westside Irrigation Project will
not affect the bald eagle (Haliaeetus leucocephalus).

We appreciate your efforts to meet our joint responsibilities under the Endan-
gered Species Act.

cc: SA, Cheyenne, WY

CTaylor:gh



UNITED STATES
 DEPARTMENT OF THE INTERIOR
 FISH AND WILDLIFE SERVICE
 Endangered Species, Field Office
 Federal Bldg., U.S. Courthouse
 301 South Park
 P.O. Box 10023

FEB 17 '87	
NO. 700	RAM 2/19
700	RAM 2/19
710	
February 13, 1987	

PLEASE REFER TO:
 W-04 Westside Irrigation Project Helena, Montana 59626

MEMORANDUM

To: Regional Director, Bureau of Reclamation, Missouri Basin Region,
 Billings, MT

From: Acting Field Supervisor, Fish and Wildlife Service, Endangered
 Species, Helena, MT

Subject: Westside Irrigation Project

Carl M. Taylor

Thank you for your January 26, 1987 letter regarding the Westside Irrigation Project. Based upon the additional information provided in your letter:

1. All powerlines constructed will be built in accordance with Raptor Research Report No. 4; and
2. Water from Boysen Reservoir will be released for Westside Project demands whenever the flow passing beyond the Bighorn Canal is equal to or less than 580 cubic feet per second;

we concur with your determination that the Westside Irrigation Project will not effect the bald eagle (Haliaeetus leucocephalus).

We appreciate your efforts to meet our joint responsibilities under the Endangered Species Act.

cc: ES, Cheyenne, WY

CTaylor:clh

"Take Pride in America"

40500

MR-710

JAN 26 1987

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, Montana

From: *Assistant* Regional Director, Billings, Montana

Subject: Westside Irrigation Project

Your letter of October 28, 1986, highlighted two needs for the bald eagle. If these needs were fulfilled, your office would then concur with the Bureau's "no effect" conclusion of October 8, 1986. The following information should expedite your concurrence.

Any powerlines constructed will be built in accordance with Suggested Practices for Raptor Protection on Powerlines - The State of the Art in 1981 (Raptor Research Report No. 4). This commitment will also be a part of the Planning Report/Environmental Statement.

The flow recommendations provided by the State of Wyoming will also be adopted. There are, however, some points which need clarification. These points are: (1) the project is only responsible for those losses directly attributable to the project [table IV-A4], (2) a completed Westside Project is not responsible for flows which naturally fall below the recommended flows [table IV-A3], (3) the project cannot assume responsibility for water released post the Bighorn Canal, and (4) the project is not responsible for maintaining 690 ft^3/s at Kane; however, during a low-flow year (when flows are less than 320 ft^3/s at Worland) the flow at Kane will be above historical levels because releases will be made from Boyesen Reservoir to meet Westside demands and return flows will also occur at Kane.

Enclosures showing the flows are provided for your information.

In conclusion, to avoid an impact caused by water withdrawals, water from Boyesen Reservoir will be released for Westside Project demands whenever the flow passing beyond the Bighorn Canal is equal to or less than 580 ft^3/s [this corresponds to a flow of 320 ft^3/s at Worland.] This should not be construed to mean that a flow of 580 ft^3/s would be maintained in the Bighorn River by the Westside Project.

1/25 M. W. Under

Enclosures
GLKaiser:dlw 1-15-87 Disk 1 19.1



UNITED STATES
DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023

REPLY REFER TO:

W.04 Westside Irrigation Project

Helena, Montana 59626

OFFICIAL FILE NO. 1		
OCT 29 '85		
NO REPLY NECESSARY	INITIAL	DATE
REPLY OR OTHER ACTION TAKEN	CODE NO.	DATE
October 28, 1986		
REPLY	TIME	DATE
SG 760		
770		

MEMORANDUM

To: Regional Director, BR, Missouri Basin Region, Billings, MT
ATTN: Jerry Kaiser

From: Acting Field Supervisor, FWS, Endangered Species, Helena, MT

Subject: Westside Irrigation Project

We have reviewed your October 8, 1986 biological assessment for the proposed Westside Irrigation Project in Big Horn and Washakie Counties, Wyoming. The assessment alludes to measures to avoid impacts to threatened and endangered species, but does not provide sufficient detail for us to concur with your determination of no impact to the bald eagle (Haliaeetus leucocephalus). We have the following comments and recommendations that, if incorporated by the Bureau of Reclamation (Bureau), will assure that the threatened and endangered (T/E) species will not be adversely affected by the proposed project.

