



**U.S. Army Corps
of Engineers**
Omaha District

Big Bend Dam/Lake Sharpe Master Plan

Missouri River, South Dakota

Update of Design Memorandum MB-90

October 2003

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Big Bend Dam/Lake Sharpe Master Plan
Missouri River, South Dakota

Update of Design Memorandum MB-90

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PERTINENT DATA

GENERAL

Location of Dam	The dam is located at Fort Thompson, South Dakota, on the Missouri River about 990 miles from its mouth (1960 mileage).
Operating and Management Agency	U.S. Army Corps of Engineers
Purposes	Flood control, navigation, hydropower, fish and wildlife, recreation, municipal and industrial water supply, irrigation, and other purposes.
Authorization	Flood Control Act of 22 December 1944, as amended (Public Law 534, 78th Congress)
Year Construction Started	1959
Year Dam Placed in Operations	1964
Project Cost	\$107,500,000 (as of September 1986)

DAM AND EMBANKMENT

Type of Fill	Rolled earthfill; shale and chalk fill
Fill Quantity	17 million cu. yd.
Abutment Formations (under dam and embankment)	Pierre Shale and Niobrara Chalk
Top of Dam Elevation	1,440 ft. m.s.l.
Length of Dam (including spillway) at Crest	10,570 ft.
Damming Height (height from low water to maximum operating pool)	78 ft.
Maximum Height (from average streambed to top of dam)	95 ft.
Width at Top	50 ft.
Base Width –	

With Berms	1,200 ft.
Without Berms	700 ft.

SPILLWAY

Location	Left Bank
Type	Chute, concrete lined with gated overflow weir
Crest Elevation	1,385 ft. m.s.l.
Width (including piers)	376 ft.
Types of Gates, Number, Size	Tainter, 8 each, 40 ft. x 38 ft.
Design Discharge Capacity At Elevation 1,433.6 ft. m.s.l.	390,000 c.f.s.
Discharge Capacity at Maximum Operating Pool Elevation 1,423 ft. m.s.l.	270,000 c.f.s.

OUTLET

Number and Size of Conduits	None (River regulation is attained by flows through turbines and over low-crested spillway).
Entrance Invert Elevation (spillway crest)	1,385 ft. m.s.l.
Present Tailwater Elevation at Discharge	1,351 ft. m.s.l. at 25,000 c.f.s. 1,355 ft. m.s.l. at 100,000 c.f.s.

POWER FACILITIES

Average Gross Head	70 ft.
Conduits	None, direct intake
Surge Tanks	None
Type of Turbines, Number, Speed	Fixed blade, 8, 81.8 r.p.m.
Discharge Capacity	103,000 c.f.s. at 67 ft.
Generator Rating of Each Unit	58,500 kW
Plant Capacity	468,000 kW

Dependable Capacity	497,000 kW
Average Annual Energy Production	1,001 million kWh

POWERHOUSE AND INTAKE

Location and Type	Right bank, concrete
Type of Service Gates, Number, Size	Vertical lift tractor, 3, 20 ft. x 36 ft.
Type of Emergency Gates, Number, Size	Bulkhead, 3, 20 ft. x 40 ft.
Intake Inlet Elevation	1330 ft. m.s.l.

RESERVOIR

Total and Incremental Drainage Areas (includes 4,280 sq. mi. of noncontributing areas)	249,330 sq. mi.	5,840 sq. mi.
Length of Reservoir at Maximum Normal Operating Pool	Approximately 80 miles, ending near Pierre, South Dakota	
Shoreline at Elevation 1,420 ft. m.s.l.	200 miles	
Average Width	1 mile	
Average Total Inflow	25,900 c.f.s.	
Storage Capacity at 1,422 ft. m.s.l. (maximum pool) (1997)	1,738,000 acre-feet	
Maximum Depth	78 feet	
Maximum Operating Pool Elevation and Surface Acres	1,423 ft. m.s.l.	61,000 acres
Maximum Normal Operating Pool Elevation and Surface Acres	1,422 ft. m.s.l.	60,000 acres
Flood Control and Multiuse Pool	1422-1420 ft. m.s.l.	117,000 acre-feet
Inactive Storage Zone	1,420-1,345 ft. m.s.l.	1,621,000 acre-feet
Gross (from bottom of reservoir to top of exclusive flood control pool)	1,423-1,345 ft. m.s.l.	1,799,000 acre-feet
Estimated Annual Sediment Inflow and Reservoir Life	4,300 acre-feet	418 years

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CORPS OF ENGINEERS REPORTS

BIG BEND DAM/LAKE SHARPE PROJECT

DM/REM¹ NUMBER	TITLE	DATE SUBMITTED	DATE APPROVED
MO-27	Preliminary Study, Big Bend Dam and Reservoir	MAR 54	JAN 55
MB-1	Site Selection	JUL 57	OCT 57
MB-2	Hydrology and River Hydraulics	JAN 58	APR 58
MB-3	Sediment (Aggradation)	MAR 58	AUG 58
MB-4	General	JUL 58	SEP 58
MB-5	First Supplement to DM No. MB-4, General Design Memorandum	OCT 58	JAN 59
MB-6	Hydropower Studies	DEC 58	JAN 59
MB-7	Cemetery Relocations	NOV 58	JAN 59
MB-8	Construction Bridge and Road	JAN 59	FEB 59
MB-9	Spillway Hydraulic Design	FEB 59	MAR 59
MB-10	Preliminary Master Plan for Reservoir Development	JAN 59	MAY 59
MB-11	Turbines	AUG 59	OCT 59
MB-12	Supplement to DM No. MB-1, Site Selection	JUN 59	JUL 59
MB-13	Second Supplement to DM no. MB-4, General Design Memorandum	SEP 59	DEC 59
MB-14	Generators	AUG 59	NOV 59
MB-15	Preliminary Design Memorandum, Powerhouse	JAN 60	APR 60
MB-16	Preliminary Master Plan, Part of the Master Plan for Reservoir Development (Supersedes DM No. MB-10)	OCT 59	MAR 60
MB-16B	Master Plan for Big Bend Dam/Lake Sharpe, Missouri River, SD Includes appendixes:	FEB 64	JUN 64

DM/REM¹ NUMBER	TITLE	DATE SUBMITTED	DATE APPROVED
MB-16B (appendix)	Natural Resource Management Plan	JUN 77	JUL 78
MB-16B (appendix)	Lakeshore Management Plan	JAN 77	MAY 77
MB-17	First Supplement to DM No. MB-6, Hydropower Studies	OCT 59	DEC 59
MB-18	Supplement to DM No. MB-7, Cemetery Relocations	OCT 59	--
MB-19	Earthwork, Stage 1	DEC 59	FEB 60
MB-20	Spillway and Access Road Bridge	NOV 60	FEB 61
MB-21	Big Bend Dam and Reservoir Project, Buffalo, Hughes, Hyde, Lyman, and Stanley Counties, SD	JAN 60	--
MB-22	Sewer Facilities, Pierre	MAR 60	--
MB-23	Sewer and Water Facilities, Fort Pierre	MAR 60	AUG 60
MB-24	Geology Building, Administrative Area	AUG 60	SEP 60
MB-25	Permanent and Mobile Exhibits	DEC 60	JAN 61
MB-26	Family Housing	JAN 61	FEB 61
MB-27	Landing Strip	FEB 61	APR 61
MB-28	Earthwork – Stage II	FEB 61	APR 61
MB-29	Pierre Waterfront Protection	MAY 61	JUL 61
MB-30	Segment 8, Pierre and Fort Pierre, SD	MAY 61	--
MB-31	Reservoir Clearing	MAY 61	JUL 61
MB-32	Spillway Tainter Gate Hoists	JUL 61	SEP 61
MB-33	Service Roads, Dam, and Vicinity	AUG 61	MAY 62
MB-34	Tree Planting	JUL 61	DEC 61
MB-35	Fallout Protection	OCT 61	DEC 61
MB-36	Bank Erosion Protection, Pierre and Fort Pierre, SD	DEC 61	MAR 62
MB-37	Chicago and North Western Railway Relocation	DEC 61	FEB 62
MB-38	Temporary Trailer Housing for Government Employees	DEC 61	FEB 62

DM/REM¹ NUMBER	TITLE	DATE SUBMITTED	DATE APPROVED
MB-39	South Dakota State Highway 34 Relocation	JUL 62	OCT 62
MB-40	Pressure Relief Wells	AUG 62	SEP 62
MB-41	Radio Facilities	OCT 62	NOV 62
MB-42	Relocation of Lower Brule Indian Sub-Agency	NOV 62	JAN 63
MB-43	Lower Brule and Crow Creek Indian Reservation Road Relocations	NOV 62	JAN 63
MB-44	Cemetery Relocation Plan	DEC 62	--
MB-45	Spillway Monorail Hoist	DEC 62	FEB 63
MB-46	Relocation of Rousseau School	APR 63	MAY 63
MB-47	Fish and Wildlife Resource Development	APR 63	JUN 63
MB-48	Operating Plan	APR 63	AUG 63
MB-49	Tailrace Floating Boom	--	--
MB-50	Alterations to Electric Distribution Facilities	APR 63	JUN 63
MB-51	Alterations to Mid-State Telephone Company Facilities	MAY 63	JUL 63
MB-52	Modifications of Waterfront and Bank Erosion Protection, Pierre, SD	MAY 63	--
MB-53	Access Road, Parking Areas, and Boat Ramps	JUL 63	AUG 63
MB-54	Powerhouse and Appurtenant Structures	JUN 63	--
MB-55	Alterations to Sully Buttes Telephone Cooperative Facilities	AUG 63	SEP 63
MB-56	Hughes County, South Dakota Road Relocations	OCT 63	NOV 63
MB-57	On-Project Signs	SEP 63	--
MB-58	Alteration to Facilities, Iron Nation Telephone Company	SEP 63	NOV 63
MB-59	Crow Creek Indian Townsite Facilities, Fort Thompson, SD	NOV 63	FEB 64
MB-60	Crow Creek Indian Townsite Water Supply Facilities, Fort Thompson, SD	JUN 64	AUG 64

DM/REM¹ NUMBER	TITLE	DATE SUBMITTED	DATE APPROVED
MB-61	Community Center Building, Crow Creek Indian Townsite, Fort Thompson, South Dakota	JUL 64	SEP 64
MB-62	Soldier Creek Detention Dam	MAY 65	--
MB-63	Crest Road Lighting	OCT 65	NOV 65
MB-64	Boat Barriers at Power Intake Structure and Spillway	JAN 66	APR 66
MB-65	Powerhouse Intake Security Fence	DEC 66	--
MB-66	Embankment Underseepage Treatment	JAN 67	MAR 67
MB-67	Maintenance Facilities	OCT 66	FEB 67
MB-68	Big Bend Landing Strip Lighting System	MAR 67	--
MB-69	Spillway and Maintenance Facilities Power Feeder	MAY 67	AUG 67
MB-70	Parking Lot Lighting	AUG 67	OCT 67
MB-71	Supplement to DM No. MB-15 and Supplement to Preliminary DM No. E-119, Supervisory Control	SEP 67	OCT 67
MB-72	Sprinkler System	MAR 68	APR 68
MB-73	Installation of Line Inductor, Fort Thompson Line No. 2	DEC 68	FEB 69
MB-74	Tailrace Riprap Rehabilitation	MAR 70	JAN 71
MB-75	Supplementary Control for Generator Excitation at Big Bend Power Plant	MAY 71	AUG 71
MB-76	Relocation to Hughes County Road	AUG 72	--
MB-77	Embankment Upstream Slope Protection	DEC 72	JAN 73
MB-78	Buildings and Grounds Electrical Distribution System Study	JAN 73	--
MB-79	Drainage – South Dakota State Highway 34 and Chicago and North Western Railway	APR 73	--
MB-80	Tailrace Bank Stabilization	APR 73	--
MB-81	Bank Stabilization – Tailrace, Tower Island and Spillway Discharge Channel	JUL 74	AUG 74

DM/REM¹ NUMBER	TITLE	DATE SUBMITTED	DATE APPROVED
MB-82	Bank Stabilization – Road 10-4 at Medicine Creek Bridge	APR 78	--
MB-83	Lower Bank Slope Protection, Vicinity of Relocated Hughes County Road	DEC 79	AUG 80
MB-84	LaFramboise Island Area, Vicinity of Pierre, South Dakota	FEB 80	--
MB-85	Maintenance Facility Fire Suppression System	JUN 83	JUL 83
MB-86	Repair of Bank Erosion at Mile 1037, Highway 1806	JUL 83	--
MB-87	Administration Building	JUL 85	--
MB-88	Whistling Elk Archaeological Site Bank Stabilization	NOV 86	--
MB-89	Left Bank Spillway Discharge Channel Bank Stabilization	MAY 87	--
M(Gen)19	Implementation Plans for Lake Oahe and Lake Sharpe Wildlife Mitigation	DEC 87	--
MB-90	Master Plan – Missouri River, South Dakota, Big Bend Dam/Lake Sharpe	JUN 93	--
MB-91	Replace Generator Excitation System	SEP 89	OCT 89
MB-20	Supplement to DM No. MB-20, Renovate Tainter Gates	JUL 92	--

¹ DM/REM – Design Memorandum or Real Estate Memorandum

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ACRONYMS AND ABBREVIATIONS

AC-FT	Acre-Feet
AC-FT/YR	Acre-feet per year
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CCST	Crow Creek Sioux Tribe
CFR	Code of Federal Regulations
C.F.S.	Cubic feet per second
CNW	Chicago and North Western Railroad
COE	Corps of Engineers
CRMP	Cultural Resource Management Plan
DM	Design Memorandum
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	Engineer Manual
EPA	Environmental Protection Agency
ER	Engineer Regulation
F	Fahrenheit
FY	Fiscal Year
GSA	General Services Administration
HPMP	Historic Properties Management Plan
HQUSACE	Headquarters, U.S. Army Corps of Engineers
LBST	Lower Brule Sioux Tribe
LWCF	Land and Water Conservation Fund
MAF	Million Acre Feet
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MNRR	Missouri National Recreational River
MPH	Miles Per Hour
MRD	Missouri River Division, U.S. Army Corps of Engineers
MSA	Metropolitan Statistical Area
M.S.L.	Mean sea level
MU	Management Unit
NAWMP	North American Waterfowl Management Plan
NCRI	North Central Reservoir Investigations, U.S. Fish and Wildlife Service
NDEC	Nebraska Department of Environmental Control
NGPC	Nebraska Game and Parks Commission
NEPA	National Environmental Policy Act
NPS	National Park Service

NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRMS	Natural Resource Management System
OD	Omaha District
OMP	Operational Management Plan
ORV	Offroad Vehicle
PAR	Post-Authorization Mitigation Report
P.L.	Public Law
PPCS	Power Plant Control System
PPJV	Prairie Pothole Joint Venture
RA	Recreation Area
REHAC	Regional Hydropower Action Center
RM	River Mile
RO	Resource Objective
RV	Recreational Vehicle
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCS	Soil Conservation Service
SDTF	South Dakota Trust Fund
SHPO	State Historic Preservation Officer
SDGFP	South Dakota Department of Game, Fish, and Parks
SRA	State Recreation Area
SQ. MI.	Square Mile(s)
SRUF	Special Recreation User Fees
SRST	Standing Rock Sioux Tribe
TMDL	Total Maximum Daily Load
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAPA	Western Area Power Administration
WES	Waterways Experiment Station
WMA	Wildlife Management Area
WRDA	Water Resource Development Act

1. INTRODUCTION

The Big Bend project was authorized by the Flood Control Act of 1944, Public Law 534, 78th Congress, 2nd session, along with four other Missouri River main stem projects -- Gavins Point, Fort Randall, Oahe, and Garrison. These five reservoirs are elements of a plan for the development of the Missouri River main stem system (Figure 1-1). This main stem plan is a component of the comprehensive river basin development program in the Missouri River Basin, the Pick-Sloan Plan, also authorized by the Flood Control Act of 1944. Fort Peck Dam, located in northern Montana, was constructed prior to the Pick-Sloan Plan but is operated as part of the Missouri River main stem system.

The Big Bend project (Figure 1-2) was authorized for flood control, navigation, hydropower, fish and wildlife, recreation, municipal and industrial water supply, irrigation, and other purposes. This updated Master Plan reaffirms land classifications and management practices similar to those already in effect and provides for recreational opportunities while maintaining the integrity of the natural resources.

The Corps of Engineers (Corps) is the steward of the lands and waters at Corps water resources projects. Its Natural Resources Management mission is to manage, conserve, and improve these natural resources and the environment while providing quality public outdoor-recreation experiences to serve the needs of present and future generations. In all aspects of natural and cultural resource management, Corps managers promote awareness of environmental values and adhere to sound environmental stewardship, protection, compliance, and restoration practices.

The Master Plan provides for stewardship of natural resources and manages for long-term public access to, and use of, the natural resources in cooperation with other Federal, State, and local agencies, as well as the private sector. Natural resource managers integrate the management of diverse natural resource components such as fish, wildlife, wetlands, grasslands, soil, air, and water with the provision for public outdoor-recreation opportunities. The Corps conserves natural resources and provides recreation opportunities that contribute to the quality of American life. The land classifications and management guidelines reflect the potentials of the natural resources of the area and the identified population and visitation patterns.

Figure 1-1. Omaha District Civil Works Boundary Emphasizing the Missouri River Main Stem System of Six Dams and Reservoirs

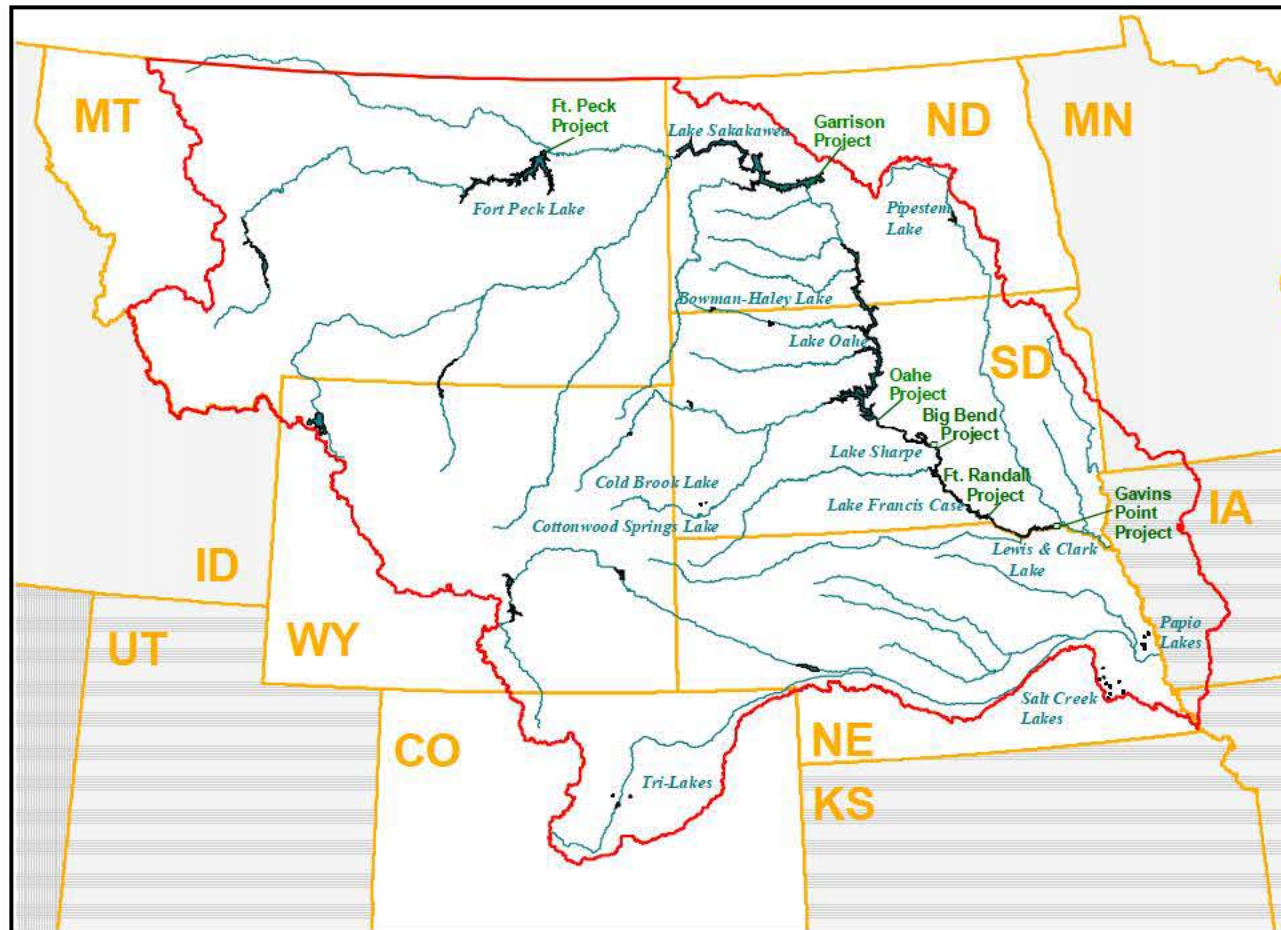
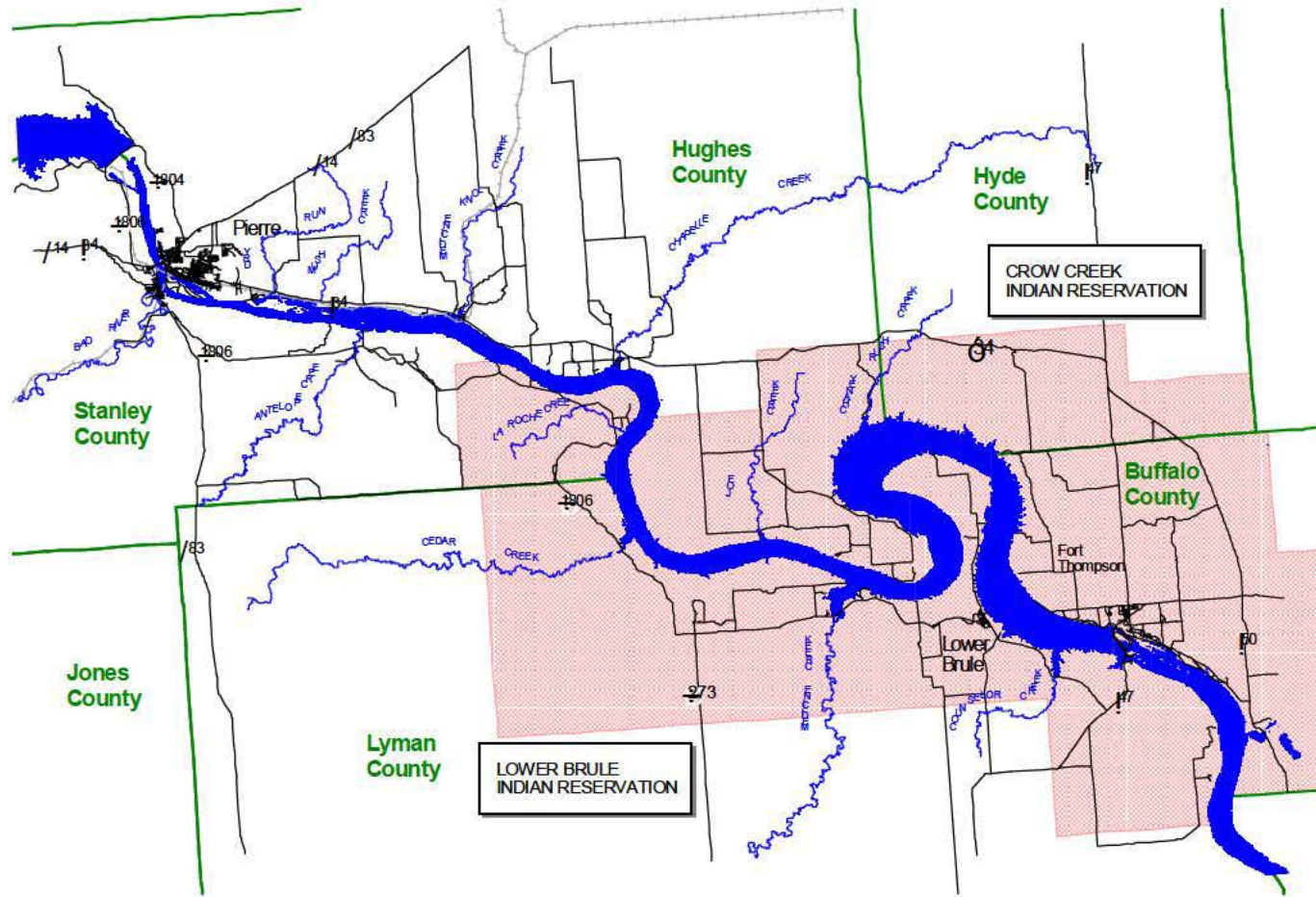


Figure 1-2. Location Map of Big Bend Project



1.1. PROJECT DESCRIPTION

The Big Bend Dam/Lake Sharpe project is located in the Missouri River Valley in Buffalo, Hyde, Hughes, Stanley, and Lyman Counties in central South Dakota. The dam is located approximately 990 miles upstream from the mouth of the Missouri River at Fort Thompson, South Dakota. The embankment of the dam is 2 miles long. The left abutment of the dam is in Buffalo County and the right abutment is in Lyman County.