Bald eagle. The Fish and Wildlife Service (Service) and the Wyoming Game and Fish Department (WG&F), have been working with the Wyoming Water Development Commission (WWDC) and the Bureau to assure that project impacts do not adversely affect the bald eagle. In July 1986, the WG&F presented WWDC and the Bureau with a "Combined Report on Potential Aquatic and Terrestrial Wildlife Impacts".

Although the report was not intended to satisfy the Bureau's Section 7 responsibility; it did provide the following recommendations for the Bureau to incorporate to avoid adverse impacts to the bald eagle:

1. Suggested flows to mitigate fishery impacts from dewatering the Bighorn River.
2. Powerlines associated with the project should be raptor proofed.

Maintenance of fishery resources is necessary to maintain a prey base for bald eagles. Your assessment references Boysen Reservoir water releases during July and August, and that WG&F concurred that such releases would maintain the current fishery resource. However, no mention is made of what flow levels would be maintained in the Bighorn River. We understand that the Bureau, WG&F, and our Ecological Services personnel agreed to the following release schedule at the August 6, 1986 mitigation meeting:

"At least portions of these anticipated fishery losses may be mitigated or avoided by stabilizing instream flow conditions downstream from the Bighorn Canal. To mitigate fishery impacts associated with the project, we recommend release of all water for Westside from storage in Boysen during July and August or whenever flow in the Bighorn River would otherwise fall below 380 cfs immediately upstream from the Bighorn Canal, 550 cfs at Greybull or 690 cfs at Kane regardless of the alternative selected for development." (Combined Report on Potential Aquatic and Terrestrial Wildlife Impacts - page 49).

The assessment makes no mention of raptor proofing powerlines built as a result of the project. Although the primary bald eagle winter roosts and nesting habitats are located along the Bighorn River, bald eagles do use upland areas. Bald eagles are opportunistic feeders, and may utilize power poles in the project area for hunting perches, especially during the winter and migration periods.

Therefore, in order for us to concur with the Bureau's "no effect" to the bald eagle we need to receive written confirmation that the Bureau will commit to the following:

1. That the Bureau will release project water from storage in Boysen Reservoir during July and August, or whenever flow in the Bighorn River would otherwise fall below 380 cfs immediately upstream from the Bighorn Canal, 550 cfs at Greybull, or 690 cfs at Kane; and
2. Any powerlines constructed as part of the project will be built according to the specifications in "Suggested Practices for Raptor Protection on Powerlines - the State of the Art in 1981" (Raptor Research Report No. 4). If you do not already have a copy of the publication, it can be purchased at \$5.00 per copy from:

Jim Fitzpatrick
Treasurer, Raptor Research Foundation
Carpenter St. Croix Nature Center
12805 St. Croix Trail
Hastings, Minnesota 55033

Peregrine falcon (Falco peregrinus). We concur with your determination that the Westside Irrigation Project will not affect the peregrine falcon.

Black-footed ferret (Mustela nigripes). We concur with your determination of no effect to the black-footed ferret, based upon your commitment to conduct black-footed ferret surveys within one year before project construction. All ferret surveys should be conducted pursuant to the survey guidelines we mailed to you on September 15, 1986. If you have questions regarding survey procedures, please contact Ron Crete at 585-5225.

We look forward to hearing from you regarding the Bureau's commitment to protect T/E species. Please contact Carol Taylor at 585-5225 if you have questions regarding our joint responsibilities under the Endangered Species Act, as amended.

Ronald A. Cretz

cc: BR, Billings (Environmental Branch, Erwin)
ES, Cheyenne, WY
WG&F, Cheyenne, WY (Stone, Harju)

CMT/1a1/clh

ME-750

OCT 8 1986

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, ~~Montana~~
From: *Robert J. [unclear]* Regional Director, Billings, Montana
Subject: Endangered Species - Westside Project Near Worland, Wyoming

In our letter of February 15, 1985, we asked for identification of threatened or endangered species either on the list or being proposed for the list in the project area; the proposed project lies adjacent to the Bighorn River in Washakie and Bighorn Counties.

Your response of February 22, 1985, listed the following species:

Listed Species

Expected Occurrence

Bald eagle (Haliaeetus leucocephalus)

Breeding and winter resident

Peregrine Falcon (Falco peregrinus)

Migrant and possible summer resident

Black-Footed Ferret (Mustela nigripes)

Possible resident on prairie dog (Cynomys sp.) towns

Proposed Species

None

In an April 9, 1986, memorandum we requested verification of the list. Your response of April 14, 1986, verified the preceding listed species.

Description of Proposal

The Westside plan proposes to provide irrigation service to about 4,068 acres. This would require an annual diversion requirement of about 16,680 acre-feet of water from the Bighorn River. Approximately one-third of the years would require supplemental flows from Boysen Reservoir. Water will be pumped from the existing Bighorn Canal and delivered through an 11-mile pipe system.

Affected Area

The study area includes portions of Bighorn and Washakie Counties, Wyoming (T. 48 N., R. 93-92 W., and T. 49 N., R. 92 W. - 93 W.). The lands are bordered on the east by the Bighorn canal, and on the north by Alamo Creek and Tenmile Creek on the south.

The project area is mostly sagebrush and Nuttall's Saltbush. This habitat provides critical winter range for antelope and a browse area for mule deer.

Assessment Basis

Bald Eagle (*Haliaeetus leucocephalus*)

No historical or currently active bald eagle nests are known to occur within the project area (Denton personal communication, 1985). Therefore, it is highly unlikely that this project would interfere with the bird's reproductive capabilities.

The peak bald eagle activity in the area occurs during migratory and wintering periods. The following discussion illustrates this point (Discussion from WG&FD Report, 1986).

Bald eagles winter and nest along the Bighorn River between Wind River Canyon and Yellowtail Reservoir. Nesting territories active in 1983 included one on WG&FD's Yellowtail Habitat Unit adjacent to Yellowtail Reservoir and one along the Bighorn River approximately 4 miles downriver from the town of Basin (approximately 30 miles from the project area). The Yellowtail nest was active in 1984. The Basin nest territory was occupied in 1984, but nesting did not take place. Nesting pairs along the Bighorn River probably winter on or near nesting territories, but defend their nest territory only during the April-July period.

The Bighorn River system is an important bald eagle wintering area. The annual January census conducted by BLM personnel show an average of 30 bald eagles wintering between Wind River Canyon and Basin during the years 1979-1984. An average of 14 bald eagles wintered along the Westside Project Area during those same years (Table 1).

Table 1. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming, during the years 1979-1984.

Year	Wind River Canyon to Heiber	Westside Project Area	% of Total	Manderson to Basin	Total
1979	8	22	71	1	31
1980	18	15	45	0	33
1981	9	7	41	1	17
1982	0	19	100	0	19
1983	8	13	26	29	50
1984	14	9	32	5	28
Mean	10	14	47	6	30

Census work conducted by the FWS indicates the season of use by wintering bald eagles is November-March (Jenkins 1980). Table 2 shows the results of monthly censuses along the Bighorn River between Wind River Canyon and Basin, Wyoming, in 1980.

Table 2. Bald eagles wintering along the Bighorn River between Wind River Canyon and Basin, Wyoming, during November-March 1980.

Month	Wind River Canyon to Haiber	Westside Project Area	% of Total	Manderson to Basin	Total
November	3	1	14	3	7
December	6	7	47	2	15
January	17	13	41	2	32
February	10	32	73	2	44
March	0	2	25	6	8

These data indicate that peak bald eagle numbers may not be present until February, and therefore, the January census data presented in Table 9 may not show the maximum winter populations.

Based on bald eagle distribution data, heavy winter use areas occur about 1 mile downriver from the mouth of Tenmile Creek and approximately 1 to 2 miles downriver from the Rairden Bridge where a communal roost has been reported (Jenkins 1980).

Because the one active nest is about 30 miles from the project area, there will be no project-caused effect on the bird's nesting capabilities. The winter concentrations also occur off the project area; therefore, there will be no project-caused winter disturbances. Reduced flows on the Bighorn could impact the bird's feeding abilities.