Big Bend Dam was named for the unique bend in the Missouri River 7 miles upstream from the dam. At this point in its course, the Missouri River makes almost a complete loop, traveling about 25 miles before returning to the "neck" where the land is only 1 1/2 miles wide. This is the location where steamboat passengers would disembark and walk across the "narrows" for a break in the monotony of the river journey and then wait for the boat to make its way around the "big bend" to pick them up.

Lake Sharpe was named for former South Dakota Governor Merrill Q. Sharpe. Lake Sharpe stretches 80 miles from Fort Thompson to Pierre, South Dakota. Much of the project is bounded on the east side by the Crow Creek Sioux Reservation and on the west side by the Lower Brule Sioux Reservation. The reservations have had a significant impact on the development and use of the project lands and waters. The sparsely populated area is rich in the heritage and culture associated with the West.

Both emergent and submerged snags that were created during the lake's formation characterize the lake. Surrounding lands are used for agriculture, haying, and grazing. Lake Sharpe is well known regionally for its walleye fishery and receives particularly heavy use during the spring fishing season.

1.2. PROJECT AUTHORIZATION

The need for flood control projects along the Missouri River and its tributaries was long recognized prior to the development of the main stem system. Comprehensive development was proposed by the Corps in House Document 138 (73rd Congress, 2nd session, 1934). While the Big Bend Dam/Lake Sharpe project as it exists today was not included in House Document 138,

the report did propose construction of multipurpose reservoirs on both the main stem of the Missouri River and on tributary streams in the basin. These dams, together with levees along the lower Missouri River, were constructed as flood control measures. The beneficial influence of the reservoirs upon Missouri River and Mississippi River navigation was also recognized.

The first studies by a Federal agency for a dam in this reach of the river were made by the Bureau of Reclamation (BOR) and were included in Senate Document 191, 78th Congress. The dam site proposed in Senate Document 191 was several miles upstream from the present location. The Corps' plans for Missouri River development as contained in House Document 475 (78th Congress, 2nd session, 1944) proposed several alternative sites along the Missouri River. A dam at the Big Bend location was not included. The difference between the BOR's and the Corps' plans were adjusted in an interdepartmental conference. The coordinated plan, including the Big Bend project near its present site, was presented to Congress in Senate Document 247 (78th Congress, 2nd session). This plan became known as the Pick-Sloan Missouri Basin Program. The Big Bend Dam/Lake Sharpe project was included in the Pick-Sloan Plan, which was authorized by the Flood Control Act of 1944 and approved on 22 December 1944.

1.3. PROJECT PURPOSES

The Big Bend Dam/Lake Sharpe project is a unit of the comprehensive plan for development in the Missouri River Basin. The operation of the six main stem reservoirs creates a system to be operated for flood control, navigation, hydropower, fish and wildlife, recreation, municipal and industrial water supply, and irrigation. Criteria described in the Missouri River Reservoir Regulation Manuals for the main stem system are formulated to ensure water management in accordance with these project purposes. The specific project purposes are as follows.

1.3.1. Flood Control

Lake Sharpe, centrally located in the main stem system, is operated to impound water for regulation, to assist in the control of floods by its flood control storage and temporary surcharge, and to provide further safety to the Fort Randall project for a flood event of spillway design magnitude. Main stem dams have prevented about \$26 billion dollars in flood damages through September of 2002, of which about \$312 million can be credited to the Big Bend project.

1.3.2. Navigation

Although navigation on the Missouri River through South Dakota originally opened up this region for settlement, there is no commercial navigation through this reach of the river today. Water storage space is not provided in Lake Sharpe or in any of the other main stem reservoirs to support Missouri River navigation projects. However, releases from upstream main stem reservoirs intended to serve downstream navigation are passed through the Big Bend Dam/Lake Sharpe project.

1.3.3. Hydropower

The Big Bend power plant is operated to help meet peak-load demands for hydroelectric power in the Upper Missouri River basin. All power generated is marketed by the Western Area Power Administration (WAPA). The plant houses eight turbine and generator units with a combined generating capacity of 468,000 kilowatts. The generators produce approximately 1 billion kilowatt-hours of energy each year. Big Bend power generation is integrated with the generation provided from other main stem projects, as well as that generated from other public and private facilities throughout the power marketing area.

1.3.4. Fish and Wildlife

This project purpose is considered a high priority on all project lands, regardless of the land use classification. All areas classified as project operation or recreation are developed and managed for the incidental benefit to wildlife through a variety of different techniques including vegetation management alternatives to enhance and benefit wildlife species. The remaining project lands are also managed to enhance and benefit wildlife species.

1.3.5. Recreation

Recreational use of project lands is encouraged through public parks and recreation facilities. Main stem projects are managed to provide a high quality outdoor-recreation experience and as much diversity as is practicable. Recreational planning and improvements are supportive of and compatible with the South Dakota Statewide Comprehensive Outdoor Recreation Plan (SCORP).

Recreational planning is also done with input from local tribal communities through public meetings.

1.3.6. Irrigation

The federal irrigation projects adjacent to Lake Sharpe that were envisioned as a part of the authorization of the Pick-Sloan Program totaled approximately 37,000 acres. The only federal project developed was the Grassrope area. This project was developed by the BOR and the Lower Brule Sioux Tribe and provided 3,500 acres of irrigation. Other irrigation projects that exist are primarily withdrawals for center-pivot irrigation systems.

1.3.7. Municipal and Industrial Water Supply

Water storage is included in Lake Sharpe for municipal and industrial use. The municipalities of Lower Brule and Fort Thompson both obtain public water supplies from Lake Sharpe. Homes and farmsteads located close to the lake also withdraw water for domestic consumption. The Mni Wiconi Water Project in Lower Brule, South Dakota provides rural water to the local area.

1.4. PURPOSE AND SCOPE OF THE MASTER PLAN

1.4.1. Purpose

The Master Plan provides direction for project development and use. It is based on responses to regional and local needs, resource capabilities and suitabilities, and expressed public interests consistent with authorized project purposes and pertinent legislation. The Master Plan provides a District-level policy consistent with national objectives and other State and regional goals and programs. This Master Plan includes guidance for the use and development of the natural and manmade resources at the Big Bend Dam/Lake Sharpe project. The plan includes: (1) a comprehensive description of the project; (2) a discussion of factors influencing resource management and development; (3) an identification and discussion of special problems; (4) a synopsis of public involvement and input; and (5) descriptions of past, present, and proposed development.

The Master Plan is distinct from the project-level implementation emphasis of the Operational Management Plan (OMP). Policies in the Master Plan are guidelines implemented through provisions of the OMP, specific Design Memorandums, and the Annual Management Plans. The broad intent of this Master Plan is to document policies and analyses that do the following:

- Determine appropriate uses and levels of development of project resources;
- Provide guidelines within which the OMP and Annual Management Plans can be developed and implemented; and
- Establish a basis on which outgrants and recreational development proposals by others can be evaluated.

This updated Master Plan has been prepared in accordance with guidance contained in Engineer Manual (EM) 1110-1-400 (Engineering and Design – Recreation Planning and Design Criteria), 31 July 1987; Engineer Regulation (ER) 200-2-2 (Environmental Quality – Procedures for Implementing the National Environmental Policy Act (NEPA)), 4 March 1988; ER 1105-2-100 (Planning Guidance), 22 April 2000; Engineer Pamphlet (EP) 1130-2-550 (Project Operations – Recreation Operations and Maintenance Guidance and Procedures), 15 November 1996.

1.4.2. Scope

This Master Plan represents overall policy and management concepts applicable to the Big Bend Dam/Lake Sharpe project. Detailed cost estimates generally are not appropriate for Master Plans because they soon become outdated. Development needs are presented in conceptual terms, not in detail. The lifespan of this updated Master Plan is intended to direct the use and development of Big Bend resources into the 21st century.

The scope of this Master Plan includes all project lands at Lake Sharpe and those project lands at Lake Francis Case that are managed through the Lake Sharpe project office. Lake Francis Case project lands that are managed by the Lake Sharpe project office include only those lands adjacent to the Lower Brule Sioux and Crow Creek Sioux Reservations. This arrangement provides management of all lands adjacent to these reservations through one Corps office. The Pierre and Fort Pierre areas of Lake Sharpe are managed through the Lake Oahe project office; however, these areas have been included in this Master Plan for completeness and clarity.

Lands transferred in fee title (February 2002) to the state of South Dakota and lands transferred to the Bureau of Indian Affairs (BIA) in trust to the Lower Brule Sioux Tribe (June 2002) under Title VI of Public Law (P.L.) 105-53, Water Resources Development Act of 1999 as amended by P.L. 106-541, Water Resources Development Act of 2000, are not included in this Master Plan.

These lands will be managed in perpetuity for the restoration of terrestrial wildlife habitat loss that occurred as a result of flooding related to the Big Bend Dam/Lake Sharpe project and other reservoir projects carried out as part of the Pick-Sloan Missouri River Basin Program.

Table 1-1. Completed and Future Transfers under Title VI

Completed Transfers				
Management Area	Extent of Area (Acres)	Transferred To	Date of Transfer	Included in 2003 Master Plan
12. DeGrey RA	377	SDGFP ¹	January 26, 2002	No
14. Fort George RA	10	SDGFP	January 26, 2002	No
16. Rousseau Overlook RA	255	SDGFP	January 26, 2002	No
19. Nyoda Girl Scout Camp	16	SDGFP	January 26, 2002	No
20. Farm Island	1,013	SDGFP	January 26, 2002	No
21. Farm Island Natural area	Merge w/above	SDGFP	January 26, 2002	No
22. Golf Course Area	281*	SDGFP	January 26, 2002	No
23. Isaak Walton League Area	352	SDGFP	January 26, 2002	No
24. Pierre Waterfront East Area	358	City of Pierre	January 26, 2002	No
25. Pierre Marina & Waterfront Area	Merge w/above	City of Pierre	January 26, 2002	No
26. La Framboise Island	555	SDGFP	January 26, 2002	No
27. Fort Pierre West Area	20	SDGFP	January 26, 2002	No
28. Fort Pierre Waterfront	Merge w/above	SDGFP	January 26, 2002	No
30. Antelope Creek RA	354	SDGFP	January 26, 2002	No
32. Cedar Creek RA	249*	LBST ²	June 5, 2002	No
33. Langdeau Area	964*	LBST	June 5, 2002	No
34. Iron Nation North	146*	LBST	June 5, 2002	No
35. Medicine Creek Area	691	LBST	June 5, 2002	No
36. Iron Nation South RA	440*	LBST	June 5, 2002	No
37. Buffalo Pasture Area	523	LBST	June 5, 2002	No
38. Narrows RA	1,044*	LBST	June 5, 2002	No
39. Grassrope Area	904	LBST	June 5, 2002	No
40. Jiggs RA	23*	LBST	June 5, 2002	No
41. Grassrope South Area	391	LBST	June 5, 2002	No

Table 1-1 (continued). Completed and Future Transfers under Title VI

Completed Transfers				
Management Area	Extent of Area (Acres)	Transferred To	Date of Transfer	Included in 2003 Master Plan
42. Pheasant Haven Area	282	LBST	June 5, 2002	No
43. Lower Brule Boat Ramp	17*	LBST	June 5, 2002	No
44. Lower Brule RA	130*	LBST	June 5, 2002	No
45. No Name Dam Area	654	LBST	June 5, 2002	No
46. Counselor Creek RA	353*	LBST	June 5, 2002	No
47. Cedar Breaks	565	LBST	June 5, 2002	No
52. Fort Hale Bottom Area	1,612	LBST	June 5, 2002	No
Areas Leased in Perpetuity				
Management Area	Extent of Area (Acres)	Lessee	Date of Transfer	Included in 2003 Master Plan
2. Left Tailrace RA	66	LBST	Upon request	Yes
49. Good Solider Creek RA	17	LBST	Upon request	Yes
51. Right Tailrace Area RA	148	LBST	Upon request	Yes
Future Transfers				
Management Area	Extent of Area (Acres)	Will Be Transferred To	Projected Date of Transfer	Included in 2003 Master Plan
11.2. Bisson Area (not adjacent to CCST ³)	N/A	SDGFP	TBD ⁴	Yes
13. Whistling Elk Area	649	SDGFP	TBD	Yes
15. Medicine Knoll Creek Area	248	SDGFP	TBD	Yes
17. Arikara Area	1,002	SDGFP	TBD	Yes
18. Hippie Lake Wildlife Area	59	SDGFP	TBD	Yes
29. Schomer Area	817	SDGFP	TBD	Yes
31.1. Clark Ranch (upstream of LBST)	N/A	SDGFP	TBD	Yes
31.2. Clark Ranch (on LBST)	N/A	LBST	TBD	Yes
50. Lake Sharpe Islands	245	LBST or SDGFP	TBD	Yes

* Estimated area obtained from GIS maps

³CCST = Crow Creek Sioux Tribe

¹SDGFP = South Dakota Department of Game, Fish and Parks ⁴TBD = To be determined

²LBST = Lower Brule Sioux Tribe

Table 1-1 shows management areas that have been transferred, to be transferred, or leased in perpetuity. The table also notes lands included in this Master Plan.

Under the provisions of Title VI, the Government retains fee title to lands and structures necessary for continuation of the operation, maintenance, repair, replacement rehabilitation, and structural integrity of the Big Bend Dam/Lake Sharpe project and related flood control and hydropower structures, including land below the top of the exclusive flood control pool. However, the Government may lease in perpetuity all or part of three recreation areas associated with the Big Bend Dam/Lake Sharpe to the Lower Brule Sioux Tribe: the Left Tailrace Recreation Area, Right Tailrace Recreation Area, and Good Soldier Creek Recreation Area.

1.5. PROJECT-WIDE RESOURCE OBJECTIVES

The function of the Corps' Master Plans extends beyond the construction and use of recreation facilities to include the stewardship of project resources, both natural and manmade. Sound stewardship requires the development and management of project resources for the public benefit, consistent with resource capabilities. An important element of this approach is the establishment of viable resource objectives.

Resource objectives are realistically attainable goals for the use, development, and management of natural and manmade resources at a specific project. They are guidelines for obtaining maximum public benefits while minimizing adverse impacts and protecting and enhancing environmental quality. They are developed with full consideration of authorized project purposes, applicable Federal laws and directives, resource capabilities, regional needs, plans and goals of regional and local governmental units, and expressed public desires. Specific resource objectives for the five land classifications identified for Lake Sharpe project lands are found in Chapter 5. The project-wide resource objectives for Lake Sharpe, not in priority order, are as follows:

- To develop and manage lands and waters in full cooperation and coordination with other public management agencies and appropriate private sectors;
- To develop and manage project lands and waters to support types and levels of recreation activities indicated by visitor demand and to be consistent with carrying capacities and esthetic, cultural, and ecological values;

- To provide public education about the history of the area, Big Bend project resources, and the Corps' role in developing and managing these resources;
- To develop and manage the project lands and waters to support a diversity of fish and wildlife;
- To preserve and protect threatened and endangered species and unique and important ecological and esthetic resources;
- To maintain and manage project lands and waters to support regional management programs;
- To protect and interpret significant cultural resource sites;
- To maintain a reservoir water supply of high quality for irrigation, water supply, recreation, fish, and wildlife use; and
- To manage resources in response to sedimentation trends.

2. FACTORS INFLUENCING RESOURCE MANAGEMENT AND DEVELOPMENT

This chapter provides an overview of key factors that influence and constrain present and future options for the use, management, and development of land and water resources at the Big Bend project. These factors fall into three general, somewhat interrelated categories: natural resources, historical and social resources, and administrative and policy factors. An analysis of these factors, as well as regional needs and desires, results in a framework that maximizes the diversity of opportunities for resource use, minimizes the adverse impacts to the environment, and resolves the competing and conflicting uses. The information presented in this chapter was used to develop the resource plan that determines land classifications, develops resource objectives for land classifications, and identifies specific facility needs.

2.1. DESCRIPTION OF THE RESERVOIR

Lake Sharpe was the last of the six main stem reservoirs completed on the Missouri River and became fully operational in 1966. The lake follows a serpentine course of 80 miles between Big Bend Dam and Pierre, South Dakota. The shoreline is approximately 200 miles long and the reservoir surface area is about 57,500 acres. The average width is 1 mile and the average depth is roughly 30 feet. The maximum depth is approximately 78 feet and can be found near Counselor Creek. La Framboise Island and Farm Island are two large wooded islands located near Pierre. These islands, as well as several smaller ones, are located in the upper reservoir. Hipple Lake, located near Pierre, is the only significant backwater area. It is approximately 3 miles long, has a width of 0.4 mile, and has an average depth of 13 feet. The most distinctive feature of Lake Sharpe is the “big bend” located near the downstream end.

The reservoir bottom is generally flat as a result of sedimentation and the action of water currents. Composition of the bottom varies with location and is most diverse in the upper end of the reservoir. The river bottom in the Oahe tailrace area consists of bank gravel and changes to sand within the first few kilometers downstream. Backwaters have a mud bottom. Between Medicine Knoll and Chapelle Creeks, the bottom consists of light chalk-brown mud originally from the Bad River. Dark gray mud predominates downstream.

Prior to filling the reservoir, the Missouri River floodplain was covered by large stands of trees. Today, snags that are both above and below the water surface represent these areas. These snags are a problem for boaters and are the source of large quantities of driftwood found along the shore of Lake Sharpe.

2.2. LAKE OPERATION

Numerous reservoirs and impoundments constructed by different interests for flood control, irrigation, power production, recreation, water supply, and fish and wildlife are located throughout the basin. The Bureau of Reclamation and the Corps of Engineers have constructed the most significant of these structures. Although primarily constructed for irrigation and power production, the projects constructed by the Bureau of Reclamation do provide some limited flood control in the upper basin. Six main stem dams constructed by the Corps are the most significant authorized flood control projects within the basin, providing a combined capacity in excess of 73.5 million acre-feet of which more than 16 million acre-feet is for flood control. These six projects were completed in 1964 and provide flood protection by controlling runoff from the upper 279,000 square miles of the Missouri River basin. The six main stem reservoirs operated by the Corps of Engineers are listed in Table 2-1.

Table 2-1. Missouri River Main Stem Flood Control Reservoirs

PROJECT	INCREMENTAL DRAINAGE AREA (Square Miles)	CLOSURE DATE	FLOOD CONTROL AND MULTIPLE USE STORAGE (KAF)	TOTAL STORAGE (KAF)
Fort Peck	57,500	1937	2,717	18,688
Garrison	123,900	1953	4,222	23,821
Oahe	62,090	1958	3,201	23,137
Big Bend	5,840	1963	117	1,859
Fort Randall	14,150	1952	1,309	5,418
Gavins Point	16,000	1955	90	470

Lake Sharpe is regulated as an integral component of the system of six main stem dams and lakes on the upper Missouri River. To achieve full coordination along the river, regulation of all six main

stem reservoirs is directed by the Missouri River Region Reservoir Control Center located in Omaha, Nebraska.

The pool elevation in Lake Sharpe is held near elevation 1,420 feet mean sea level (m.s.l.), except for weekly cycling in response to high power load periods. Under such conditions, normal reservoir levels fluctuate approximately 1 foot from elevation 1,420 feet m.s.l. during the course of a week. The storage lost during the week in response to producing peaking-power loads is regained during the succeeding weekend periods of lower power demands.