The Bureau of Reclamation will release water from Boysen Reservoir during the critical months of July and August to meet project irrigation demands. Releases from Boysen will assure that incidences of dewatering at Worland will not increase because of project needs.

The Bureau's Reservoir Regulation Branch, Billings, will be responsible to assure that the releases are made from Boysen Reservoir so that incidences of dewatering do not occur beyond the historical levels. Wyoming Game and Fish (August 1986 meeting) has agreed that these supplemental flows would prevent a negative impact upon the fishery. Since the fishery would then be unaffected, there would be no impact upon feeding eagles. We, therefore, conclude that the project will have no impact on the bald eagle.

Peregrine Falcon (*Falco peregrinus*)

Peregrine falcons are known, in the area, as migrants and possible summer residents. Since there are no sites on project lands suitable for resting or nest construction, the project will not affect the peregrine falcon. (Oakleaf personal communication, 1986)

Black Footed Ferret (mustela nigripes)

Three white-tailed prairie dog towns of approximately 300 acres (15-20 holes/acre), 300 acres (5-10 holes/acre) and 1,000 acres (0-5 holes/acre) respectively, occur in the project area, so potential habitat for the endangered black-footed ferret is present. Winter searches conducted on two of the towns in 1984-1985 did not indicate current use of either town by black-footed ferrets.

Since the winter searches (Luce 1984-1985) proved negative, it is improbable that ferrets exist in the project area. The completed surveys do not, however, preclude ferret presence. Reclamation recognizes that the Westside dog towns may be a part of a larger complex and thus important to ferrets. For this reason, and in keeping with Species Endangered guidelines (1986), the Bureau of Reclamation proposes to conduct another ferret search. The ferret survey would be done within 1 year before project construction.

Conclusions

The species in question neither live on/nor depend on the project area for reproduction or as a food source; we have concluded that the Westside Project will have no effect on any threatened or endangered species.

References

Deaton, Jeff 1985, Personal Communication BLM Wildlife Biologist

Oakleaf, Bob 1986. Personal Communication WG&FD Nongame Biologist.

WG&FD. 1986. Westside Irrigation Project, Combined Report on Potential Aquatic and Terrestrial Wildlife Impacts. Prepared for: Wyoming Water Development Commission and U.S. Bureau of Reclamation.. Only the amendments affecting planning documents are presented.

B. S. M. Wenden

bc: MB-150,-770

GLKaiser:klm retyped 9.15/86



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023

IN REPLY REFER TO:

W.04 Westside Irrigation Project

Helena, Montana 59626

April 14, 1986

To: Regional Director, Missouri Basin Region, Bureau of Reclamation,
Billings, MT

From: Field Supervisor, Endangered Species, Helena, MT (SE-61130)

Subject: Westside Irrigation Project

Thank you for your April 9, 1986 memorandum requesting verification of our February 22, 1985 species list for the Westside Irrigation Project. That list included the bald eagle, peregrine falcon, and black-footed ferret; and remains current.

We appreciate your efforts to meet our joint responsibilities under the Endangered Species Act. Please contact Carol Taylor of my staff at FTS 585-5225 or the above letterhead address when we can be of further assistance, or if you have questions regarding preparation of your biological assessment.

cc: / ES Cheyenne
RO (FA/SE/60153)

Surname
G 4/14/86
W 4-14-86
LL 4/14

MB-750

APR 9 1986

Allen

Memorandum

To: Field Supervisor, Fish and Wildlife Service, Helena, Montana

From: ^{FO} Regional Director, Billings, Montana

Subject: Verification of Endangered Species List - Westside Irrigation Project, Washakie and Bighorn Counties, Wyoming

We are requesting verification of your February 22, 1985, memorandum of listed, proposed, threatened or endangered species which may occur on or near the Westside Irrigation Project near Worland, Wyoming.

Our February 15, 1985, memorandum contained a project map; this map remains valid.

1st Robert H. Madson

GLKaiser:kh 4-8-86

Response received April 14



UNITED STATES
DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
Endangered Species, Field Office
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:

6-1-85-I-018

February 22, 1985 2/26

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* 770
750
Jerry K

TO: Regional Director, Bureau of Reclamation, Billings, MT.

FROM: Acting Field Supervisor, Endangered Species, Helena, MT.

SUBJECT: Westside Irrigation Project

This responds to your February 15, 1985 memorandum regarding the proposed Westside Irrigation Project in Washakie and Big Horn Counties, Wyoming.

In accordance with Section 7(c) of the Endangered Species Act as amended ESA, we have determined that the following listed and proposed threatened and endangered species may be present in the project area.

<u>Listed Species</u>	<u>Expected Occurrence</u>
Bald eagle (<u>Haliaeetus leucocephalus</u>)	Breeding and winter resident
Peregrine Falcon (<u>Falco peregrinus</u>)	Migrant and possible summer resident
Black-Footed Ferret (<u>Mustela nigripes</u>)	Possible resident on prairie dog (<u>Cynomys sp.</u>) towns

Proposed Species

None

Section 7(c) of the Act requires that you conduct and submit to the Fish and Wildlife Service (FWS) a biological assessment to determine the effects of the proposed project on listed and proposed species. If not initiated within 90 days, the list should be verified with the FWS prior to initiation of the assessment. The biological assessment should be completed within 180 days of initiation, but can be extended by mutual agreement between your agency and the FWS. The assessment conducted pursuant to Section 7(c) may be undertaken as part of your agency's compliance with the requirements of Section 102 of NEPA and incorporated into the draft EIS. The biological assessment should include:

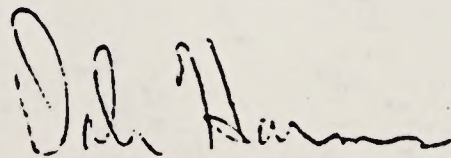
- 1)- a description of the project;
- 2) the current status, habitat use, and behavior of T/E species in the project area;
- 3) discussion of the methods used to determine the information in item 2;
- 4) direct and indirect impacts of the project to T/E species;
- 5) cumulative impacts from federal, state, or private projects in the area;
- 6) mitigation/coordination measures that will reduce/eliminate adverse impacts to T/E species;
- 7) the expected status of T/E species in the future (short and long term) during and after project completion;
- 8) determination of "no affect/may affect" to listed species.
- 9) citation of literature and personal contacts used in assessment.

If you determine that the project will affect any of the above listed species, formal consultation should be initiated with us.

Section 7(d) of the ESA requires that during consultation on listed species, the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives.

Pursuant to Section 7(a)(4) of the ESA, if you determine that any proposed species may be jeopardized, you should contact us to discuss conservation measures for those species.

Please contact us by mail at the above letterhead address or by telephone at 406-449-5225 (FTS 585-5225) if we can be of further assistance.



cc: Regional Director, FWS (FA/SE), Denver, CO.
Ecological Services, Billings, MT.
Ecological Services, Cheyenne, WY.

Kaiser

UM-750

555./123.9-

FEB 15 1985

Memorandum

To: Team Leader, Endangered Species of the Fish and Wildlife Service,
Helena, Montana

From: FO¹ Regional Director, Billings, Montana

Subject: Endangered Species

We are requesting identification of listed, proposed, threatened, or endangered species which may occur on or near the Westside Irrigation Project near Worland, Wyoming.

The proposed project lies adjacent to the Bighorn River in Washakie and Big Horn Counties. For your information, a project map is enclosed.

1st Robert H. Madson

Enclosure

bc: UM-770

GLEKaiser:kh 2-12-85

List of Preparers

Linda Verd-Williams: Archeologist

B.S., M.A. Anthropology, University of Wyoming. Linda wrote the cultural resources sections of the report. She has 18 years of experience, having worked with BLM for 2 year before joining Reclamation 8 years ago.

Jeff Jackson: Hydrologist

B.S. Watershed Science (Hydrology), Utah State University. Jeff worked for the Forest Service and the Utah State Engineering Office for 8 years before joining Reclamation 18 years ago. He wrote the surface and ground water quality sections for the report and the Hydrology Appendix.

Larry Allison: Cartographic Technician

Larry has worked with BLM on the Snake Falls, and Billings for the past 25 years. He wrote the Chapter graphics and some of the figures for the R2/026.