Lake Sharpe was not intended to provide storage space to serve the Missouri River navigation project, like other main stem projects. However, releases from the main stem reservoirs that are intended to serve downstream navigation are passed through the Big Bend project.

Fluctuating water levels can have a major effect on recreation at some reservoirs. However, Lake Sharpe is quite unique when compared to the other Missouri River main stem reservoirs or to reservoirs in general, in that its fluctuations are minor. Unless very unusual conditions occur, Lake Sharpe fluctuates only about 1 foot from the normal operating level of elevation 1,420 feet m.s.l. The exclusive flood control storage zone in Lake Sharpe extends only 1 foot between elevations 1,422 and 1,423 feet m.s.l. and the estimated 100-year lake level is elevation 1,423 feet m.s.l. Very infrequent drawdowns below the normal operating level have been made to facilitate the construction or improvement of fish and wildlife projects.

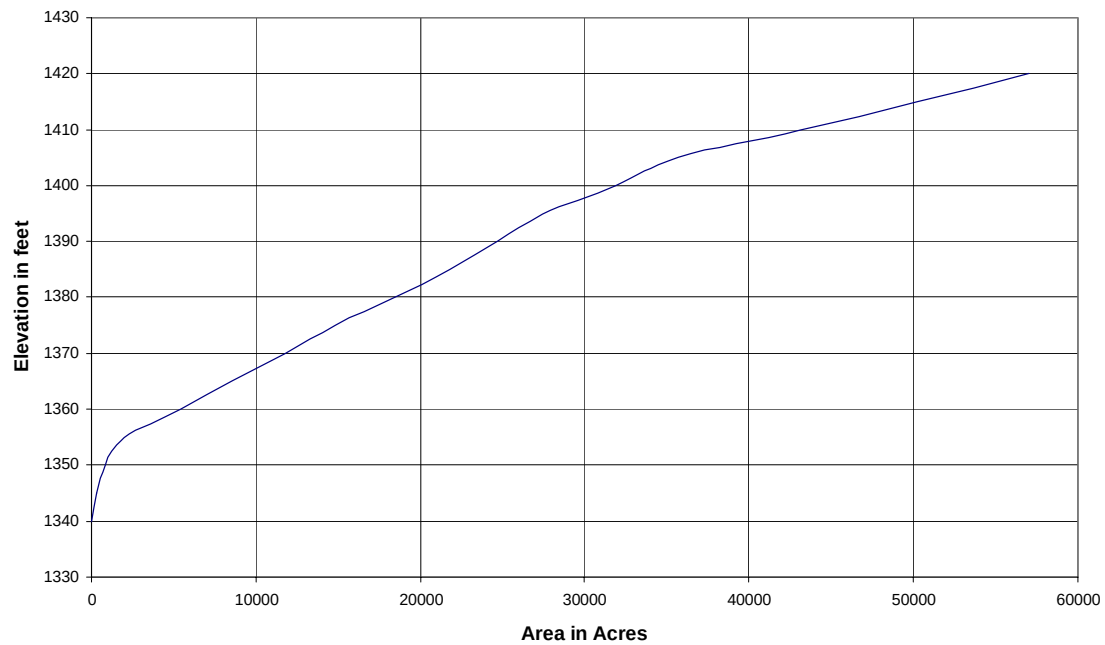
Since the main stem reservoirs first filled to normal operating levels in 1967, the Lake Sharpe level has fluctuated between a maximum of elevation 1,422.1 to a minimum of 1,415.0 feet m.s.l. with an average level of 1,420.4 feet m.s.l. Figure 2-1 shows a reservoir area curve and a reservoir capacity curve for Lake Sharpe.

2.2.1. Statistical Analysis of Reservoir Operation

A statistical analysis of reservoir operation is presented that examines pool and release duration and probability for Big Bend Dam/Lake Sharpe. Pool duration and release duration relationships were based on observed data from historical reservoir operation records and on simulated data from reservoir operation studies. Pool-probability and release-probability relationships were derived from historical records reflecting actual reservoir regulation and from the results of model simulation

Figure 2-1. Lake Sharpe-Reservoir Surface Area Curve and Capacity Curve

LAKE SHARPE - RESERVOIR SURFACE AREA CURVE



LAKE SHARPE - RESERVOIR CAPACITY CURVE

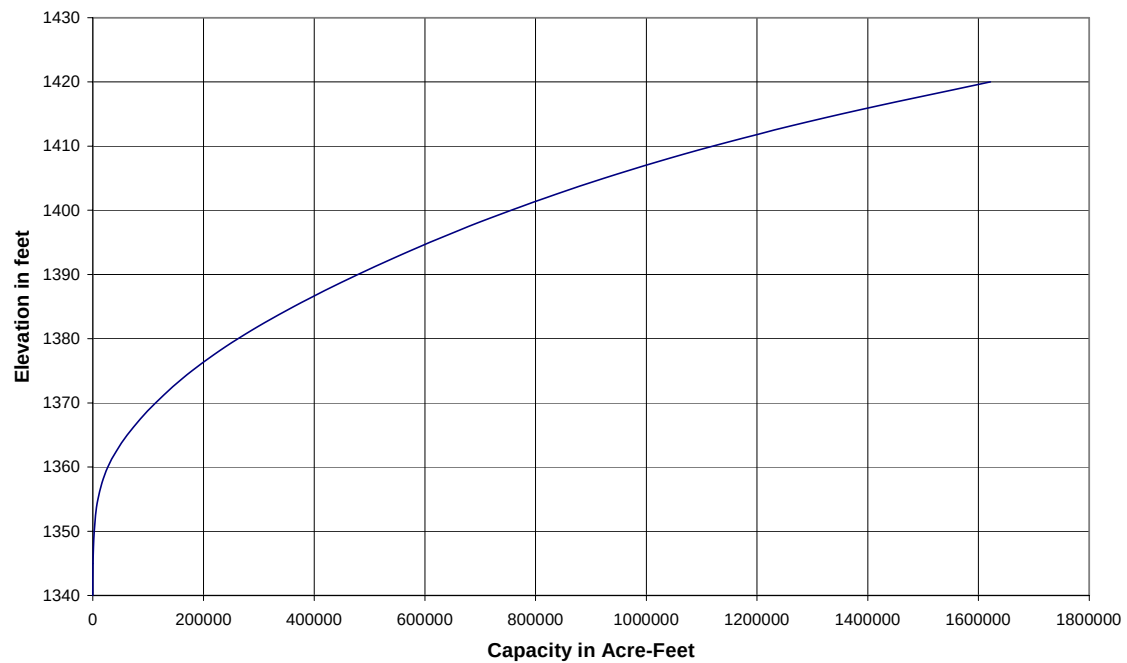


Table 2-2. Annual Pool Duration Relationships, Lake Sharpe

Percent of Time Equaled or Exceeded	Observed 1967 – 2003 Pool Elevation (Ft msl)	Simulated, DRM RCC F-99 Pool Elevation (Ft msl)
0	1,421.90	1,421.8
1	1,421.30	1,421.1
5	1,421.00	1,420.9
10	1,420.90	1,420.8
20	1,420.70	1,420.6
50	1,420.40	1,420.2
80	1,420.00	1,419.6
90	1,419.80	1,419.5
95	1,419.60	1,419.4
99	1,419.00	1,419.2
100	1,416.40	1,418.4

Table 2-3. Monthly Pool Duration Relationships, Lake Sharpe

Percent of Time Equaled or Exceeded	Pool Elevation (ft msl)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1,421.7	1,421.4	1,421.6	1,421.9	1,421.8	1,422.1	1,421.2	1,421.4	1,421.8	1,421.7	1,421.5	1,421.4
1	1,421.2	1,421.2	1,421.2	1,421.6	1,421.5	1,421.3	1,421.1	1,421.1	1,421.2	1,421.3	1,421.2	1,421.2
5	1,421.0	1,421.0	1,420.9	1,421.1	1,421.1	1,421.0	1,420.9	1,420.9	1,421.0	1,421.0	1,421.0	1,421.0
10	1,420.9	1,420.9	1,420.8	1,421.0	1,420.9	1,420.9	1,420.8	1,420.8	1,420.8	1,420.9	1,420.9	1,420.8
20	1,420.8	1,420.7	1,420.7	1,420.8	1,420.8	1,420.7	1,420.7	1,420.6	1,420.7	1,420.7	1,420.8	1,420.7
25	1,420.7	1,420.7	1,420.7	1,420.8	1,420.8	1,420.7	1,420.6	1,420.6	1,420.7	1,420.7	1,420.7	1,420.7
50	1,420.5	1,420.4	1,420.4	1,420.5	1,420.4	1,420.3	1,420.3	1,420.3	1,420.3	1,420.4	1,420.4	1,420.4
75	1,420.3	1,420.3	1,420.2	1,420.2	1,420.2	1,420.0	1,420.0	1,420.0	1,420.0	1,420.1	1,420.2	1,420.2
80	1,420.2	1,420.2	1,420.1	1,420.1	1,420.1	1,419.9	1,419.9	1,419.9	1,419.9	1,420.0	1,420.1	1,420.1
90	1,420.0	1,420.0	1,419.9	1,419.9	1,419.9	1,419.7	1,419.7	1,419.7	1,419.7	1,419.8	1,419.9	1,419.9
95	1,419.8	1,419.9	1,419.7	1,419.7	1,419.6	1,419.4	1,419.6	1,419.5	1,419.5	1,419.4	1,419.7	1,419.8
99	1,419.5	1,419.7	1,419.0	1,418.6	1,418.6	1,418.8	1,419.2	1,419.1	1,418.6	1,417.8	1,419.0	1,419.1
100	1,419.1	1,419.1	1,418.0	1,418.0	1,417.8	1,418.2	1,418.7	1,418.1	1,416.3	1,415.8	1,418.5	1,418.3

studies reflecting current regulation criteria over a long-term hydrologic record. Results of these analyses were compared with the previously developed relationships from the Missouri River Main Stem Reservoirs Hydrologic Statistics, RCC Technical Report F-99, published by the Missouri River Region Reservoir Control Center (MRR-RCC). The RCC Technical Report F-99 also contains a description of the assumptions used in the long-term computer model simulation studies.

The RCC Technical Report F-99 study was based on 31 years actual historical data from the period of 1967 through 1997, and simulating a longer period of record (1898 to 1997) using the Daily Routing Model (DRM). Updated duration and frequency relationships for this report use observed historical data from June 1967 through June 2003.

Pool Duration

Pool duration relationships are used to define the percent of time that a given pool elevation is equaled or exceeded, while release duration relationships represent the percent of time that a given release from the reservoir is equaled or exceeded. Duration curves represent the cumulative distribution function of all data recorded at the site, and can be based on annual or seasonal periods. Seasonal duration curves can be defined to represent particular months or seasons such as the navigation or non-navigation season. A duration curve is not a probability curve. It should not be interpreted on an annual event basis because it provides only the fraction of time that a given event was exceeded and not the annual probability of an event occurring. It can be used to determine the average number of days per year that a particular magnitude is equaled or exceeded if it is an annual duration curve or the number of days during a particular month or season if it is a seasonal duration curve. Duration curves are developed using class interval analysis. Class interval analysis involves subdividing the data into defined class intervals and computing the relative frequency of each class interval based on the number of data within each class. For this report monthly and annual pool duration relationships were developed using the HEC-STATS computer program with daily data. Table 2-2 shows the observed and simulated annual pool elevation duration relationships for various percentages of time in which the values are equaled or exceeded. Table 2-3 shows observed monthly pool elevation duration relationships.

Figure 2-2 shows the maximum, median, and minimum pool elevations for each month along with the upper and lower Decile and Quartiles for Lake Sharpe. The Upper Quartile relationships represent the pool elevation equaled or exceeded 25% of the time. The Lower Quartile relationships are the pool elevations equaled or exceeded 75% of the time. The Upper and Lower Decile relationships represent pool elevations equaled or exceeded 10% and 90% of the time respectively. The median pool elevation represents the elevation equaled or exceeded 50% of the time.

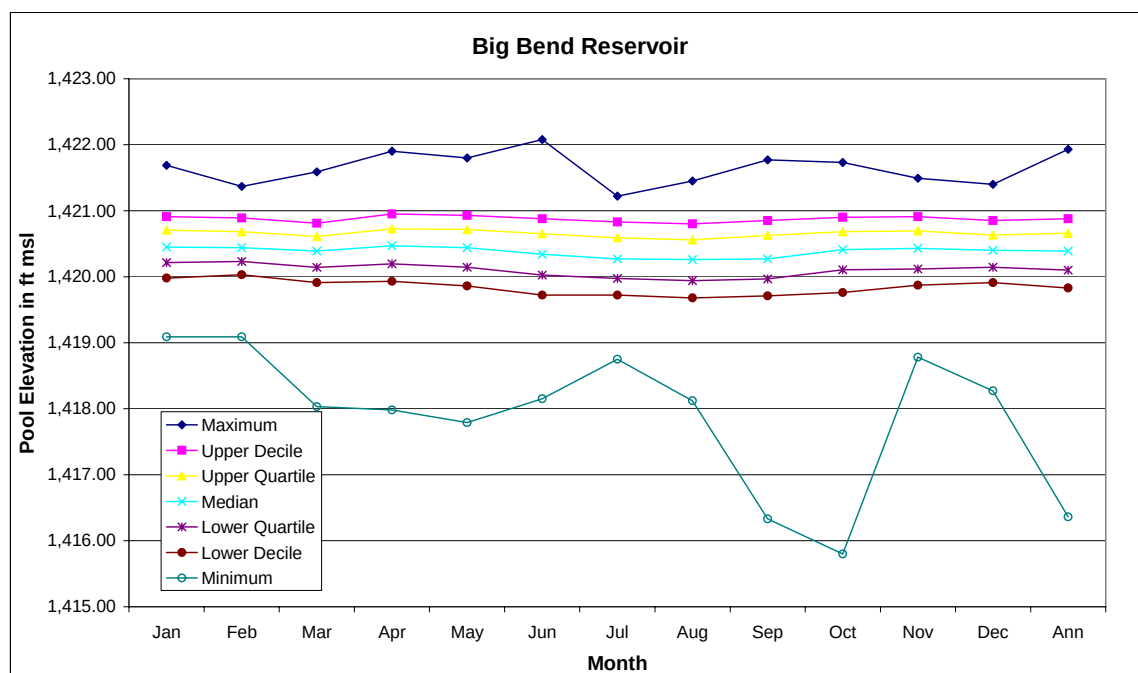


Figure 2-2. Monthly Pool Duration Relationships

Release Duration

Table 2-4 shows the observed and simulated annual release duration relationship for various percentages of time in which the values are equaled or exceeded. Table 2-4 also shows the observed hourly release duration relationship for various percentages of time in which discharges are equaled or exceeded. Table 2-5 shows observed monthly release duration relationship on a daily basis, while Table 2-6 shows the observed monthly release duration relationship on an hourly basis. As can be seen, hourly flow values are often quite different than daily flow values, due to the peaking hydropower operation of Big Bend Dam.

Table 2-4. Annual Release Duration Relationships, Big Bend Dam

Percent of Time Equaled or Exceeded	1967 - 2003 Observed Daily Release (cfs)	1967 - 2003 Observed Hourly Release (cfs)	RCC F-99 Simulated, DRM Release (cfs)
0	73,300	108,100	74,300
1	57,300	92,100	57,700
5	49,200	75,300	49,400
10	43,900	62,700	44,600
20	37,000	48,600	37,500
50	25,200	14,500	25,400
80	11,500	0	11,600
90	4,540	0	4,700
95	84	0	0
99	0	0	0
100	0	0	0

Table 2-5. Monthly Release Duration Relationships, Daily, Big Bend Dam

Percent of Time Equaled or Exceeded	Release (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	56,500	57,300	69,200	68,000	55,700	71,000	74,300	67,100	66,100	65,700	63,700	58,600
1	47,500	42,200	48,200	56,400	50,000	53,300	57,900	61,400	59,400	59,700	58,100	52,300
5	40,600	35,400	38,200	45,300	44,200	47,900	52,800	54,500	52,500	52,600	53,100	41,100
10	36,600	32,100	34,800	39,500	40,000	44,400	47,900	51,600	48,500	46,800	45,600	36,900
20	31,700	28,400	30,000	32,800	34,200	38,400	42,000	46,200	44,200	38,700	37,900	32,000
25	30,000	27,000	28,300	30,900	32,600	36,500	39,800	43,800	42,000	35,600	35,100	30,200
50	22,400	20,100	20,300	23,000	24,200	27,200	31,400	33,900	31,400	24,700	24,200	22,600
75	13,700	11,300	10,600	12,000	12,900	16,200	19,500	23,500	19,800	15,000	12,400	13,600
80	11,200	7,940	8,360	9,140	10,400	13,300	16,300	20,100	16,700	12,100	10,300	10,800
90	4,000	2,200	3,400	3,300	4,800	6,900	8,100	10,700	8,700	3,500	4,300	3,800
95	200	0	0	0	1,100	1,800	3,000	5,900	2,700	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0

Table 2-6. Monthly Release Duration Relationships, Hourly, Big Bend Dam

Percent of Time Equaled or Exceeded	Release (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	99,200	99,000	100,300	104,700	107,100	104,200	108,100	104,400	104,800	106,400	100,100	99,600
1	81,400	74,600	79,000	91,000	87,500	91,900	101,000	101,300	92,500	88,000	92,600	85,500
5	62,300	59,900	61,500	67,800	65,700	76,500	87,500	89,600	81,300	74,600	78,300	70,500
10	54,900	48,900	50,100	53,900	54,400	64,300	75,600	78,100	74,000	63,500	68,500	59,000
20	44,600	37,000	36,100	39,700	43,200	50,500	61,000	62,400	61,100	48,100	48,700	45,500
25	36,800	35,600	36,000	37,700	38,300	45,200	50,900	57,200	51,200	40,100	45,900	36,600
50	14,500	12,500	13,300	14,200	14,400	14,800	15,000	23,000	23,500	17,100	14,200	13,400
75	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0

Pool Probability

Pool-probability relationships are used to define the annual probability of the reservoir pool level reaching or exceeding a certain elevation. Current standards are to express the probability in terms of annual percent chance of exceedance. The percent chance of exceedance is equal to the annual exceedance probability multiplied by 100. Once the exceedance probability is estimated, the recurrence interval or return period can be computed as the reciprocal of the of the exceedance probability. Table 2-7 shows adopted pool elevation probability relationship from the RCC Technical Report F-99.

Table 2-7. Pool Elevation Probability, Lake Sharpe

Percent Chance Exceedance	Return Period (years)	Elevation (Ft. msl)
50	2	1421.3
20	5	1421.5
10	10	1421.8
2	50	1422.2
1	100	1422.4
0.2	500	1423.0

Release-probability relationships are used to define the annual probability of making a release from the reservoir equal to or greater than a certain discharge. For an uncontrolled reservoir, the release probability relationship may be derived directly from the pool probability relationship and a fixed elevation-outflow relationship since the maximum outflow is a function of the maximum pool elevation. For a regulated reservoir, such as those that comprise the Missouri River Main Stem reservoir system, the release-probability relationship must be determined independently of the pool-probability relationship since maximum releases do not necessarily correspond with maximum pool elevations.

For Big Bend, maximum releases are dependant on a variety of factors in addition to the pool elevation within the reservoir. These factors include downstream flow targets for flood control, navigation, water supply, and environmental needs, hydropower requirements, recreation, and intra system balancing for all authorized purposes. Duration of the maximum releases can vary considerably from year to year. Therefore, if the duration or volume of the maximum releases is of concern, the release probability relationships defined in this report should not be used. Additionally, releases can vary tremendously throughout the course of the day; daily discharges may not be representative of the peak hourly releases. Table 2-8 shows adopted release probability relationship from the RCC Technical Report F-99.

Table 2-8. Release Probability

Percent Chance Exceedance	Return Period (years)	Daily Release (cfs)	Peak Hourly Release (cfs)
50	2	55,000	103,000
20	5	61,000	105,000
10	10	65,000	107,000
2	50	72,000	109,000
1	100	75,000	110,000
0.2	500	80,000	110,000

2.3. HYDROLOGY AND GROUND WATER

2.3.1. Hydrology

The drainage pattern of the incremental area between the Oahe and Big Bend projects is shown in Figure 2-3. West of the Missouri River, the drainage pattern is generally well defined. However, to the east of the river, there are numerous depressions and portions of the region that do not contribute directly to streamflow unless substantial amounts of runoff occur. This runoff would fill and overflow the features that normally restrict runoff.

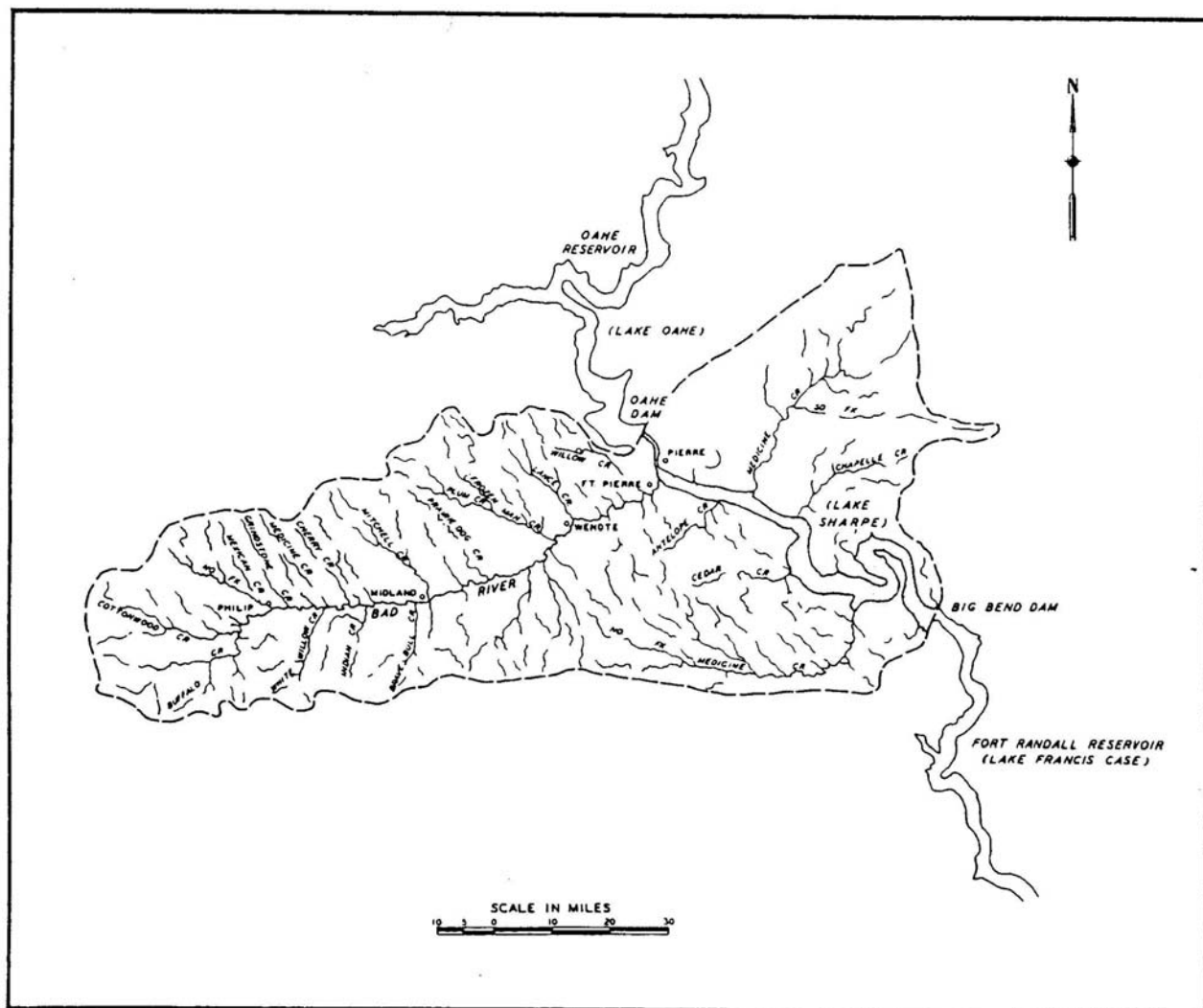
The prominent feature of the Big Bend drainage area is the single major tributary, the Bad River. The mouth of the Bad River (river mile (RM) 1065) is located in Fort Pierre, South Dakota, 78 miles upstream from Big Bend Dam and 7 river miles downstream from Oahe Dam. The 3,120-square-mile drainage area of the Bad River is located entirely in western South Dakota, is about 100 miles long, and has a maximum width of 46 miles.

The remainder of the Big Bend drainage area, about 2,720 square miles, is drained by numerous small creeks discharging directly in Lake Sharpe. The largest of these is Medicine Knoll Creek (RM 1050.5), a left-bank tributary having a drainage area of about 800 miles. This creek enters the Missouri River about 60 river miles upstream from Big Bend Dam. Another tributary, Medicine Creek (RM 1021.0), enters the Missouri River from the right bank about 33 river miles upstream

from the dam and has a drainage area of about 600 square miles. Other significant tributaries are Antelope Creek (RM 1055), Cedar Creek (RM 1032.5), and Counselor Creek (RM 990.5), all entering from the right bank, and Chapelle Creek (RM 1042) and Joe Creek (RM 1025.5), entering from the left bank.

The total fall of the Missouri River from Oahe Dam to Big Bend Dam is about 75 feet, averaging about 0.8 feet per river mile. Tributary stream slopes are significantly steeper, averaging between 5 and 8 feet per mile. Slopes of the tributaries tend to flatten toward the stream's mouth. Generally, the right-bank tributaries have comparatively narrow valleys and are entrenched some 100 to 150 feet below the surrounding uplands. The left-bank tributaries have substantially flatter slopes and, characteristically, have a lower quantity of runoff.

Figure 2-3. Incremental Drainage Area Between Oahe Dam and Big Bend Dam



Runoff from the Big Bend drainage area is extremely variable from year to year and is quite low unless severe storms occur. The primary source of the runoff is snow that accumulated during the winter months. Occasional severe storms during May and June can result in substantial runoff amounts from the basin, although the total runoff is usually very low from July until the end of the year. Winter is characterized by frozen streams, intermittent snowfall, thaws in the drainage area, and very low runoff. Ice jams are frequently experienced on tributary streams. Available records indicate that runoff from the Bad River at the Fort Pierre gage averages about 108,000 acre-feet per year.

The total average daily water inflow into Lake Sharpe, computed from U.S. Geological Survey (USGS) water resources data and other available data, is approximately 26,000 cubic feet per second (c.f.s.) with an average contribution from the Bad River of about 150 c.f.s. Throughout the year, there are several days when the Bad River contains no flow.

2.3.2. Groundwater

The source of small quantities of shallow ground water is limited to alluvium in river valleys. Shallow aquifers of less than 100 feet deep, are found east of Lake Sharpe and generally follow the courses of present streams. Deep aquifers, up to 300 feet below the surface, have not been studied as extensively as the shallow aquifers. There is little similarity between the location of the deep aquifers and present streams.

2.4. ICE AFFECTED FLOWS

Channel aggradation and high water releases from Oahe Dam, coupled with the formation of river ice under severe winter conditions, have caused the threat of periodic winter flooding in the Pierre and Fort Pierre areas since 1979. The weather conditions proceeding and during each ice event was severe, with temperatures of -10°F to -20°F, usually accompanied by strong winds. As previously stated, the major source of the channel aggradation is the Bad River's heavy sediment flow into the Missouri River at Fort Pierre. Although aggradation results in increased stages throughout the year, the combination of aggradation and ice-affected flow conditions has dramatically increased the potential for flooding along the shoreline of Pierre and Fort Pierre during the wintertime.

The peaking operation at the Oahe powerplant results in rapid increases and decreases in water releases from the powerplant which, in turn, cause rapid changes in river stages in the Pierre and Fort Pierre areas. During extremely cold periods when the head of ice is moving upstream, the rapid changes in river stage tend to break up the new ice cover and push it downstream, thus resulting in a thicker ice cover in the downstream areas. At the same time, frazil ice (made of ice crystals or granules, sometimes resembling slush, formed in turbulent water), which is being produced in the open-water reach upstream, also clings to the underside of the downstream ice cover to further add to the thickening process. As cold weather continues, the thickened ice cover eventually extends upstream until it reaches the area between the Pierre and Fort Pierre bridges. The additional roughness and reduction in flow area caused by the thickened ice cover then results in river stages from 3 to 4 feet higher than under open-flow conditions.

The resulting ice-affected condition causes minor flooding and sewer system backups, usually on the golf course and roads in the Stoesser Addition in Pierre and occasionally for the city water wells in Fort Pierre. To prevent flooding, the Corps reduces releases from Oahe Dam, preventing the Oahe powerplant from generating near capacity. This constraint on power generation comes at an unfortunate time because the same severe winter conditions that cause the ice-affected conditions also result in high demand for power generation. Because of its low elevation, Fort Pierre has the potential to experience a much greater level of ice-affected flooding than has been experienced in Pierre.

2.5. SEDIMENTATION

Sedimentation is an important factor in resource use planning at reservoir projects. It can present hazards to boaters, impair fisheries, create marshy areas, and jeopardize recreation facilities. Sedimentation increases operation and maintenance costs and determines the useful life of the lake.

The major sedimentation processes affecting Lake Sharpe are transport and deposition of watershed sediments into the reservoir, littoral drift, and erosion of banks along the shoreline. Watershed sediments are transported to Lake Sharpe via the tributaries entering the reservoir. Erosion of the banks, the product of many physical agents (wind, waves, precipitation, freeze-thaw, and so forth), redistributes sediments from the flood control zones to the multiuse zone. Littoral drift, set in motion by wind and waves, moves sediment along the shoreline. The volume and rate of sediments entering the lake or being redistributed by any of these processes must be taken into consideration when determining the usable life for any reservoir use.

Sedimentation processes must be carefully considered during the recreation planning process. Deposition and bank erosion can result in excessive maintenance costs and curtail the useful life of recreation areas. Boating facilities, such as launching ramps and harbors, can be rendered unusable as sediment accumulates on the ramps, across harbor entrances, and in embayments. Fish spawning areas can be adversely affected by silt deposition. Delta encroachment can raise the groundwater table causing flooding and other problems. Recognizing the extent of the sedimentation phenomena and planning recreational development accordingly can avoid many of these problems.

2.5.1. Sediment Deposition

Oahe Dam traps nearly all of the sediment entering Lake Oahe. Therefore, most of the sediment in Lake Sharpe originates from the Bad River, other tributaries, and from the banks surrounding the reservoir.

Major sediment deposition occurs in the headwaters and tributary inlets of the reservoir as a result of soil erosion in the upstream watershed. During heavy precipitation, the eroded material is washed into tributary streams and carried into the reservoir. As the velocity of the transporting stream diminishes, the sediment drops out to form a delta. This delta formation has encroached into the upper reaches of Lake Sharpe, the Missouri River channel, and the tributary inlets and has created problems at several recreation areas. In the upstream reaches of Lake Sharpe, a growing delta formation has caused a change in the ground water table that can ultimately cause an adverse effect to existing vegetation and convert the surrounding low-lying area into a marsh. These marsh areas are forming at the mouth of the Bad River and other tributaries.

In the inlets, the first step in the process of delta formation is the establishment of a marshy area. As the sediment continues to accumulate, the bay gradually fills in and becomes very shallow. Sediment deposition is limiting boat access at many areas. Some of the sediment is deposited on the boat ramps, decreasing the depth available to launch a boat. The accumulated sediment in the bay makes boating difficult after launching. At Lake Sharpe, most of the recreational embayments are relatively wide but shallow. Periodic dredging may be necessary to maintain boat access between the lake and the boat ramps.

An analysis of cross-section plots was made using surveys obtained at Lake Sharpe between the years 1963 and 1997. This analysis shows that the Missouri River delta is mainly moving in the downstream direction. The main river channel near upper Farm Island shows between 0 to 6 feet of

deposition (Figure 2-4). Over 14 feet of deposition has occurred in areas near the Rousseau Area and 20 plus feet of deposition has occurred in areas near DeGrey. The Cedar Creek Area (located about 27 miles downstream from Farm Island) has lately had an increase in deposition. Deposits in this area are between 5 to 12 feet in the old Missouri River channel and 2 to 4 feet on the old floodplain.

Another major source for sediment deposits is in the banks that surround Lake Sharpe. The banks consist of material that is highly erodible and does not form protective beaches. When the banks are undercut and fall into the lake, the material is transported away from shore and deposits in deeper areas of the reservoir. Locally the surface area, near the normal operating pool, increases as the shoreline recedes (overall, this increase may be offset by a loss of surface area near deltas). Presently and in the near future sediment deposits in the lower half of the reservoir contain a higher percentage of material originating from banks than in the upper half of the lake.

An aggradation assessment, which gave a cursory look at reservoir bank erosion, was completed for this area in 1999. In the study assumptions were made for unmeasured sediment load, density, and unit weight of bank and deposited material, and assumed contributions of unmeasured tributaries. However, it is believed a good sediment budget was developed which found that about 52% of the depositing Lake Sharpe sediment originates from the Bad River, about 21% from other tributaries, and about 27% from reservoir shoreline bank erosion.

Table 2-9 shows the water storage volume lost to sediment deposition from 1963 to 1997. By 1997, approximately 181,354 acre-feet of capacity had been lost, roughly a 9-percent reduction in the original storage capacity. This results in an average depletion rate of about 5,300 acre-feet per year since closure of the dam. This rate is higher than the original projected rate of 4,300 acre-feet per year. However, it should be noted that the measured rate includes 19,000 acre-feet of sediment deposited in the delta of Lake Francis Case prior to the closure of Big Bend Dam. The future long-term deposition rate is expected to be near the original projection.

2.5.2. Littoral Drift

Alongshore currents and waves in the reservoir transport eroded material along the sides of the lake. This littoral drift, primarily sand and gravel, moves along the shoreline of Lake Sharpe and forms bars or shoals across embayments. In embayments containing recreation area, this shoal or shallow-water area becomes a hazard to boaters. Littoral drift also moves into the embayments, making

them shallower and more difficult to navigate. Accumulation on boat ramps severely impairs launching capabilities and will completely bury the ramp if not periodically removed. On Lake Sharpe, littoral drift causes more sediment deposits on boat ramps than sediment inflows from upstream watersheds. Unfortunately, this means that locating boat ramps on the lake instead of in embayments would not be a solution to the problem of sediment deposition on the boat ramps.

Table 2-9. Sediment Depletion at Maximum Pool Elevation 1,423.0 msl

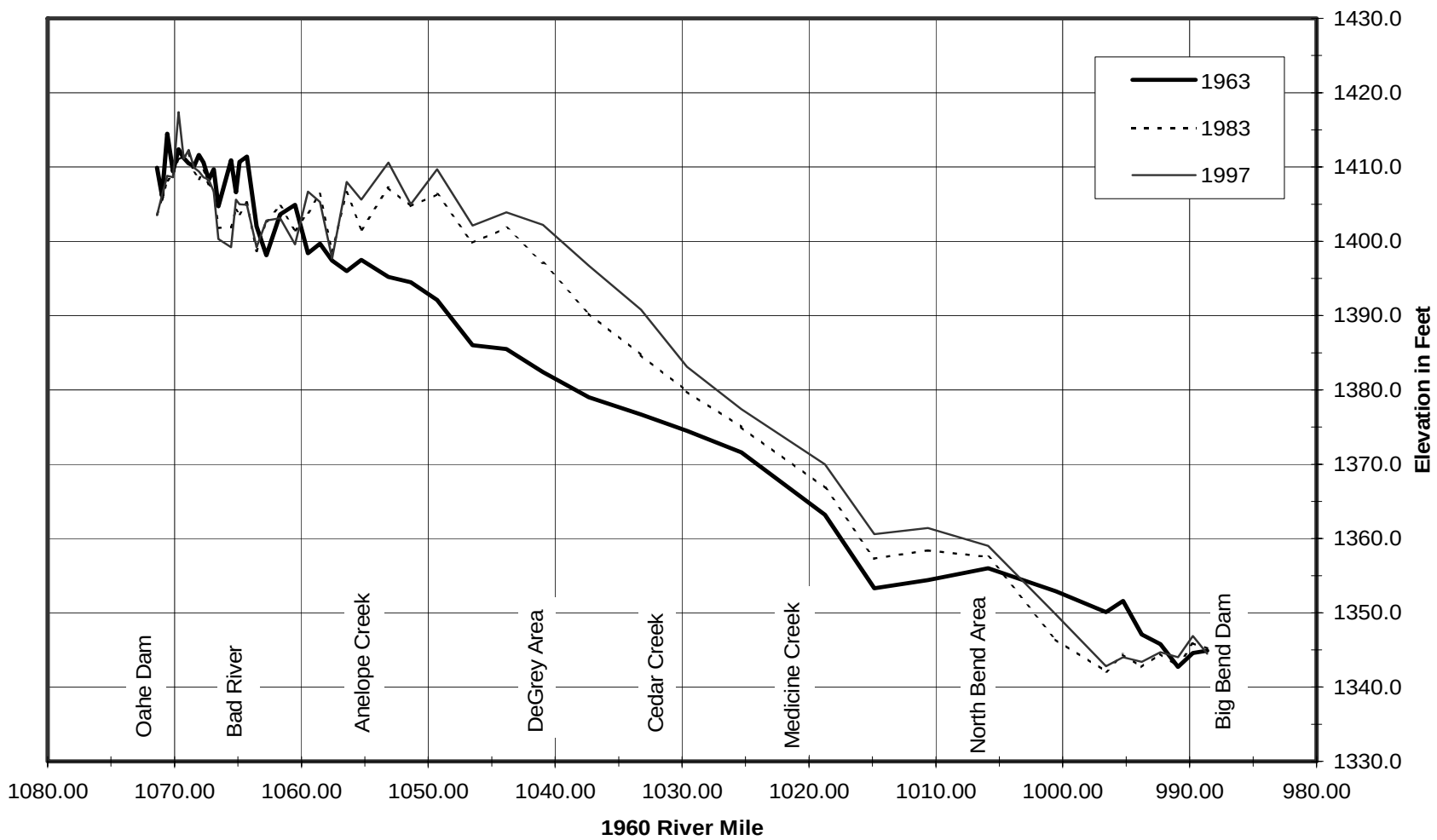
Date of Survey	Capacity (acre-feet)	Capacity Lost Since Closure (acre-feet)	Storage Loss Since Closure	
			Total Loss (%)	Annual loss (%)
1963	1,979,968	***	***	***
1971	1,914,737	65,231	3.29	0.41
1975	1,907,627	72,341	3.65	0.30
1979	1,884,003	95,965	4.85	0.30
1983	1,874,456	105,512	5.33	0.27
1991	1,859,152	120,816	6.10	0.22
1997	1,798,614	181,354	9.16	0.27

2.5.3. Shoreline Erosion

Shoreline erosion occurs at many locations around the 200-mile shoreline of Lake Sharpe. When erosion occurs close to recreational development, archeological sites or infrastructures, or encroaches on private land, it often necessitates either the protection of the shoreline, the relocation of facilities, or the purchase of additional land. The rate and extent of erosion is governed by: (1) the composition of the bank material; (2) the orientation of the bank; (3) the reservoir ice cover; and (4) the energy of the oncoming waves as determined by wind velocity, direction, and fetch. Fetch is the distance traveled by waves without obstruction.

Generally, as bank erosion progresses, the eroded material will form offshore slopes that break wave energy and tend to stabilize shorelines. However, in this area most of the banks are composed of clay. When this material is eroded, it is believed to be transported into deeper areas of the lake, precluding the formation of a protective beach. Under these conditions, erosion can continue unabated and shoreline protection measures may be considered. The relatively constant pool elevation allows the use of less costly bank protection measures than at the other main stem projects. However, the constant pool levels on Lake Sharpe allow year-round attack by the forces of wind, wave, and ice on exactly the same bank elevations.

Figure 2-4. Lake Sharpe - Thalweg Profile



Recreational development is planned with a view toward the consequences of sedimentation and bank erosion. Before facilities are constructed, an assessment of future aggradation trends in the reservoir is made and its consequences on proposed facilities determined. The extent of future bank erosion is evaluated when placing facilities near the shoreline. When establishing boat ramps, the effects of littoral drift and sedimentation are given a high priority in design consideration. Recognizing sediment phenomena and predicting the impact on development is an essential element in the recreation planning process. In addition, the effects of ice in a non-fluctuating pool should be taken into consideration when planning a boat ramp. The force of wind-driven ice can buckle boat ramps, push up berms of earth and sod in recreation areas, undercut banks, and remove sand from beaches. In the spring of 1989, the boat ramp at Cedar Creek was accordion-pleated onto the shore and 2-foot-high berms of earth and sod were pushed up in the West Bend Recreation Area. Boundary markers have been lost because of erosion and others are threatened with imminent loss. Many acres have washed away and many more acres are threatened.

Shoreline erosion is a major problem that negatively impacts water quality at Lake Sharpe. Efforts are currently underway to determine methods of controlling this problem. Such efforts will consider the impacts of shoreline erosion upon both water quality and the fishery.

There have been several experimental programs to control erosion with vegetative plantings. In 1988, vegetative plantings were made in an effort to control shoreline erosion in a tailrace area embayment. These programs were highly successful and the area is now stabilized with established vegetation. Plantings were also made in the North Shore area but these plantings were not successful because of the long fetch, the sandy soil, and the pounding of wind-driven waves. During 1989, personnel from the Lake Sharpe office and the Waterways Experiment Station (WES) collaborated in another erosion control program in the DeGrey area by using snags and wetland plants on a larger scale than had been attempted previously. The plants were growing vigorously at the end of 1994 growing season and the area has established a beach plant community.

Other efforts to control shoreline erosion have been investigated at various locations around the lake. Also, at the DeGrey area, large driftwood logs were anchored near the shoreline. Sediments have deposited in the area behind the logs and vegetation has begun to grow. Thus, the erosion process in this area has abated. South of West Bend Recreation Area, a similar procedure was tried using snow fences and drift logs. Initially the area behind the logs and fences filled in with sand and herbaceous plants. Eventually, winter ice removed the fences and logs and erosion took care of the sediment and plants.

Although riprap is the most effective solution to shoreline erosion at many locations, there are other solutions to the erosion problems at certain areas that are more aesthetically pleasing, more environmentally acceptable, and less costly. Project personnel at Lake Sharpe have made great strides in experimenting with alternatives and continue to try new techniques to control shoreline erosion. In one such procedure, tightly wound hay bales have been laid end to end near the shoreline at seven locations near West Bend and DeGrey. These hay bales effectively stop the violent force of the waves from attacking the eroded bank. Transported sediment has deposited behind the bales and vegetation is beginning to reestablish itself. As another benefit to this procedure, coarse particulate organic matter is deposited in the lake as the hay bales are broken down.

2.6. SURFACE WATER QUALITY

2.6.1. Federal Clean Water Act

In 1972, Congress enacted the first comprehensive national clean water legislation in response to growing public concern for serious and widespread water pollution. The Clean Water Act is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers, wetlands, and coastal areas. The Clean Water Act's primary objective is to restore and maintain the integrity of the nation's waters. This objective translates into two fundamental national goals: 1) eliminate the discharge of pollutants into the nation's waters, and 2) achieve water quality levels that are fishable and considered safe for swimming. The Clean Water Act focuses on improving the quality of the nation's waters. It provides a comprehensive framework of standards, technical tools, and financial assistance to address the many causes of pollution and poor water quality including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction.

Among other things, the Clean Water Act charges the states and tribes to establish water quality standards that appropriately protect waters within their jurisdiction. Executive Order 12088, Federal Compliance With Pollution Control Standards, dated 13 October 1978, requires compliance by federal facilities and activities with applicable pollution control standards in the same manner as any non-federal entity. To ensure project compliance, the Federal Facilities Compliance Act of 1990 provides for EPA and/or states to inspect federally owned or federally operated facilities that are subject to the Clean Water Act.

2.6.2. Corps Water Quality Management Program

The Corps water quality management program for civil works projects is defined by the Corps primary water quality regulation – Engineer Regulation (ER) 1110-2-8154, “*Water Quality and Environmental Management for Corps Civil Works Projects.*” ER 1110-2-8154 was updated in 1995 to encourage a holistic, ecosystem approach to water quality management.