ATTACHMENT 6

LIST OF PREPARERS

Joseph Landolt: Range Specialist

B.S. Agriculture/Range Management. Landolt has 17 years experience working with BLM land use restrictions on public land. He provided information for the "Land" Section of this report.

John Taggart: Civil Engineer

B.S. Civil Engineering, Montana State University. John coordinated the engineering sections of the report and Appendix with Nelson Engineering, Inc. He has 7 years experience as an Engineer, 1 year with BLM, 1 year with DOE, and the rest with Reclamation.

John Taylor: Environmental Planner

B.S. Ecology, University of South Florida, M.S. Ecology, Montana State University. Jerry wrote the environmental sections of the R2/026 and assisted with the water quality analysis. Jerry has 10 years experience in the field, having worked for the U.S. Fish and Wildlife Service, Environmental Protection Agency, and the Montana State Quality Bureau before joining Reclamation.

Harry Sharp: Outdoor Recreation Planner

B.S. Outdoor Recreation, Polytechnic University, Ph.D. Wildlife Recreation Management, University of Idaho-Rexburg. Harry provided the information on recreation for the report. He has 9 years experience with BLM.

Bob Walker: Geomorphologist

B.S. Geomorphology, University of Iowa, M.A., Sedimentology, State University. He wrote the standards sections of the R2/026 and wrote the Geomorphology Appendix. He worked for the Department of Commerce for 11 years and Reclamation 11 years.

Jane Meyer: Team Leader

B.A. Education, Southern State University. Jane has worked for Reclamation for 13 years. She acted as the team leader.

List of Preparers

Linda Ward-Williams: Archeologist

B.A., M.A. Anthropology, University of Montana. Linda wrote the cultural resources sections of the report. She has 19 years of experience, having worked with BLM for 1 year before joining Reclamation 8 years ago.

Jeff Lucero: Hydrologist

B.S. Watershed Science (Hydrology), Utah State University. Jeff worked for the Forest Service and the Utah State Engineering Office for 6 years before joining Reclamation 3½ years ago. He wrote the surface and ground water quality sections for the report and the Hydrology Appendix.

Larry Allsop: Cartographic Technician

Larry has worked with Reclamation in Boise, Great Falls, and Billings for the past 25 years. He made the Chapter graphics and some of the figures for the PR/DES.

Leonard Larson: Realty Specialist

B.S. Agriculture/Range Management. Leonard has 12 years experience working with BLM land use descriptions on public land. He provided information for the "Land" Sections of this report.

John Daggett: Civil Engineer

B.S. Civil Engineering, Montana State University. John coordinated the engineering sections of the report and appendix with Nelson Engineering, Inc. He has 9 years experience as an Engineer, 1 year with BLM, 1 year with SCS, and the rest with Reclamation.

Jerry Kaiser: Environmental Planner

B.S. Zoology, University of South Dakota; M.S. Limnology, Montana State University. Jerry wrote the environmental sections of the PR/DES and assisted with the water quality analysis. Jerry has 15 years experience in the field, having worked for the U.S. Fish and Wildlife Service, Environmental Protection Agency, and the Montana Water Quality Bureau before joining Reclamation.

Marty Sharp: Outdoor Recreation Planner

B.S. Outdoor Recreation, Polytechnic University, Pomona; M.S. Wildlife Recreation Management, University of Idaho-Moscow. Marty provided the information on recreation for the report. He has 3 years experience with BLM.

Bob Walker: Economist

B.A. Economics, University of Iowa; M.A., Economics, Drake University. He wrote the economic sections of the PR/DES and wrote the Economic Appendix. He worked for the Department of Commerce for 3½ years and Reclamation 11 years.

Jane Meyer: Team Leader

B.A. Education, Montana State University. Jane has worked for Reclamation for 13 years. She acted as the team leader.

List of Preparers
(continued)

Donna Wallace: Clerk Typist

High School Diploma, Billings Public School. Donna typed and retyped this report and the Appendices. She has worked for Reclamation for 2 years, after 1½ years with BLM.

Mike Ruthledge: Realty Specialist

B.S. Forestry, University of Montana. Mike was Worland District coordinator for the Westside Project. He has worked 19 years with BLM, the last 12 as a realty specialist.