The diversity and magnitude of impacts Corps projects and water management activities have on water quality are significant. As water moves through Corps projects, the projects alter the physical, chemical, and biological character of much of that water. Corps water control decisions determine or significantly influence whether or not Corps projects have a positive or negative impact on water quality. The impacts of projects and their operation are often far reaching, affecting the aquatic environment and its usefulness quite distant from the project.

As stewards of a significant percentage of the nation’s aquatic environment, the Corps has a responsibility to preserve, protect, and where necessary restore water quality altered by Corps projects. This requires a comprehensive understanding of the interactions of the uses and users of the aquatic environment and the impact of Corps structures and their operation on water quality. Understanding the physical, chemical, and biological processes that shape water quality conditions allows the Corps the opportunity to operate, maintain, and modify projects in ways that provide for sustainable human uses while protecting, restoring, and conserving the environmental value of the aquatic resource. The factors that determine the persistence, resilience, and robustness of aquatic ecosystems are often counter-intuitive processes and lack of understanding complicates attempts to manage them. A continuing water quality-monitoring program is critical if the Corps is to understand and effectively manage aquatic resources at its projects.

2.6.3. Data Collection

The Corps of Engineers collects and analyzes water samples six times per year at the outflow of Oahe Dam, the outflow of Big Bend Dam, at Big Bend Dam, and upstream of the dam. The outflow of Oahe Dam is considered inflow to Lake Sharpe. The United States Geological Survey collects and analyzes samples six times per year on the Missouri River near Pierre, South Dakota.

All water quality data up to 1998 are stored in the Environmental Protection Agency's Legacy STORET system. Water quality data from 1999 through the present are stored by the COE in a water quality database, Dasler. These data will be transmitted to the STORET system in 2003.

Corps and sponsor designated swimming beaches are sampled by their respective area personnel for bacterial analysis in accordance with state regulations. Any exceedance of state standards requires the closing of the beaches and retesting until the results fall within the regulations.

2.6.4. Water Quality

Lake Sharpe is used as a water supply by the South Dakota municipalities of Fort Thompson and Lower Brule. The lake may also serve as a water supply for some individual cabins, farmsteads and homes situated close to the lake, which have obtained easements to withdraw water for domestic consumption. The Mni Wiconi Water Project in Lower Brule, South Dakota provides rural water to the local area.

The City of Pierre provides secondary wastewater treatment and discharge is made directly into the lake. Both Fort Pierre and Lower Brule have sewage stabilization lagoons that discharge into the lake when the effluent meets state standards.

Lake Sharpe does not stratify, primarily because of the short water retention time, although brief periods of weak stratification can occur as a result of Lake Oahe inflows. Periodic algal blooms occurring in Lake Sharpe are the result of sufficient nutrients coupled with ideal weather conditions. Wind will disperse the algal bloom within the lake but the blooms can continue in protected embayments.

The water quality-monitoring program has detected several parameters within Lake Sharpe that exceed South Dakota water quality standards. These parameters include: sulfate, arsenic, pH, dissolved oxygen and iron. The source of this exceedance is suspected to be naturally occurring. Although state ambient water quality standards do not exist for most pesticides, atrazine has been detected in minute concentrations.

Lake Sharpe was on the 1998-303(d) list of impaired water bodies for accumulated sediment. A TMDL was developed by the state of South Dakota and approved by the EPA on February 7, 2001. Lake Sharpe was not listed by the state of South Dakota on its 2002 303 (d) list.

Few changes are anticipated within the drainage basin in the near future. With the current land uses, changes in agricultural practices will have the greatest impact on reservoir water quality.

2.7. FUTURE ACTIONS – MONITORING WATER QUALITY AT THE BIG BEND PROJECT

2.7.1. Water Quality Monitoring Goals and Objectives

The “Monitoring Strategy for the Omaha District’s Water Quality Management Program” identifies the goals and objectives for water quality monitoring implemented by the Omaha District. Of the 5 goals and 16 objectives identified in the District’s water quality monitoring strategy, the following are deemed directly applicable to monitoring at the 6 Missouri River mainstem projects, including the Big Bend Project.

Goal 1: Determine surface water quality conditions at Corps projects.

- 2) Characterize the spatial and temporal distribution of water quality conditions at Corps projects.
- 3) Determine if water quality conditions attributed to the operation of Corps projects are improving, degrading, or staying the same over time.

Goal 2: Determine if any surface water quality concerns exist that are due to the operation of Corps projects.

- 4) Determine if water quality conditions at Corps projects, or attributable to the operation of Corps projects (i.e., downstream conditions resulting from reservoir discharges), meet applicable Federal, State, and local water quality standards.
- 5) Assess water quality conditions at Corps projects in relation to potential sources, transport, fate, and effects of contaminants.
- 6) Evaluate water/sediment interactions and their effects on overall water quality at Corps projects.
- 7) Identify the presence and concentrations of contaminants in indicator and human-consumed fish species at Corps projects.

- 8) Investigate, as necessary, unique events (e.g., fish kills, hazardous waste spills, operational emergencies, health emergencies, public complaints, etc.) at Corps projects that may have degraded water quality or indicate that the aquatic environment has been impacted.
- 9) Identify pollutants and their sources that are affecting water quality and the aquatic environment at Corps projects.

Goal 4: Provide data to support reservoir regulation elements at Corps projects for effective management and enhancement of surface water quality and the aquatic environment.

- 14) Provide water quality data required for real-time regulation of Corps projects.
- 15) Collect the information needed to design, engineer, and implement measures or modifications at Corps projects to enhance surface water quality and the aquatic environment.

Goal 5: Evaluate the effectiveness of structural or operational measures implemented at Corps projects to enhance surface water quality and/or the aquatic environment.

- 16) Evaluate the effectiveness of implemented measures at Corps projects to improve water quality and the aquatic environment.

2.7.2. Data Collection Approach

Of the four data collection approaches identified in the District's water quality monitoring strategy, the following three will be utilized to monitor water quality at the Big Bend project:

- Long-Term Fixed Station Monitoring,
- Special Studies Monitoring, and
- Investigative Monitoring.

Long-Term Fixed Station Monitoring

The primary purpose of long-term fixed station monitoring at the Big Bend project is to determine water quality trends and temporal variability. Defining water quality trends and temporal variability

will directly address monitoring objectives 2, 3, and 4; and facilitate meeting monitoring objectives 9, 15, and 16. Monitoring objective 14, “Provide water quality data required for real-time regulation of Corps projects,” could be addressed through a properly located long-term fixed monitoring station; however, at this time no such monitoring need has been identified at the Big Bend project.

Deepwater Sites: A deepwater site will be established in the deeper, downstream end of Lake Sharpe near the dam. This deepwater site is meant to represent pelagic conditions present in the lake in the deepwater area near the dam. The location of these sites, if appropriate, will be at the same location where previous monitoring has occurred and been identified as a deepwater site.

Water quality grab samples will be collected at two depths at the deepwater sites: near-surface and near-bottom. The near-surface sample will be collected at approximately one-half the measured Secchi depth, and the near-bottom sample will be collected at approximately 1 meter above the lake bottom. Profile measurements will also be taken from the lake surface to the bottom in 1-meter increments. The deepwater sites are to be monitored monthly from May through September (i.e. five “evenly-spaced” samples). The five samples are to be separated by at least 21 days, but no more than 35 days.

Powerhouse Site: A powerhouse water quality-monitoring site will be maintained at Big Bend dam. Water discharged from Lake Sharpe is primarily through the powerhouse. Water quality monitoring at the powerhouse site will encompass placing monitoring probes in the “penstock” to continuously monitor water temperature, dissolved oxygen, pH, conductivity, and possibly other water quality parameters year-round. Measurements would be taken at an appropriate interval (e.g., hourly) and stored to an appropriate data logger on-site. The data stream provided by this monitoring could be made real-time if the communication network allows and it is deemed warranted.

Tailwater Site: A tailwater site will be established downstream of Big Bend dam in the Missouri River. The tailwater site is meant to represent “completely-mixed” conditions present at the start of the river reach immediately downstream of the dam. The tailwater site will be located mid-channel at an appropriate distance downstream from the dam to allow for mixing of discharges made through the powerhouse, outlet works (if they occur), and initial stabilization of the dam discharge with the atmosphere. A near-surface water quality grab sample will be collected at the tailwater site. The near-surface sample will be collected just below the surface (i.e., approximately 6 inches below the surface). The tailwater site will be monitored monthly year-round. The monthly samples collected at the tailwater site are to be separated by at least 21 days, but no more than 35 days.

Collection of monthly samples during the winter may be curtailed or sampling may be from the bank if weather and ice conditions warrant.

2.7.3. Parameters to be Measured and Analyzed

The water quality parameters that are to be monitored at the deepwater and tailwater sites are given in Table 2-10. Profile measurements will include water temperature, pH, conductivity, and dissolved oxygen (mg/l and percent saturation), and possibly ORP (i.e., oxidation-reduction potential). Explanatory variables to be quantified include lake water surface elevation and discharge through the power plant, outlet works, and spillway. Water surface elevation and discharge will be obtained on-site from the project office or after-the-fact from project records.

Table 2-10. Water Quality Parameters to be Monitored at Lake Sharpe

Parameter	Deepwater		Tailwater
	Near Surface	Near Bottom	
Total Suspended Solids	X	X	X
Total Kjeldahl Nitrogen	X	X	X
Nitrate/Nitrite Nitrogen	X	X	X
Total Ammonia Nitrogen			X
Total Phosphorus	X	X	X
Dissolved Orthophosphorus	X	X	
Alkalinity	X	X	X
Chlorophyll	X		X
Total Organic Carbon			X
Chemical Oxygen Demand			X
Chloride			X
Pesticides ¹	X	X	X
Dissolved Metals ²	X	X	X
Selenium, Total ³	X	X	X
Water Transparency (Secchi Depth)	X		X
Turbidity	X		X
Profile ⁴	X ⁵	X ⁵	X ⁶

¹ One complete pesticide scan in May or June and "Rapid Assay" for atrazine, alachlor, and metholachlor all months. The complete pesticide scan includes: acetochlor, alachlor, atrazine, benfluralin, butylate, chlorpyrifos, cyanazine, cycloate, EPTC, hexazinone, isopropalin, metolachlor, metribuzin, molinate, oxadiazon, oxyfluorfen, pebulate, pendimethalin, profluralin, prometon, propachlor, propazine, simazine, trifluralin, and vernolate.

² Only analyzed for in the month of May or June. Metals to be analyzed: Ag, As, Be, Ca, Cd, Cr, Cu, Hg, Mg, Na, Ni, Pb, Sb, Ti, Zn.

³ Only analyzed for in the month of May or June.

⁴ Profile to include: water temperature, pH, conductivity, dissolved oxygen (mg/l and % saturation), and ORP (oxidation-reduction potential).

⁵ 1-meter increments surface to bottom

⁶ Near surface only.

The primary purpose of special studies monitoring is to address specific water quality issues at the main stem projects. A special studies effort that will be implemented on a regular basis is the Rotating Mainstem Project Monitoring Program (RMPMP). The RMPMP will intensively monitor water quality at each of the main stem projects on a 5-year cycle. A selected project(s) will be monitored each year with all projects being monitored over a 5-year period. The tentative schedule for the first cycle of RMPMP monitoring is as follows:

- Gavins Point and Fort Randall (2003)
- Big Bend (2004)
- Oahe (2005)
- Garrison (2006)
- Fort Peck (2007)

Water quality data collected from the RMPMP will be used to prepare project-specific reports as identified in ER 1110-2-8154, "*Water Quality and Environmental Management for Corps Civil Works Projects*." As stated in ER 1110-2-8154, these reports are to be prepared for each project and updated as needed. These technical reports are to contain: 1) a general project description; 2) watershed characteristics; 3) physical project elements affecting water quality; 4) water quality management objectives; 5) data collection activities; 6) evaluation of water quality conditions, 7) effect of water control operations on water quality; and 8) a description of the physical, chemical, and biological processes that take place in the project, affect the project, or are affected by the project. The report is to comprehensively describe project water quality and the project's impact on water quality. It is to identify specific concerns, problems, or opportunities.

It is envisioned that RMPMP monitoring will include expanded monthly monitoring during the period May through September and possibly some winter sampling in the reservoir. An objective of the RMPMP monitoring will be to enhance the spatial coverage of collected water quality data. This will include additional sampling along the longitudinal axis (e.g., every 10 miles) and sampling in major tributary embayments of the reservoir. In addition to the monitoring of traditional water quality parameters, sediment and biological (i.e., benthic macroinvertebrates, plankton, fish tissue) monitoring may be undertaken. Water quality information needs will be determined on a project-by-project basis prior to data collection. The Omaha District's Water Quality Unit will implement the RMPMP monitoring program with assistance from project personnel.

Investigative monitoring is typically initiated in response to an immediate need for water quality information. This may be in response to an operational situation at the project, the occurrence of a significant pollution event, public complaint, or a report of a fish kill. Any Omaha District response to a pollution event or fish kill would need to be appropriately coordinated with the proper State and local agencies. The type of sampling that would be done for investigative purposes will be highly specific to the situation under investigation.

2.8. ACCESSIBILITY

2.8.1. Road Access

The Big Bend Dam/Lake Sharpe project is located in south-central South Dakota between the Fort Randall and Oahe projects. Big Bend Dam is located 25 miles north of Interstate 90 and the city of Chamberlain and 60 miles southeast of the capitol of Pierre as shown on Figure 1-2. Interstate 90 is a primary access point because it is the only east/west interstate crossing South Dakota. The east side of Lake Sharpe can be reached from South Dakota Highway 50, which runs between Chamberlain and Fort Thompson, and from South Dakota Highway 34, which runs between Fort Thompson and Pierre. Both of these roads are good all-weather highways. Access to the west side of Lake Sharpe is from South Dakota Highway 47, which runs from Interstate 90 to Big Bend Dam, and from county and Bureau of Indian Affairs (BIA) paved and improved roads from the dam to Fort Pierre. Areas at the north end of the lake can be reached from U.S. Highways 14 and 83 that run through Pierre and Fort Pierre. Access to project lands other than designated recreation areas can be difficult in some locations.

2.8.2. Rail Access

Twenty-five miles south of Big Bend Dam, a former main line of the Milwaukee Railroad, now known as the Dakota Southern Railroad, runs parallel to Interstate 90 at Chamberlain. This line provides freight service but not passenger service to the areas south of the dam. The Chicago and North Western Railroad (CNW) cross the Missouri River in Pierre, and then run parallel to the lake from Pierre to the Rousseau Recreation Area, 15 miles to the southeast. This spur line provides only freight service to the northern portion of Lake Sharpe.

2.8.3. Air Access

Both Northwest Airlines and United Airlines provide commercial air service to Pierre. Flights are scheduled throughout the day on small commuter aircraft (usually 25 seats or less). A small municipal airport is operated at Chamberlain. Although no public air transportation service is available to Chamberlain, the airport is extremely busy during the hunting season for use by private planes.

Seaplane use of Lake Sharpe is allowed if the rules, regulations, and restrictions contained in the Corps' Seaplane Landing Plan (Omaha District Pamphlet 1125-2-1) are followed. In addition, these aircraft must adhere to the prescribed federal, state, and local statutes. Lake Sharpe is closed to all seaplane operations from September 15 until December 31 each year.

2.8.4. Lake Navigation

Lake Sharpe is classified as a navigable water of the United States. Although no commercial water travel exists on Lake Sharpe, private recreational boats can navigate from Fort Thompson and the dam area upstream to Pierre and Oahe Dam. Fuel and harbor accommodations are available at Pierre. Boat operators are encouraged to participate in a Coast Guard-approved training course.

2.9. CLIMATE

South Dakota is situated in the heart of the North American continent and has a continental-interior climate; characterized by cold winters, hot summers, and little precipitation in the winter. This is a land of climatic extremes that can periodically devastate the local economy and have disastrous effects on wildlife. Weather-related natural disasters that have occurred in South Dakota are dramatic, ranging from blizzards and droughts to plagues of grasshoppers and prairie fires. Sudden weather changes are typical. The Guinness Book of Records lists the world's most freakish temperature rise, 49°F in 2 minutes, as occurring in South Dakota. South Dakota also holds other records for weather extremes. Weather tends to be cyclical with periods of drought occurring in uneven cycles.

The air is generally clear with excellent visibility. The percentage of possible sunshine ranges from 75 percent in July to 50 percent in December and averages about 63 percent. The following climatic data for Lake Sharpe are based on averages of the many extremes.

2.9.1. Temperature And Humidity

Temperatures range from in excess of 110°F in the summer to less than –30°F during the winter. Because of large air masses entering the area from the north and south, air temperatures may vary greatly from day to day. During the summer, hot spells are frequent and cool days are occasional. As shown in Table 2-11, the average daily maximum temperature during the summer at Lake Sharpe is 88°F and the average daily minimum temperature is 60°F. The high temperatures are usually accompanied by low humidity. Because of the warm temperatures, a demand exists for water-related recreation in the area. The project is very cold in the winter when arctic air frequently surges over the area. In the winter, the average daily maximum temperature is 29°F and the average daily minimum temperature is 9°F. The frost-free period averages 140 days from approximately May 10 to September 25. Late killing frosts in the spring are not infrequent and early autumn frosts occasionally occur.

Lake Sharpe has a long period of ice cover averaging from January 1 to April 3 (approximately 95 days). The length of time in which the ice cover occurs is due to the relatively low volume of water in Lake Sharpe as compared to other reservoirs in the main stem system. The ice cover is continuous from Big Bend Dam upstream to near Pierre and ice fishing is popular at many locations around the lake. Periodic winter flooding that has occurred in Pierre and Fort Pierre appears to be attributable to the ice cover on the reservoir, extreme cold, high winds, Oahe Dam release patterns, developing aggradation, and Lake Sharpe pool elevations.

Table 2-11. Representative Temperature Data for Chamberlain (5 miles south of Big Bend Dam) and Pierre, South Dakota (Degrees Fahrenheit)

	Average Daily Minimum Temperature		Average Daily Maximum Temperature	
	Chamberlain	Pierre	Chamberlain	Pierre
January	9	6	30	26
February	14	12	36	33
March	23	22	46	43
April	33	34	59	59
May	45	46	71	71
June	55	56	80	81
July	60	62	87	89
August	59	60	87	88
September	48	49	77	77
October	36	37	62	63
November	23	23	43	44
December	11	12	31	31
Year	35	35	59	59

Data were taken from the CD-ROM Disk "Climate Data, Vol. 12.0 Summary of the Day-Western, Hydrosphere (2001). Chamberlain (5 miles south) data were for the period 1980-2000. Pierre dates were for the period 1948-2000.

The relative humidity usually varies widely from early morning to late afternoon and occasionally from day to day. The average winter humidity ranges from about 80 percent during early morning to about 66 percent in the afternoon. In the summer, the humidity ranges from about 84 percent during early morning to about 45 percent in the afternoon.

2.9.2. Precipitation And Evaporation

Rainstorms occur most frequently in early summer, hailstorms are most frequent in midsummer, and lightning generally occurs in late summer. Table 2-12 shows how the annual precipitation decreases moving northwestward from about 20 inches at Chamberlain to about 19 inches at Pierre. The temperature and precipitation differences between the ends of the reservoir indicate the existence of a slight climatic gradient over the project area. This is also indicated by the subtle changes in vegetation, which occur from one end of the project to the other.

Approximately 75 percent of the precipitation falls during the growing season, which lasts from April through September. On the average, precipitation is heaviest during late spring and early summer.

Thundershowers are the main source of rainfall during the summer season. Thunderstorms occur on an average of 10 days per month from May through August. Hail falls in scattered small areas during some of these storms. These storms are local and of short duration and usually result in little damage to structures because of the relatively low population and lack of development. Crop damage from these storms can be severe.

Annual evaporation from the surface of Lake Sharpe averages 180,000 acre-feet/year or slightly more than 3 feet. Most of the annual net evaporation can be expected to occur during the 6-month period of July through December.

Seasonal snowfall varies from an average of 31 inches at Pierre to 23 inches at Chamberlain. Days with a snow cover of 1 inch or more average about 53 per year. Snowfall reaches a maximum in February and March, although total winter snowfall is normally not too heavy. Strong winds often accompany snowfall and cause large drifts in or near sheltered areas, while much of the open ground is free of snow.

Blizzards occur several times each winter and are a major threat to travelers, livestock, and wildlife.

Table 2-12. Representative Precipitation Data for Chamberlain (5 miles south of Big Bend Dam) and Pierre, South Dakota (Inches)

	Average Precipitation		Average Snowfall	
	Chamberlain	Pierre	Chamberlain	Pierre
January	0.43	0.47	4.26	5.17
February	0.69	0.6	5.94	6.11
March	1.08	1.05	4.68	7.11
April	2.35	1.92	1.21	2.73
May	3.14	2.88	0	0.24
June	3.59	3.7	0	0
July	2.45	2.4	0	0
August	2.05	1.95	0	0
September	1.83	1.34	0	0
October	1.09	1.25	0.13	0.66
November	0.64	0.56	1.92	3.62
December	0.62	0.55	4.98	5.58
Year	19.96	18.67	23.12	31.22

Data were taken from the CD-ROM Disk Climate Data, Vol. 12.0 Summary of the Day-Western, Hydrosphere (2001). Chamberlain (5 miles south) data were for the period 1980-2000. Pierre data were for the period 1948-2000.

2.9.3. Wind

Wind has a significant effect on project resources in several different ways. Although erosion from wind-driven waves is a significant problem, wind also affects the comfort and safety of visitors, particularly when they are on or in the water.

Table 2-13 shows the percentage of time the wind is coming from a compass direction. The prevailing wind direction is from the south and southeast during the spring and early summer and from the north and northwest during the fall and winter. Wind speeds are often moderate at midday and almost calm at night, averaging 11 miles per hour year-round. Strong winds exceeding 50 miles per hour or more can occur during any month. High winds frequently accompany seasonal cold and warm air masses and summertime thunderstorms and considerable damage is caused by straight-line thunderstorm winds. Tornadoes may occur, with an average of 29 funnels sighted per year within the state. The state's tornadoes seldom cause great structural damage because of the widely spread population centers. However, the Lake Sharpe visitor center was destroyed and several project maintenance buildings and private residences were damaged during a tornado that hit the Big Bend Dam/Fort Thompson area in June 1992.

Table 2-13. Wind Direction in Percent

Compass Direction	Percent of time wind comes from compass direction
N	13
NE	8
E	8
SE	19
S	23
SW	7
W	7
NW	15

2.10. TOPOGRAPHY, GEOLOGY, AND SOILS

2.10.1. Topography

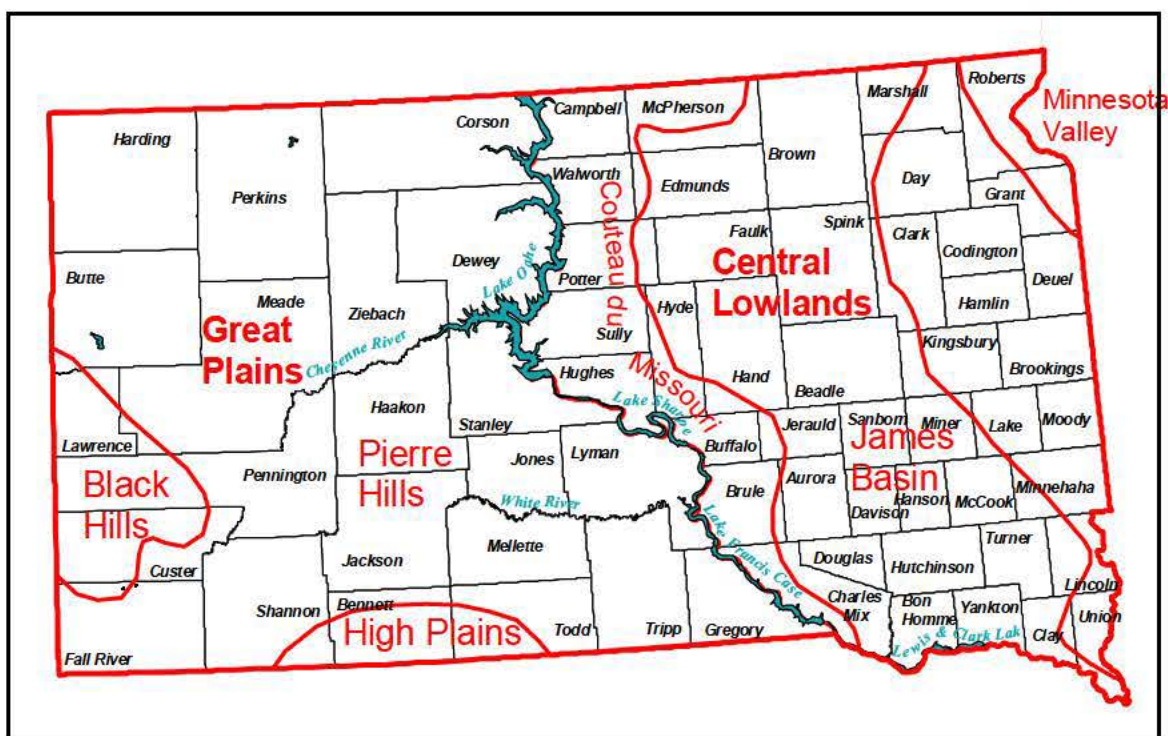
The surface of South Dakota is generally a sloping plateau from the northwest to southeast, as if tipped on its diagonal. The landscape is typified by rolling hills, spacious grass-covered prairies, and bluff-bordered rivers. The State of South Dakota is divided into two main major physiographic provinces, predominantly the Great Plains Province and the Central Lowlands Province (Figure 2-5). Excluding the High Plains and the mountainous Black Hills, the Great Plains Province can be subdivided into Coteau du Missouri (the glaciated) region and the Pierre Hills (the unglaciated) region. The Missouri River is the approximate line of demarcation for these two areas. The eastern third of the state falls into the Central Lowlands Province.

Most of the Big Bend Dam/Lake Sharpe project lands are located within the Great Plains Province. Although the Lake Sharpe drainage area includes only a small portion of land in the Central Lowlands Province, recognizing the features, which differentiate the two provinces, is important in understanding the topography of the Lake Sharpe area.

The formerly glaciated Central Lowlands area in eastern South Dakota consists of gently rolling hills in which stream dissection and drainage are not well established except in areas immediately adjacent to the river. Drainage in upland areas is largely into potholes, small intermittent lakes, and a few larger permanent lakes. In some areas, from 100 to 400 feet of glacial debris were deposited on the original surface of the land.

During the Pleistocene epoch, ice sheets moved into South Dakota from the north, blocking the streams flowing eastward from the Rocky Mountains and forcing the impounded waters to cut their way along the western edge of the glaciers, forming the present channel of the Missouri River. East of the Missouri River, in the Coteau du Missouri subdivision of the Great Plains Province, melting glacial waters formed lakes and carved out new river valleys; therefore, this topography is still considered "young" and the drainage systems are considered to be incomplete. Along the eastern border of this subdivision, the ice sheets built up moraine ridges; created plains by leveling off high points and filling in low places, and left behind debris--boulders, gravel, and fine sand.

Figure 2-5. Physiographic Divisions, South Dakota



The Pierre Hills subdivision was not glaciated and numerous small, hilly areas with high buttes and rough canyons characterize the region. This constitutes the largest topographic section in South Dakota. The west side of Lake Sharpe is in this subdivision. There are small, nearly level areas on the stream divides, although the region as a whole is rolling and rather thoroughly dissected by streams.

To demonstrate this difference in topography, one needs only to look at the area around the dam. The natural slope of the right abutment of the dam rises abruptly from about elevation 1,350 m.s.l. to 1,460 feet m.s.l., forming a steep bluff. Maximum elevation of the right valley wall is about 1,620 feet m.s.l. In the area of the left dam abutment, the valley wall rises more gently from the floodplain to the top of a bluff line at elevation 1,455 feet m.s.l. The area extending beyond the abutment is a relatively level glacial terrain.

2.10.2. Geology

The geology of South Dakota near the Big Bend Dam/Lake Sharpe project consists of rock units from the Cretaceous era. The bedrock of the area consists of essentially flat-lying sedimentary rocks of marine origin. Prior to the deposition of the Cretaceous rocks, inner-continental seas periodically covered the area.

The deposition of marine sedimentary rock in these seas was repeatedly interrupted by periods of non-deposition and erosion. At the beginning of the Cretaceous era (about 135 million years ago), stream and swamp sediments were deposited. A shallow sea in which thick layers of shale, sandstone, and limestone were deposited then covered the area. The Pierre and Niobrara formations are part of these sediments. Volcanic ash falling into the sea and settling to the bottom formed the bentonite layers in the Pierre and Niobrara formations. Fluctuations in the depth of the sea produced variations in the bedding characteristics within the Pierre Shale formation. When the sea bottom was deep enough to be beyond the depth of influence of surface waves, sharp shale-bentonite contacts and shale bedding laminations were developed.

Around the end of the Cretaceous era, the sea withdrew and erosion of the marine sediments began. By the early Pleistocene era (about 1 million years ago), the area was drained by eastward flowing streams draining into the Hudson Bay region and the Gulf of Mexico. As a glacier moved westward up the stream valleys, water ponded in each valley ahead of the glacier. This caused the deposition of sediments in the lakes that formed in the stream valleys west of the glacial margin. The level of these lakes rose until the water spilled over the divides between them and cut a continuous channel. This channel then began carrying runoff from the west and glacial melt water from the north and east. The glacier margin was then located approximately at the present position of the Missouri River. As the glacier retreated, the topography east of the Missouri River Trench was smoothed and the stream valleys were partially filled with glacial debris.

Three dominant formations are present in the Big Bend Dam/Lake Sharpe project area. These formations are (in ascending order) the Carlile Shale, the Niobrara Chalk, and the Pierre Shale. The formations in the project area lie on the northeast flank of a broad northwest plunging anticline. The anticline underlies central and north-central South Dakota. The result is a very gentle dip of the formations to the northwest. Except for some minor flexures, the formations can be assumed to be horizontal.

The Carlile Shale formation is neither exposed in the area nor related to any of the foundation excavations; however, it was encountered in a few of the deeper holes at another site on the project. The Niobrara Chalk formation supports all of the appurtenant structures at the project. The formation is a gray, medium-hard, impervious, argillaceous chalk or chalky shale derived chiefly from marine microorganisms and precipitates of calcium carbonate materials. It occurs in nearly horizontal strata that vary from a few inches to several feet in thickness. Bentonite, bentonitic clay, and shale seams occur throughout the formation. The chalk weathers to a tan or buff color and does not readily deteriorate by natural weathering but tends to spall (break off chips or slabs) rapidly when subject to freezing action.

The Pierre Shale formation overlies the Niobrara Chalk formation and occurs in the spillway and powerhouse intake and discharge channels; however, it does not comprise any of the foundation bedrock at the project, except for a short embankment section between the powerhouse and right abutment. The formation is a gray to dark gray compaction-type shale composed chiefly of clay and silt constituents. It has well-defined bedding planes and includes numerous bentonite and bentonitic shale seams.

Undoubtedly, minor folding and faulting has occurred in the area due to regional stresses. However, along the riverbank and at other bedrock exposures, the local slumping of the Pierre Shale formation obscures any effects of regional folding.

2.10.3. Soils

Soil is produced by the action of soil-forming processes on parent material that was deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by: (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material accumulated and weathered, (3) the plant and animal life on and in the soil, (4) the relief or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material.

Differences in these soil formation factors result in different soil characteristics. Soils, which have similar profiles, are classified by the Natural Resources Conservation Service (NRCS) as belonging to the same soil series. Two or more soil series are combined to form a soil association, which is a group of soils geographically associated in a characteristic pattern. The soil associations found

within the Big Bend project are described below.

Most of the soils of South Dakota are very fertile and yield abundant crops if the rainfall is adequate. Variations in soil types occur as a result of the diversity in geology, topography, and climate. The difference in color and the accumulation of carbonates in the subsoil are the result of rainfall variations. The soil associations present at Lake Sharpe are listed in Table 2-14. Most of the soils on both banks of the Missouri River in the Lake Sharpe area are classified in the Chestnut groups. The Chestnut soils east of the river are comprised of various clay loams and sandy loams. The surface soils are a dark brown or dark grayish-brown color. West of the Missouri River, the Chestnut groups also include the Pierre soils.

The Pierre soils are distinguished by their heavy, sticky nature and moderately dark surface color and by dense clayey or shaly subsoils. These are unglaciated soils formed mostly from the weathering of various shales. They form a slick mire when wet, tend to cake when dry, and do not absorb moisture readily. An intractable clay layer near the surface makes them difficult to cultivate. The Pierre soils dominate the central part of the state west of the Missouri River. When they receive adequate moisture, the Chestnut and Pierre soils provide high yields of wheat and other small grains. They are, however, the typical soils of the cool and temperate semiarid grassland and are known for their value as grazing land.

Soils found within the Lake Sharpe area vary in their suitability or limitations for particular uses. Potential problems posed by soils for a particular kind or level of development must be identified during the early stages of planning for that development so that recreation areas, roads, and structures can be properly sited; vegetative plantings can contain appropriate species and utilize special planting techniques if needed; and the proper type and location of a waste disposal system can be selected. Detailed information on locations, characteristics, suitabilities, and limitations of specific mapping units within each soil series is included in each specific county's soil surveys published by the NRCS.

Table 2-14. Soil Associations of the Big Bend Dam/Lake Sharpe Project

<u>Oahe-Delmont</u> - Well-drained and somewhat excessively drained, nearly level to rolling loamy soils that are shallow or moderately deep over sand and gravel on outwash plains and terraces. Most soils in this association support native grass. (Buffalo County)
<u>Lowrv-Sully</u> - Deep, well-drained, nearly level to steep silty soils on uplands. About 60 percent are in cropland. (Buffalo County)
<u>Sansarc-Opal-Chantier</u> - Shallow and moderately deep, well-drained, gently sloping to steep clayey soils on uplands. These soils support native grasses and grazing and landslides are common in steeper areas. (Buffalo County)
<u>Lowrv-Azar</u> - Nearly level to gently sloping, deep well-drained silty soils that formed in loess on uplands and terraces. Of medium fertility, erosion risks are slight. Most areas are cultivated. (Hughes County)
<u>Gettys-Betts</u> - Rolling to steep, well-drained to excessively drained loamy soils that formed in glacial drift and glacial till on uplands. These soils are low in fertility with slight to severe hazards of erosion. Almost all of this association is in native grass. (Hughes County)
<u>Sansarc</u> - Shallow, strongly sloping to steep, well-drained clayey soils that are shallow over shale on uplands. These soils are low in fertility, have slow permeability, and have a severe risk of erosion. All areas are in native grass. (Hughes County)
<u>Munior</u> - Nearly level, well-drained, deep, and loamy soils that formed in stratified sandy alluvium on bottomland. These soils are low in fertility. The risk of erosion is slight and soil blowing is moderate. Many areas are under cultivation, but these soils have a potential for recreation, park, and wildlife uses. (Hughes County)
<u>Schamber</u> - Excessively drained, nearly level to moderately sloping silty soils on uplands and terraces. (Stanley County)
<u>Lowrv</u> - Deep, well-drained, nearly level to moderately sloping silty soils formed in loess on uplands and terraces. (Stanley and Lyman Counties)
<u>Swanboy-Wendre-Nimbro</u> - Deep, well-drained and moderately well-drained, nearly level and gently sloping clayey and silty soils on low terraces, alluvial fans, and floodplains. (Stanley County)
<u>Sansarc-Onal</u> - Shallow and moderately deep, well-drained, moderately sloping to steep clayey soils on uplands that formed over shale. (Stanley, Hyde, and Lyman Counties)
<u>Wendre-Bullcreek</u> - Deep, moderately well-drained, nearly level, and gently sloping clayey soils formed in alluvium. (Lyman County)

2.11. LAND USE

Prior to its purchase by the Corps of Engineers, project land was primarily used for farming and grazing. Local residents for firewood, rough lumber, and fence posts cut portions of the timbered Missouri River bottoms.

Today, agriculture represents the primary use of 95 percent of the land in the five counties adjacent to Lake Sharpe in the Missouri River Basin. The remainder is devoted to recreation, wildlife, transportation, and urban areas. Of the total agricultural area, 55 percent is used for pasture and range and 45 percent is used for cropland. Woodlands are restricted to bottomlands adjacent to streams and areas where plantings have been made. Water bodies in this drainage make up about 1 percent of the total area, but the rivers, lakes, reservoirs, farm ponds, and other bodies of water are extremely important to the region's economy.

2.12. BORROW AREAS AND UTILITIES

The large power transmission lines, supporting stations, and substations located in the area of the dam and powerhouse are the only major utilities on the project. The transformer yard located north of the Big Bend project is one of the largest in the United States.

The materials that were required for the construction of the Big Bend Dam was obtained from borrow areas around the project. Currently, no active borrow sites are located on project lands. However, abandoned borrow sites are located in the North Shore, Iron Nation North, and Old Fort Thompson Recreation Areas. The borrow site at the North Shore Recreation Area was used as a spoil site when the embayment at the North Shore boat ramp was dredged. If leveled, the borrow/spoil site at the North Shore Recreation Area could serve as a primitive camping area. At the Iron Nation North and Old Ford Thompson Recreation Areas, the borrow sites have been revegetated and are currently managed as wildlife habitat.

Any sand and gravel material that is necessary for project operations is purchased by contract. The material is then hauled into areas on Lake Sharpe when needed.

2.13. VEGETATION RESOURCES

Terrestrial vegetation on the Big Bend project lands is typical of that found in the northern Great Plains. Mixed prairie vegetation dominates the landscape but ribbons of eastern deciduous woodland are found on the floodplains along the larger intermittent drainageways, along the free-flowing reach of the Missouri River below Oahe Dam, and within many of the larger draws along the main stem and its tributaries. Eastern red cedar woodlands have developed in several of the upland draws in the lower part of the project. A periodically flooded area below Big Bend Dam supports wetland scrub-shrub and forested vegetation. Patches of shrubland often border the bottomland woodlands but may also exist in favorable areas within draws and north-facing slopes of the uplands. Numerous tree plantings for wildlife habitat exist on the upper terraces and benches and on nearly flat bottomlands along entering tributaries. Areas dominated by clay soils occupy most of the landscape around Lake Sharpe. Western wheatgrass and green needlegrass, both mid-height species, are usually the dominant species with the short grasses, such as blue grama and buffalo grass, as secondary species. When such sites are overgrazed or otherwise disturbed, the mid-height grasses are replaced by the short grasses and a disclimax short-grass prairie quickly develops. (A disclimax is a relatively stable ecological community often including species foreign to the region).

Fertile land developed in loess, coarser bedrock, or glacial till can be found on the broad tablelands or on lower terraces along the lake. These areas have good moisture-retention capabilities and support mid-height grasses, such as green needlegrass and Western wheatgrass. Grasses, including needle-and-thread, porcupine, big bluestem, little bluestem, and side oats grama, may also occur. Forbs such as lead plant and snowberry are abundant in these areas and shrubs are common.

A few range sites around Lake Sharpe are located within draws or on low alluvial terraces containing medium-textured alluvium where added water is received each year because of slope or drainageway runoff. Warm-season, tallgrass vegetation dominates these sites. Predominant species include big bluestem, Indiangrass, and switchgrass. Mid-height species in these areas include side oats grama, little bluestem, and green needlegrass.

On steeply sloping land, Pierre Shale outcrops support a community characterized by sparse cover of low-growing shrubs and herbs that are tolerant of high salinities and other unfavorable soil conditions. A Slick spot community, similar to the Pierre Shale community in its sparse cover and salt-tolerant vegetation, is less common but occurs on bottomlands and lower slopes.

Aquatic vegetation at Lake Sharpe is most extensive in the upstream reach near the Bad River delta. Lesser areas are found within the embayments and deltas of entering tributaries. Rooted emergent forms, such as river pondweed, are common in the embayment areas, such as the Good Soldier Bay. An epiphytic algae community is also present in shallow, clear water and may be attached to macrophytes, rock, or logs.

2.13.1. Bottomland Woodlands

Bottomland woodlands, considered as an extension of the eastern deciduous forest by biogeographers, are best developed on La Framboise Island and Farm Island, but small tracts also exist along the right bank of the Missouri River between Oahe Dam and Fort Pierre and along the left bank downstream from Pierre. These woodlands also exist along several of the tributaries on both sides of the lake.

Along the east side of the lake, they are found along the lower floodplains of the following streams: Medicine Knoll Creek, Chapelle Creek, Joe Creek, an unnamed stream near West Bend, Chaney Rush Creek, Soldier Creek, Campbell Creek, and Cow Creek. On the west side, the floodplains of Cedar Creek, Medicine Creek, and Antelope Creek are partially wooded.

A study of Farm Island woodland vegetation was completed shortly after the filling of Lake Sharpe. At the time of the study, mature stands of cottonwoods were dominant but smaller amounts of green ash, American elm, box elder, peach leaf willow, and eastern red cedar were also present. Dogwood, smooth sumac, gooseberry, chokecherry, and numerous other native shrubs dominated the understory. Stress on the forest was noted as a result of the rising water table, and, since 1966, the bottomland forest at Farm Island has greatly deteriorated as predicted. The canopy has opened because of the die-off of most of the cottonwoods and is only partly being replaced by other trees, such as red cedar, green ash, and Russian olive. There is essentially no cottonwood regeneration taking place. The understory has probably changed less in terms of composition and cover; however, skunkbush, sumac and buffaloberry stands are being reduced in vigor and cover through overbrowsing by deer.

The cottonwood forest on La Framboise Island is younger and was probably regenerated after the large flood of 1952. While there is no imminent danger of die-off, production and successional dynamics in this forest are likely to be impeded by the lack of flooding.

There has been evidence of erosion on the upstream end of both La Framboise Island and Farm Island. In the mid-1980s, riprap was installed on the upstream end of La Framboise Island to provide bank protection. Although this effort has been successful at slowing the erosion process, additional protective measures will eventually be needed to protect the floodplain forests found on both islands.

The woodlands of the tributaries are shorter in height, less diverse in species composition, and less valuable for wildlife habitat than the main stem bottomland forests. These forests tend to be dominated by bur oak, green ash, and box elder. The taller cottonwoods are largely absent, but a shrubby understory composed of wild plum, chokecherry, snowberry, and other species is typically present in areas where grazing is better managed. The effects of grazing on these woodlands have not been examined; however, many of these areas are located on Federal lands, are fenced, and are not subjected to grazing.

2.13.2. Woodland Draws

These woodlands are located within upland draws and on northerly and easterly slopes, especially in the southern part of Lake Sharpe and the upper end of Lake Francis Case. In the area of Crow Creek, examples of upland deciduous woodland, upland mixed woodland, juniper woodland, and closed juniper woodland are all present. The deciduous draws typically contain a sparse overstory of green ash but support a dense understory cover comprised of chokecherry, wild plum, buffaloberry, and snowberry. The deciduous-juniper draws are similar in composition, but eastern red cedar comprised most of the cover and the understory is less dense. The most dense, even-aged stands of eastern red cedar are often located at elevations above the Pierre Shale outcrops. Because of heavy shading by the cedars, understory vegetation is either nonexistent or is dominated by a sparse covering of native grasses.

Evidence from numerous studies and observations indicate that the draws in the southern end of Lake Sharpe were originally less extensive than present and contained less red cedar. Big Bend project personnel and long-time residents have observed the expansion of red cedar in the draws of the grasslands surrounding the lake. Stands of cedar have invaded rangeland within the Good Soldier Creek watershed, and observations of draws in the Medicine Creek area indicate the presence of multi-aged stands of red cedar trees encroaching into prairie and shrubland vegetation. Expansion of the red cedar stands into adjacent prairie areas has also been noted.

The effect of grazing and browsing on woody draw vegetation in the study area has not been examined, but past studies in the North Dakota part of the Great Plains have documented adverse effects on habitat if grazing is heavy or if the draws are used to over winter cattle.

2.13.3. Shrublands

Shrublands in the area are usually associated with grasslands, wetlands, or woody draws. Low shrubby species, such as leadplant, snowberry, and wild rose, are most often found associated with silty soils while the big sagebrush community is associated with clay areas on lower slopes and bottomlands. Most of these community types are limited in their extent because of the nature of the soils, the topography, or various disturbances. Taller shrublands associated with woody draws have been unaffected by most development because they occur in broken or rough topography.