Gray Harris: Technical Writer/Editor

B.A. Education, Seattle University; M.A. English, Wayne State University. Gray worked for BIA and BLM before coming to Reclamation 5 years ago. He wrote parts of this report, edited it, and is responsible for the graphics.

Ken Stinson: Range Conservationist

B.S., M.S. Range Science, Texas Tech. University. Ken has worked for BLM for 19 years. He provided the information for the range and vegetation sections of this report.

Nora Phelps: Hydrologic Technician

Attended Eastern Montana College. Nora gathered information for the hydrologic sections of the PR/DES and Hydrology Appendix.

Larry Rossow: Environmental Specialist

B.S. Biology (Wildlife) Moorhead State University; M.S. System Management, University of California. Larry rewrote the environmental analysis in the report and the Environmental Appendix. He has worked with Reclamation for 11 years.

Glen Sanders: Regional Drainage Engineer

B.S. Agricultural Engineering, South Dakota State University. Glen wrote the drainage sections of the PR/DES and the Hydrology Appendix. He has been with Reclamation for 22 years.

Jeffery Denton: Wildlife Biologist

B.S., M.S. Wildlife Biology, University of Montana. Jeff has worked for BLM for 12 years, after working 2 years with the Montana Department of Fish, Wildlife and Parks. He provided information on wildlife impacts and mitigation.

Arlyn Shineman: Soil Scientist

B.S., Agronomy, University of Nebraska. Arlyn wrote portions of the report and the Land Classification Appendix about the Food Security Act and about soil erosion. He has had 5 years experience with the Soil Conservation Service and 19 years with Reclamation.

List of Preparers
(continued)

Kip Gjerde: Civil Engineer

B.S., Construction Technology, Montana State University. Kip did the water supply studies for the project and wrote the surface water sections of the PR/DES and the Hydrology Appendix. He has worked with Reclamation (and before Reclamation with BLM) for 13 years.

Coordination With the Study Partners

Derwood Mercer, Reclamation

GLOSSARY

AUM - Animal unit month; the forage necessary for the complete support for a mature cow for one month.

Average annual effective precipitation - Precipitation that can be used by a crop and can fill the soil profile.

BLM - U.S. Bureau of Land Management

CIR - Crop Irrigation Requirement

EOM - End-of-month; a measurement of reservoir storage levels.

EPA - U.S. Environmental Protection Agency

farm delivery requirement - The sum of the CIR plus onfarm losses (deep percolation, runoff, nonbeneficial consumptive use and evaporation).

fcr - Fire cracked rock

FLPMA - Federal Land Policy and Management Act of 1976.

ft³/s - cubic feet per second

HQI - Habitat Quotient Index

HU - Habitat Units; the wildlife habitat necessary to produce a one-unit increase in habitat quality.

kW - kilowatt

kWh - kilowatt/hour

Lek - Sage grouse breeding grounds.

Lithic scatter - A surface distribution of culturally modified stone.

Market clearing prices - The price that equates supply and demand.

NED - National Economic Development

Onfarm losses - Water lost to deep percolation, surface runoff, deep return flow, and pipe and sprinkler losses to spray and drift.

Peak rate - The rate at which water must be applied to a crop during a critical period to avoid plant stress.

ppb - parts-per-billion (the same as micrograms-per-liter, ug/L)

ppm - parts-per-million (the same as milligrams-per-liter, ug/L)

P-S MBP - Pick-Sloan Missouri Basin Program

G
L
O
S
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A
R
Y

Reclamation - U.S. Bureau of Reclamation

Rill erosion - Removal of soil by small ephemeral streams several inches deep.

Sheet erosion - Detachment of the soil by the impacts of a raindrop and its removal by prechannel or overland water flow.

SHPO - Wyoming State Historical Preservation Office.

TDH - Total dynamic head

TDS - Total dissolved solids; an indication of water quality.

USFWS - U.S. Fish and Wildlife Service

USGS - U.S. Geological Survey

USLE - Universal Soil Loss Equation; a model used to predict soil losses on farmland to water erosion.

WEG - Wind Erodibility Group; a rating by the U.S. Soil Conservation Service of the ability of soils to resist wind erosion.

WGFD - Wyoming Game and Fish Department

WWDC - Wyoming Water Development Commission

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