Because many of these shrubs are dependent upon periodic fire or other minor disturbances for vigorous growth and reproduction, some stand deterioration is expected under current management. Overbrowsing by cattle and deer are negative influences. Along gently sloping shorelines of Lake Sharpe, small areas of scrub-shrub wetlands have developed. Predominant species include Russian olive and sandbar willow.

2.13.4. Woody Plantings

An extensive amount of tree planting has been conducted at Lake Sharpe for the purposes of providing shade and wind protection, developing wildlife habitat, and improving site aesthetics. Originally, plantings were made on uplands near the dam or near the recreational access areas. Species commonly planted included Siberian elm, hackberry, green ash, Russian olive, eastern red cedar, honeysuckle, and lilac. More recently, there have been plantings of honey locust, flowering crab, chokecherry, American plum, bur oak, cottonwood, and red cedar. Attempts to establish single row, scalp plantings are also being made, using cottonwood, willow, green ash, and eastern red cedar as the main plant materials. Plantings also have been made within some deteriorating shelterbelt areas, native grasslands, and brushy draws.

Several of the older shelterbelts in the North Shore and Lower Brule areas do not have sufficient woody cover for quality wildlife habitat. This is attributed to the high mortality rates of planted materials and to the near absence of natural reproduction. Droughty soils, rodent predation, and the competition from weeds and nonnative grasses are the major cause of mortality. Plantings that were made in soils with better infiltration rates and water-retaining capacities (silty range sites) are in generally better condition, as at the North Iron Nation area, along lower terraces, and in the bottomlands at the confluence of various tributaries. Plantings established on subirrigated sites, such as at Joe Creek and West Bend, exhibited high growth rates and are producing good cover.

Extensive Open Shallows of the Lake. These include open-water areas less than 6 feet deep that are found along the shoreline, especially in embayments that are silting in, and the extensive shallows in the upper end of the lake between the DeGrey Recreation Area and the Bad River.

Nearly Barren Beaches and Sandbars. Barren beaches fringe most of the lake, and wetland vegetation has become naturally established only in isolated areas.

Wetland vegetation requires a favorable morphometry that provides protection from waves, snags, and boulders that provide natural riprap, or artificial riprap that provides bank protection. Established woody species include various willows, indigo bush, and cottonwood, while herbaceous species include cattail, river bulrush, softstem bulrush, American bulrush, giant reed, and reed canary grass. Areas with the most wetland vegetation cover were the boat access areas at Good Soldier Bay, Counselor Creek, Lower Brule, and South Iron Nation. Some woody vegetation has also become established in the Fort George boat ramp area and the Medicine Knoll Creek area.

In the Medicine Knoll Creek area, natural boulders and snags provide limited shoreline protection, while at the West Bend area snags provide limited protection. In the latter areas where the Corps' staff succeeded in stabilizing a short length of shoreline by using snow fence, the shoreline is well covered with herbaceous wetland plants. In the DeGrey area, staff persons from both the Corps and WES conducted some experimental shoreline stabilization in 1989 by using snags and wetland plants. Inspection of this area during the fall of 1990 showed that the areas behind the snags were becoming filled in with sediment. In these areas, wetland plants, primarily cattails and bulrush, were becoming established.

Small Ponds. Ponds along Lake Sharpe were originally confined to the islands. However, as barrier beaches have been formed across embayments, numerous small ponds have developed. Most are

less than 1 acre in size, are 5 feet or less in depth, contain large masses of driftwood, are fringed by emergent or woody wetland vegetation, and typically contain submerged aquatic beds. Aquatic animal life, including fish, was observed in the deeper ponds. Pond hydrology is poorly understood. Elevations of these ponds with respect to the lake water surface are unknown, so there is much uncertainty about their source of water. They could be filled by the wave run-up by the lake, by surface or ground water inflow, or by various combinations of the above.

Submergent Aquatic Beds in the Lake and Ponds. The extent of submerged aquatic bed wetlands is not well defined. During the 1965-75 period, NCRI did not document the presence of wetlands in the lake. Small areas of aquatic beds were documented on island ponds during 1987 by Corps staff but not along the main river or in the lake. However, during the fall of 1989, Corps staff observations indicated the presence of submerged aquatics along many lower and middle reaches of the lake. Species identified included water milfoil, river pondweed, and sago pondweed. All three species were identified in beds found along the shoreline of Good Soldier Bay, with river pondweed being most extensive in 3 to 7 feet of water.

Other areas containing one or more of the above aquatics include a boat access area at North Shore, several small embayments upstream from North Shore, the Counselor Creek and Medicine Creek embayments, and a long shoreline reach in the Lower Brule area. In late summer, sago pondweed has been observed on the beach in the DeGrey area, and Corps staff has reported observing large rafts of sago pondweed floating downstream between Fort George and Medicine Creek. These rafts are thought to have originated in the island-wetland complex found in the Bad River delta area.

Field observations during the past two decades suggest that submerged aquatics are increasing in aerial cover. Nutrient levels have been high enough to support aquatic vegetation for many years, but other factors could also cause an increase in submerged aquatics. During drought periods, there can be a reduction of turbidity, a reduction of water turnover rates in the lake, and a reduction in sediment inflow. Also, it was noted that many small embayments are subject to agricultural runoff that would provide thermal and nutrient loading to the system.

Emergent Marshes. Most of the vegetated wetlands occurring in the upper reaches of Lake Sharpe are on the islands and along the shore between Oahe Dam and Antelope Creek. This includes the La Framboise Island and Farm Island areas.

About 430 acres of emergent wetlands are associated with Farm and La Framboise Islands, with about an equivalent amount at the mouth of the Bad River, Antelope Creek, and Mush Creek. Other observations indicate that significant marsh habitat also occurs in deltas created at the mouths of Medicine Knoll Creek, Chapelle Creek, Joe Creek, Chaney Rush Creek, Medicine Creek, and Cedar Creek. A large marsh is also present along the shoreline several miles north of Lower Brule. In total, it is likely that well over 1,000 acres of marsh exists along the shorelines of Lake Sharpe. Because of incoming sediment flows and bank erosion, this acreage is expected to increase greatly within the next 50 years.

Periodically Flooded Scrub-Shrub and Forested Types. Scrub-shrub and forested wetlands are of lesser extent than marshland. The largest area is below Big Bend Dam, in the Lake Francis Case headwaters. Smaller amounts occur on Farm and LaFramboise Islands and at the mouth of Medicine Creek.

2.14. FISH AND WILDLIFE RESOURCES

Several groups of fish and wildlife at the Big Bend Dam/Lake Sharpe project are important for recreational, economic, cultural, esthetic, and ecologic reasons. In order to understand the fishery resource, this section also includes a description of the aquatic food base: the phytoplankton, the zooplankton, and the macroinvertebrates.

2.14.1. Aquatic Food Base

NCRI surveys conducted prior to 1987 indicated that diatoms comprise over 50 percent of the phytoplankton flora in Lake Sharpe with green algae being the next most abundant group. Abundance of these species follows a seasonal cycle, with generally higher densities in April and May. During the 1970-75 period, it was noted that the standing crop of phytoplankton was several times higher at the lower end of the reservoir than in the middle and upper sections. Although no explanation has been given for this phenomenon, phytoplankton densities are known to vary because of available phosphorus, water-exchange rates, temperature, turbidity, and zooplankton grazing.

The same NCRI investigations also indicated that the zooplankton community was dominated by five species of copepods, which accounted for 80 percent of the crop. Four species of cladocerans accounted for most of the remaining biomass. Annual variations were noted in density, with the highest levels in June and lowest levels in April, indicating a lag time for peak phytoplankton concentrations. Spatial differences in populations were also noted, with levels twice as high or higher at the lower end of the lake. These differences were attributed to temperature and turbidity.

Benthic macroinvertebrate surveys were made in the lake during the 1967-68 period. At that time, chironomids comprised over 90 percent of the fauna, followed by lesser numbers of oligochaetes, mayfly larvae, larval ceratopogonids, and trichopterans. Densities were generally low and standing crop estimates were far below other estimates in the region. Densities were higher in embayments; backwaters; and mud substrates, as compared to sandy substrates. Seasonal differences were noted with the highest levels occurring in late winter and the lowest in summer.

2.14.2. Fisheries

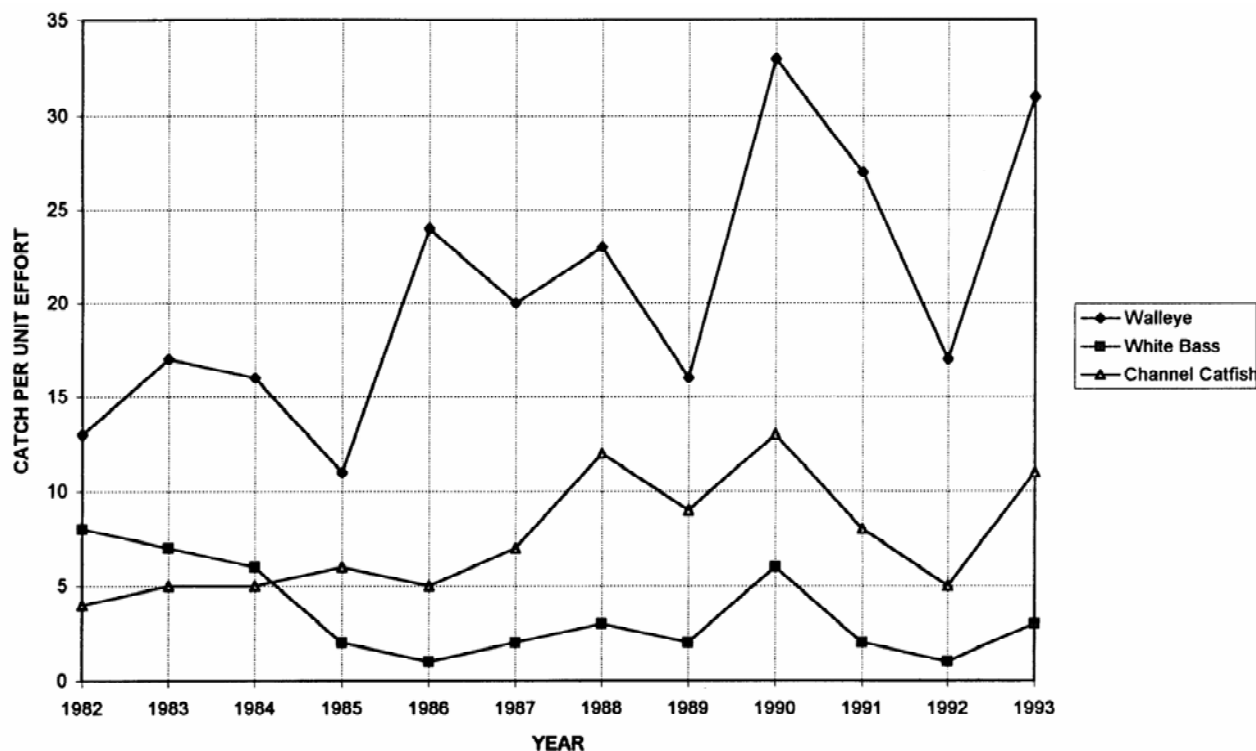
Hipple Lake and the numerous embayments represent important nursery and adult habitat for most of the warm- and cool-water fishes, including walleyes and white bass; for the most important sport fishes; and for gizzard shad, the most important forage fish. Increased levels of food and cover are higher in these areas because of greater biological production. In general, the embayments are becoming shallower because of sedimentation, and conditions are favorable for the development of aquatic bed and marsh wetlands. These shallows may provide more cover for forage fish. In addition, the formation of beaches is reducing shoreline erosion and turbidity levels in the embayments. At the present time, the Medicine Creek and Cedar Creek embayments are considered to be significant spawning and nursery areas for walleyes, as are Antelope Creek, the lower reaches of the Bad River, Chaney Rush Creek, Chapelle Creek, Counselor Creek, Joe Creek, the Lower Brule bay area, and West Bend.

The Lake Sharpe walleye fishery is among the best in the Nation, with generally high catch rates of average-size fish. The walleye in Lake Sharpe average 1½ to 3 pounds but larger fish are frequently taken. Average harvest is over 60,000 walleyes per year. Adult walleyes are distributed throughout Lake Sharpe, but greater numbers are caught in the lower reservoir during the summer, especially at Big Bend Dam, West Bend, and Joe Creek. Migration of walleye from the lower to the upper lake was believed to take place in late summer. The stability of the forage species base, especially gizzard shad, is a concern because of its susceptibility to winterkill.

State studies of fish abundance are performed annually. As shown in Figure 2-6, this work has found high numbers, high growth rates, and good reproduction of walleye populations throughout most of the lake. This is attributed to an adequate forage fish base, based primarily on gizzard shad, emerald shiner, and yellow perch. The walleye harvest ranged between 100,000 to 200,000 from 1994 and 2002 and the estimate for 2002 was 144,000.

Studies suggest that although yellow perch rebounded substantially after some low production years noted in the early 1970s, populations have been slowly declining since 1989. State data also indicated that populations of white bass, white crappie, freshwater drum, goldeye, and carp are still substantial and stable, while catfish numbers have increased since 1982. Populations of the buffalofish, northern pike, shovelnose sturgeon, creek chub, blue suckers, and other fish dependent on riverine habitat or vegetated slackwater habitat are still very limited.

Figure 2-6. Lake Sharpe Fish Abundance



Two events have had minor effects on the Lake Sharpe fishery, the movements of rainbow smelt and Chinook salmon into the lake. In 1971, rainbow smelt were introduced into the upper portion of Lake Sakakawea, North Dakota, and were caught in Lake Sharpe in 1975. Chinook salmon were

introduced into Lake Oahe in the early 1980s and are occasionally found in the upper reaches of Lake Sharpe. However, these populations of cold-water fishes do not appear to be self-sustaining and have not appreciably affected the cool- to warm-water Lake Sharpe fisheries.

Large numbers of channel catfish, smallmouth bass, and walleye are caught at Lake Sharpe. A small but growing stream fishery for Chinook salmon, sauger, smallmouth bass, and trout exists in the Oahe tailwaters. Also, large catches of white bass are made at times in the Oahe tailwaters, Big Bend tailwaters, and at Hipple Lake.

When muddy inflows from the Bad River occur, there is generally a decline of fishing success in the upper lake. However, because there is an inflow of nutrients and warmer water into Lake Sharpe, some limitations to production in the lake fishery may be lessened or eliminated. A major long-term detrimental effect of sediment inflow from the Bad River is in the proliferation of shallow areas in the upper reaches of the lake. This reduces the habitat for fish species preferring cooler temperatures and deeper water. The small shallow ponds landward from the barrier beaches do support fish populations. However, sampling data in terms of composition or abundance are not available.

Since impoundment in the 1960s the intermittent stocking of a variety of fish such as rainbow trout, brown trout, and smallmouth bass, has improved the cold- to cool-riverine fishery downstream from Oahe Dam. Releases of bluegills, largemouth bass, white crappie, and tiger muskies are made in the Hipple Lake area to improve the warm- and cool-water fishery in slackwater areas.

If a value of \$70.00/angler-day is used the direct economic impact of the Lake Sharpe fishery has ranged from 4.5 to 8.5 million dollars per year from 1991 through 2002.

2.14.3. Aquatic Birds

Extensive migrations of many waterfowl and other water birds occur along the Central Flyway, which passes through the Lake Sharpe area. Of these, the waterfowl group has the most economic and recreational significance. Large water birds, such as the double-crested cormorant, great blue

heron, white pelican, and American bittern, are important for ecological and aesthetic reasons. Large numbers of sandhill cranes also make transient use of the area in the spring and fall.

The observed increase in fall and early winter populations of waterfowl coincides with the increase of cropland acreages (especially corn) along the Corps projects in South Dakota. At Lake Sharpe, the acreages of uplands converted to irrigated cropland (mostly corn) have increased greatly since impoundment. The number of irrigated acres has increased from near minimal levels prior to impoundment to over 44,500 acres by 1990. The growing supply of grain adjacent to Lake Sharpe is believed to be a major attractant for migratory waterfowl.

Four state-designated waterfowl refuges are located within the Crow Creek Reservation. The Big Bend Dam, North Shore, and DeGrey Waterfowl Refuges are all takeline refuges. Joe Creek Waterfowl Refuge is a waterline refuge. The refuges are "no hunting" areas that function as resting areas for waterfowl. (See additional information on the waterfowl refuges in Chapter 3.)

Numerous smaller aquatic birds are also common and include those species that frequent open waters, marshes, and shorelines. These species include gulls, herons, rails, bitterns, sandpipers, terns, and blackbirds. The marsh wren and common yellowthroat are also present. Various swallows live in banks along the shoreline and use the open space above the reservoir for feeding. Belted kingfishers also live in the banks and feed on fish in shallow waters.

2.14.4. Other Birds

Birds of prey found at the project include the bald eagle, golden eagle, turkey vulture, osprey, and numerous nesting species of hawks, falcons, and owls. The prairie falcon, a ground-surface nesting species, can be found in the rough breaks and badland areas along the lake. The short-eared owl and marsh hawk can be found in low-lying prairie areas or marshes. Great-horned owls nest in bottomland forests.

There are many smaller birds that use the project grasslands and woodlands as nesting habitat, a food source, or winter cover. The woody draw habitat and shelterbelts are particularly valuable for these species, as well as adjacent croplands or grasslands. The bottomland forests on Farm Island, LaFramboise Island, and wooded areas adjacent to the lake are good for wintering songbirds and support a wide variety of nesting songbirds during the summer. Common

representatives include the brown thrasher, blue jay, black-capped chickadee, robin, purple grackle, various sparrows, nuthatchers, flycatchers, woodpeckers, grosbeaks, orioles, and wood warblers.

Some quite rare songbirds have been reported on Farm Island. These include the indigo bunting, lazuli bunting, yellow-breasted chat, worm-eating warbler, eastern bluebird, wood thrush, red-eyed vireo, Bell's vireo, and possibly the Philadelphia vireo.

Upland game birds include the ring-necked pheasant, prairie chicken, sharptailed grouse, mourning dove, and Hungarian partridge. Some of these birds were adversely affected by the reservoir impoundment because of the loss of critical woody cover. Wild turkeys live along the wooded bottomlands near Pierre and in bottomlands of several tributaries along the east bank. The Lower Brule Sioux Tribe has successfully introduced wild turkey on the west bank. Sharptailed grouse and prairie chickens are most common in the more extensive broken and rolling grasslands found in large acreages on the Crow Creek Sioux Reservation and the Lower Brule Sioux Reservation. Pheasants and Hungarian partridge are more common in areas of less relief that are more intensively farmed, such as Lower Brule, Grassrope, DeGrey, and West Bend. Woody plantings and food plots have been developed along the reservoir helping to meet the needs of these birds.

Several species of ground-nesting birds depend upon native prairie grassland for survival. While surveys have not been conducted, species likely to use the native prairies include the western meadowlark, upland sandpiper, long-billed curlew, lark bunting, horned lark, McCown's longspur, chestnut-collared longspur, burrowing owl, bobolink, and several native sparrows.

2.14.5. Mammals

The mammals found in the Lake Sharpe area include various big and small game species, furbearers, and numerous rodents.

Elk and bison had been extinct in the area since the 1880s. However, the Lower Brule Sioux Tribe and the Crow Creek Sioux Tribe reintroduced these animals into game ranges in the Lake Sharpe area. Another 1,600-acre area, the Huston Unit, also supports a herd of buffalo. The

buffalo are now managed as a hunting resource. Elk are free roaming within the Lower Brule Sioux Tribe game ranges and are also subject to harvest.

Deer populations were never high in the Lake Sharpe area, even before impoundment. With the more restrictive management now practiced, it is likely that populations of white-tailed deer and mule deer are higher than prior to the impoundment. Preferred habitat areas for white-tailed deer are the large islands, weedy croplands, and marshlands along the lake, shelterbelts, and bottomland woodlands of the tributaries. As the impoundment exists within the large tracts of grassland and woody draws along the steeper lands surrounding the reservoir it has had little affect on the mule deer habitat. The increase in red cedar, which provides winter cover, an increase of irrigated cropland, and more restricted harvesting on the reservations apparently has resulted in slightly higher populations of mule deer than before impoundment.

Only small populations of pronghorns existed in the area prior to impoundment, and populations continue to remain low. The lack of shrub-grassland habitat, as well as the lack of past management interest have been the limiting factors. Existing pronghorn populations are located along both the east and west shores of the reservoir.

Furbearers and large predators found in the area include the coyote, bobcat, red fox, badger, spotted and stripped skunk, raccoon, beaver, mink, weasel, and muskrat. Small game populations include white-tailed jackrabbit, eastern cottontail, and fox squirrel. The jackrabbits inhabit the croplands and grasslands, while the cottontail and fox squirrels live in brushy and wooded areas.

A small number of porcupines live in the bottomland woodlands along the tributaries. Very few prairie dogs live on project lands but they are found in larger numbers on adjacent rangelands bordering project lands. The prairie dog towns range in size from a few holes (1/2 acre) to several hundred holes (over 320 acres). Other common rodents include the Richardson ground squirrel, thirteen-lined ground squirrel, pocket gopher, prairie vole, prairie deer mouse, and western harvest mouse.

2.14.6. Reptiles and Amphibians

Reptiles and amphibians are somewhat limited in terms of diversity in the area. Leopard and chorus frogs; the plains spadefoot, woodhouse, and Great Plains toads; and tiger salamanders are

the dominant amphibians. Common reptiles include the snapping turtle, western painted turtle, bull snake, prairie rattlesnake, red-sided garter snake, and plains garter snake. The Midland softshell turtle (*Apalone mutica mutica*), false map turtle, western hog-nosed snake, and eastern yellow-bellied racer are less commonly observed forms.

2.15. RARE AND ENDANGERED SPECIES AND COMMUNITIES

Because of a variety of factors and circumstances, several species and a few ecological communities are rare in the Big Bend Dam/Lake Sharpe project area. Therefore, there is a need to consider rare species and community types during project planning, operation, and management to reduce the level of future environmental degradation in the project area.

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2.15.1. Federally Listed Species

Species that are listed by the Federal Government as threatened and endangered (USFWS 2004) or are candidates for listing (USFWS 2003) or are considered threatened or endangered by the State of South Dakota (SDGFP 2004) are shown in Table 2-15. Several species currently on the Federal list of threatened and endangered species once lived in the project area but have now been extirpated. These include the black-footed ferret, the gray wolf, and the grizzly bear.

Table 2-15. Threatened and Endangered Species

Common Name	Scientific Name	Federal Status	State Status
Pallid sturgeon	<i>Scaphirhynchus albus</i>	Endangered	Endangered
Sturgeon chub	<i>Macrhybopsis gelida</i>		Threatened
Sicklefin chub	<i>Macrhybopsis meeki</i>		Threatened

Northern redbelly dace	<i>Phoxinus eos</i>		Threatened
Topeka shiner	<i>Notropis Topeka</i>	Endangered	
Finescale dace	<i>Phoxinus neogaeus</i>		Endangered
Bald eagle	<i>Haliaeetus leucocephalus</i>	Threatened	Threatened
Eskimo curlew	<i>Numenius borealis</i>	Endangered	Endangered
Least tern, interior pop.	<i>Sterna antillarum</i>	Endangered	Endangered
Osprey	<i>Pandion haliaetus</i>		Threatened
Peregrine falcon	<i>Falco peregrinus</i>		Endangered
Piping plover	<i>Charadrius melodus</i>	Threatened	Threatened
Whooping crane	<i>Grus Americana</i>	Endangered	Endangered
American burying beetle	<i>Nicrophorus americanus</i>	Endangered	
Scaleshell mussel	<i>Leptodea leptodon</i>	Endangered	
Dakota skipper	<i>Hesperia dacotae</i>	Candidate	
False map turtle	<i>Graptemys pseudogeographica</i>		Threatened
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	Candidate	
River otter	<i>Lutra Canadensis</i>		Threatened
Swift fox	<i>Vulpes velox</i>		Threatened
Western prairie fringed orchid	<i>Platanthera praeclara</i>	Threatened	

Federally listed species that may be observed in the Lake Sharpe area include the pallid sturgeon, bald eagle, interior least tern, piping plover, and whooping crane. Only the bald eagle and pallid sturgeon are considered resident species (USACE 1995). The black-tailed prairie dog, a candidate species for listing, is a resident species in all counties bordering Lake Sharpe (USFWS 2003).

In the 1960s, populations of pallid sturgeon were found at many locations, particularly at the Medicine Creek and Farm Island areas. Occasional sightings were also made at Joe Creek, Chapelle Creek, and West Bend. In the 1980s, findings were limited to the river reach between Oahe Dam and the DeGrey area. The State of South Dakota has tagged a few pallid sturgeons in the Farm Island area and is monitoring their movements (USACE 1995).

Bald eagles are known to occur in all five counties bordering the Big Bend project (USFWS 2004). Up to 200 eagles use the upper end of Lake Sharpe during the late fall and winter, primarily on Farm Island and LaFramboise Island. The availability of food and roosting cover in this area is critical to its use by eagles for overwintering (USACE 1995). In the spring of 2002 and again in the spring of 2003, a pair of bald eagles nested 5 miles downstream of Big Bend

Dam on the east bank, within the Crow Creek Tribal Reservation, but did not produce any fledgling chicks (Vaughn 2004).

Interior least terns have been observed in Hughes and Stanley counties, nesting on the islands downstream from Oahe Dam, but not on a regular basis. Least terns select nesting sites on open areas of sand or gravel beaches within a river channel or reservoir shoreline (USFWS 2000). Missouri River bed aggradation due to the high sediment inflow from the Bad River has resulted in higher stages and a higher water table for given discharges from Oahe Dam, and the islands have consequently become vegetated by cattails, decreasing their suitability as potential least tern nesting areas (Vaughn 2004). The least tern is not currently found in Hyde, Buffalo, or Lyman counties (USFWS 2004).

The USFWS has designated critical habitat for the piping plover in Hughes and Stanley counties (USFWS 2002), where the piping plover is known to occur. The piping plover may possibly be found in Buffalo and Lyman counties also (USFWS 2004). Use of the Big Bend project area by the piping plover has not been regular. One factor is the limited breeding habitat, since piping plovers use nesting sites similar to those of the interior least tern, discussed above. Because the Lake Sharpe pool elevation is so stable, grasses and shrubs may grow to the edge of the lake, and there are few unvegetated beach areas (Vaughn 2004). Other potential factors such as predation and/or human disturbance may also be involved.

Whooping cranes only use the project area as migratory transients. Sightings have been reported in the upper reservoir, near the DeGrey area, and at a marsh complex along the lake several miles north of Lower Brule (USACE 1995).

The black-tailed prairie dog is found in all five counties adjacent to the Big Bend project. Populations are expanding on prairie grasslands both on and off Big Bend project lands (Vaughn 2004), but few prairie dog towns are on project lands (USACE 1995).

The Topeka shiner currently is known to exist only in the eastern part of South Dakota, in counties within the James River and Big Sioux River basins. The Eskimo curlew is very rare and has not been sighted in the Lake Sharpe area in many years. The American burying beetle is presently not known to exist in the Lake Sharpe area, but status surveys have not been completed. Until the surveys are completed, the beetle could occur in any county with significant humus or topsoil suitable for burying carrion. The scaleshell mussel was historically found in the Missouri River in the extreme southeastern portion of the State. The Dakota skipper is found in the northeastern part of South Dakota, but has not been sighted in any counties adjacent to the Missouri River. The western prairie fringed orchid is a very rare species, and a status survey found no populations in South Dakota (USFWS 2004). It occurs in tallgrass calcareous silt loam or sub-irrigated sand prairies (Fritz 1993). Possible habitat may exist, mainly in the easternmost counties of South Dakota, but not in the counties adjacent to the Big Bend project (USFWS 2004).

2.15.2. State Listed Species

Exclusive of Federal listings, the State of South Dakota has listed several species of animals that would be expected to use the project for migratory, wintering, or breeding habitat. These state-threatened species include four fish species (sturgeon chub, sicklefin chub, northern redbelly dace, and finescale dace), two bird species (osprey and peregrine falcon), one turtle species (false map turtle), and two mammal species (river otter and swift fox) (SDGFP 2004). Because of altered habitat conditions (conversion of a natural river into an artificial impoundment), many of these species have lost large areas of suitable habitat and remain as remnant populations or as individual transients in the upper riverine-like area. The sturgeon chub and sicklefin chub have experienced a decline in population, and the USFWS estimated that they occupied only 55 and 54 percent, respectively, of their historic ranges in the Missouri River (USFWS 2001 FR). The osprey is considered a transient to the area, but is commonly seen in areas downstream of the Big Bend powerhouse. The peregrine falcon is also a transient, but no specific data on sightings in the project area are available. The river otter was last observed in 1979 near LaFramboise Island, while the false map turtle was last observed below Big Bend Dam in 1966 and near Farm Island in 1986 (USACE 1995).

2.15.3. Other Species and Communities

Other species of concern to the state and infrequently observed on Farm Island and LaFramboise Island include the black-and-white warbler, the broad-winged hawk, Sprague's pipit, the barn owl, and Cooper's hawk. Other relatively rare species that may live on native prairie lands on the project include the ferruginous hawk, the long-billed curlew, and small butterflies such as the Regal fritillary (USACE 1995).

Because of past perturbations related to the construction and the operation of Lake Sharpe, several plant communities within the project boundary are in a state of decline in terms of aerial extent and quality. These types include the big sage community, which is now largely found in the Medicine Creek, Cheney Rush Creek, and Lower Brule areas, and the big bluestem (a tallgrass prairie species) community found as a relict at various locations. The largest concentrations of big bluestem habitat are on gently dissected terraces and draws along the west end of the project between Cedar and Medicine Creeks. Agriculture, grazing, fish and wildlife habitat development projects, and/or cultural preservation activities have less impacted these areas. Scattered, but very limited, amounts of high quality big bluestem habitat also occur in small draws throughout much of the project. Woody riparian habitats can be found along the drainageways that enter the lake. The ecological condition of these habitats is not known. However, these areas do not appear to be threatened by development because they provide high

quality wintering habitat for big and small game species. In addition, they have much value for the overwintering of range livestock (USACE 1995).

Although the main stem bottomland forest was mostly eliminated by inundation during the filling of Lake Sharpe, extensive stands of cottonwood and understory woody browse habitat persist on the higher elevations of Farm Island and on most of LaFramboise Island (USACE 1995).

2.15.4. Biological Opinion

The USFWS reviewed the operation of the Missouri River main stem reservoir system, operation and maintenance of the Missouri River bank stabilization and navigation project, and operation of the Kansas River reservoir system in 2000 and prepared a biological opinion (USFWS 2000). In the opinion, these projects were all found to have cumulative effects that are likely to jeopardize the continued existence of the least tern, piping plover, and pallid sturgeon. A Reasonable and Prudent Alternative (RPA) was developed by the USFWS that includes actions that are intended to decrease the likelihood of jeopardizing the continued existence of these three species. An implementation plan for the RPA was prepared and this Master Plan must take into consideration the measures proposed in the RPA and work in coordination with the implementation of the biological opinion (USACE 2001a). No measures proposed in the Master Plan may interfere with the measures of the RPA. Components of the RPA include flow enhancement, habitat restoration/creation/acquisition, unbalances system regulation, adaptive management/monitoring, and propagation/augmentation of pallid sturgeon populations. More detail is provided in the biological opinion document (USFWS 2000).

2.16. VISUAL QUALITIES

The S-shaped design of the Big Bend Dam embankment along with the rugged and scenic shoreline and open water of Lake Sharpe are attractive visual resources. The unique S-shape design was created when the north end of the embankment was moved toward the west to protect an Indian burial ground. Rugged bluffs and prairie grasslands with some dense stands of trees in a few ravines surround the lake. The pristine atmosphere in many areas along the lake offers a desirable attraction to campers and sportsmen alike.

Before the construction of Big Bend Dam, the Missouri River floodplain was covered by dense stands of trees and miles of rolling prairie rangeland characterized the uplands. Today, rugged bluffs and the open water of the reservoir have replaced the dense stands of trees.

Large numbers of waterfowl, wading birds, and shorebirds use the protected bays of Lake Sharpe during migration. Deer, antelope, and buffalo roam the uplands. Many areas are of wilderness quality and provide habitat and food for large and small game. Most visitors to the project have an opportunity to view several species of wildlife. With its 200 miles of rolling prairie shoreline largely unobstructed by the clutter of civilization, Lake Sharpe retains a frontier atmosphere and furnishes an excellent setting for various kinds of outdoor recreation.

The Big Bend Dam/Lake Sharpe project is an outstanding scenic landmark in this region of South Dakota. The only distractions in the area's esthetic environment includes large power transmission lines and supporting stations that are located mostly in the vicinity of the dam embankment and powerhouse.

2.17. MINERAL AND TIMBER RESOURCES

Mineral deposits around Lake Sharpe consist of sand and gravel deposits. The sand and gravel deposits are mined for road construction materials and concrete aggregate. There are no mining activities being conducted on project lands.

Native woodlands in the project area occur in the Pierre area, below Big Bend Dam, and in narrow bands along the intermittent streams and rivers that flow into the reservoir. Timber resources are very limited and are not commercially utilized.

2.18. PALEONTOLOGY

The Missouri River trench in South Dakota has been internationally known for fossil vertebrate and invertebrate remains since the time of Lewis and Clark. In the early expedition, fossil vertebrates were recorded which probably represent marine reptiles, either plesiosaurs or mosasaurs. Later expeditions in the 1800s also resulted in collections of marine reptiles, some of which were new to science and became type specimens. All during the period in which the Missouri River was a major travel corridor, fossils were secured and transported to museums in the Northeast and Europe. As the waterway became less traveled, collections from these rocks declined. Only recently has systematic recovery of fossil remains resumed.

The vertebrates from the Missouri River Breaks along Lake Sharpe occur in the Late Cretaceous Pierre Shale. This shale was deposited at the end of the Age of Reptiles, approximately 75 to 80 million years ago. Four members of this formation, Gregory, Crow Creek, DeGrey, and Verendrye, are well exposed and produce scientifically significant paleontological specimens. This black shale was deposited at the bottom of a shallow sea that extended through the center of North America from the Arctic Ocean to the Gulf of Mexico. Deposition of black mud was punctuated by volcanic ash deposits (bentonites) and perhaps even deposits derived from a tsunami generated by a meteor impact in Iowa.

While dinosaurs dominated the terrestrial deposits to the west, both vertebrate and invertebrate fossils were preserved in the marine deposits of the shallow seaway. Commonly preserved in the Pierre Shale members are remains of fossil invertebrates, including principally clams and cephalopod mollusks. These macroinvertebrates are used throughout this seaway for correlation. Macroinvertebrates such as foraminiferans have also been found and aid in interpretations of water depth, salinity, and other environmental parameters. Vertebrate fossils include the remains of sharks, bony fishes, diving birds, plesiosaurs, and mosasaurs. The latter marine reptiles were vicious carnivores. They are the most common of vertebrate fossils along Lake Sharpe and are a major focus of current studies in the area.

At the present time, intensive collections tied to detailed stratigraphic sections are underway. These studies will determine which creatures existed in this portion of the Pierre Shale, their habits, their environment, their changes through time, and perhaps their extinction. The relationship of both invertebrate and vertebrate fossils to volcanic ash deposits is another major focus of these investigations. Overall, the exposures of the middle portion of the Pierre Shale along Lake Sharpe possess well preserved, nonrenewable, and scientifically significant fossil remains which should fill a major gap in the paleontological knowledge of Cretaceous marine deposits. Because this area contains fossil resources of international importance, the area should be managed in a manner that these resources are preserved for public research and education.

2.19. CULTURAL RESOURCES

Historians, students, and authors have long been interested in the variety of historic and prehistoric sites in the Dakotas.

Many significant cultural resources are located on Lake Sharpe project lands. These resources represent physical remains that archaeologists refer to as sites, objects, artifacts, features, components, structures, and a number of other terms that describe the physical remains of past human occupation and use.

In order to understand earlier occupation, archaeologists divide time into periods that highlight important or unique human activities. For the Lake Sharpe area, the prehistory and history are divided into five broad periods: Paleo-Indian, Archaic, Woodland, Plains Village, and Historic.

2.19.1. Prehistoric and Historic Periods

Much of the history and prehistory of the Lake Sharpe region has been shaped by the Missouri River. To the aboriginal peoples in prehistoric times, the river served as a major highway for trade and travel. The rich floodplain soils offered an excellent place for the earthlodge village peoples to raise their crops. Regular floods replenished both the soil nutrients and subsoil moisture for the season.

The region's cultural history has been described as one of the four major regions north of Mexico. The Missouri Trench, and the Great Plains in general, make up one of the most fascinating cultural areas in the Western Hemisphere. The archeology of the Missouri Trench consists of layers of occupation dating back to the post-Wisconsin glacial period (11,000 Before Present (B.P.)). Every significant time period is represented, from the Paleo-Indian tradition starting at 10,000 B.C. to the historic period of European American settlement to the present.

As shown on Table 2-16, the Big Bend/Lake Sharpe project has over 405 historic and prehistoric sites. The Big Bend Project has the highest concentration of cultural resource sites of any of the Omaha Districts main stem reservoirs, averaging 2.0 sites per shoreline mile. Many of these sites have not been evaluated for their significance to the National Register of Historic Places (NRHP). The sites range from single artifacts a few inches in length to a site over one-half mile in length. Sites may contain one or more artifacts. In some cases, a number of the sites contain two or more different periods of use. The following cultural history is based on information derived from many of the sites.

Paleo-Indian Period (10,000-6000 B.C.). This period is divided into a number of complexes, which are defined primarily by different projectile (or spear) point styles used by Paleo-Indians. They hunted the now extinct forms of mammals, such as mammoth and camel and the early forms

of horse and bison. Other animals that were hunted are still in existence today and include bear, deer, and elk. These animals were hunted with spears and darts. Most Paleo-Indian sites are found in association with butchered animals.

Archaeological investigations of the Lake Sharpe region have not found any evidence of Paleo-Indian sites. However, this does not necessarily mean that none exist. Erosion and deposition of soils along the Missouri River trench is very complex and has destroyed or obscured ancient land surfaces. Although no sites have been found on the surface of Big Bend project lands, it may be assumed that some Paleo-Indian sites are buried.

Archaic Period (6000 B.C.- A.D.1). Hunting continued to be the primary subsistence activity during the Archaic Period. As the Pleistocene animals became extinct, they were supplanted by modern animal species. Spears and darts were used in the hunt. Human diets included an increase in the use of plant foods.

The earliest evidence of human activity in the Lake Sharpe region begins early in the Archaic period. Several sites that fall within the Archaic Period have been identified. Many of the sites are located on lands in Buffalo and Hughes Counties. Archaeological excavations of these sites seem to indicate that they represent temporary campsites with some being repeatedly occupied for short periods. One site has evidence of repeated use throughout the entire Archaic Period. Much of the stone found at these sites was used for making tools and came from local sources; a small percentage was brought in from North Dakota. All of the Archaic sites identified to date are deeply buried. They are generally found as shoreline erosion cuts away the bank.

Woodland Period (A.D.1-950). The occurrence of new technologies, domestic dwellings, and social activities marked the transition from the Archaic to the Woodland Period. These changes originated far to the east and southeast of South Dakota. Hunting animals and gathering plants continued to be important subsistence activities. The introduction of the bow and arrow increased hunting efficiency.

Ceramic containers that increased the capability to cook and store foods were also introduced. Temporary campsites were supplemented by longer-term occupations represented by more substantial semi-permanent dwellings that involved more time and materials to construct. A change in social activities is reflected in the treatment of the dead. The dead were placed in pits and covered with low mounds of earth. No doubt there were other changes during the Woodland Period for which there is very little physical evidence in the form of artifacts and sites.

Table 2-16. Cultural Resource Sites at Main Stem Projects

Cultural Resources Site	Fort Peck	Garrison	Oahe	Big Bend	Fort Randall	Gavins Point
Number of Sites (rounded)	5	800	1,200	405	150	80
National Register (Quality Sites) ¹	1	40	50	77	24	5
Shoreline Miles	1,520	1,340	2,250	200	540	90
Number of Sites per Shoreline Mile	NA ²	0.6	0.3	2.0	0.3	0.9

¹ The number of cultural resource sites that are listed on, eligible for, or potentially eligible for the NRHP. This number is expected to increase.

² Not available. Surveys incomplete.

A number of known Woodland Period sites are reported on the Lake Sharpe project lands. Of these there are several campsites or village sites distributed in 4 of the 5 counties surrounding the project. There are also mound sites found in Buffalo and Lyman Counties. Like the Archaic sites, most of the Woodland Period occupation sites are buried and only become exposed because of shoreline erosion. Some mounds are still visible features on the landscape; however, farming activities have plowed some of them flat.

Plains Village Period (A.D. 950-1780). This period represents the final development and then the decline of prehistoric Native American cultures before the arrival of Europeans and European Americans. Settlement, subsistence, technology, and social customs that first occurred during the Woodland Period became more complex and diverse. Farming became increasingly important in supplementing hunting and gathering. Fortified and unfortified villages, comprised of earthlodge structures, evolved from rectangular forms to circular forms during this period. Other sites were created, used, and abandoned as well. Some of these sites were isolated earthlodges, campsites,

cemeteries, and special activity areas. Near the end of the Plains Village Period, some sites can be identified with the Arikara Indians. The Arikara left the Lake Sharpe area after a smallpox epidemic devastated the Indian population in 1780-81. In addition, westward migrating Sioux tribes proved to be hostile to these village Indians. Both factors may have contributed to the Arikara moving elsewhere.

The largest percentage of sites is recognized as belonging to the Plains Village Period. Archaeologists have identified many earthlodge villages, several lone earthlodges, and other sites including a mound and animal kill/processing locations. There are also a number of sites that have unidentified occupations associated with the earthlodge villages or short-term camps. A number of the Plains Village sites were occupied more than once during this period.

Most of the earthlodge villages were clustered in four or five locations in the Lake Sharpe area. Plains Village sites can be identified by distinctive surface artifact scatters, circular or oval depressions, and exposure by shoreline erosion. In many locations, farming has leveled once obvious earthlodge depressions.

Historic Period A.D. 1780-Present. The Sioux Indians became the predominant Native Americans in the Lake Sharpe area after 1780, until warfare with European Americans moved them onto reservations in the late 1800s. Initially, the Sioux generally hunted and camped in the same manner as was done by the Native Americans during the Archaic Period. Horses, European American weapons, and other material items later supplemented or replaced Native American counterparts in the fields of transportation, clothing, beliefs, food, and shelter.

The first record of European and European American activity in the Lake Sharpe area was of parties of fur trappers, trading caravans, and explorers. These groups traversed the Missouri River, using it as an access between their eastern headquarters and the trapping and hunting areas to the west. France and Spain supported exploration of the area in the 1700s and by the United States in the 1800s. The depletion of forage, timber, and game and the gold discoveries in Montana and the Black Hills put pressures on the Indians. Warfare between the tribes and with the U.S. Government resulted in a variety of treaties and the creation of military forts that eventually forced the Indians onto reservations. Two reservations, the Crow Creek Sioux Reservation and the Lower Brule Sioux Reservation, are located in the immediate project area.

Also in the late 19th Century, land was opened for permanent settlement to European Americans through federal homesteading laws. Farming and ranching developed and adjusted to environmental changes. Boom and bust cycles have affected farming and ranching since the 1880s. In the mid-20th century, the federal government acquired farms, ranches, and reservation lands for the construction of Big Bend Dam and the creation of Lake Sharpe.

There are numerous sites associated with the Historic Period distributed throughout the Lake Sharpe project area. Some of these sites are underwater but of the remainder, some still contain buildings, surface artifact scatters, depressions, and foundations. Farming and erosion have obscured some additional historic features. Different individuals or groups also occupied many Historic Period sites more than once. Historic sites are distributed throughout the entire project area. A great many are identified by distinctive surface artifact scatters, depressions, and foundations. Farming and erosion have also obscured some historic features.

2.19.2. Cultural Resource Management

The Lake Sharpe project has the largest number of cultural resource sites per linear mile and the largest number of historic properties (77) listed on the NRHP of all the main stem projects. The Corps in partnership with the Lower Brule Sioux Tribe, Crow Creek Sioux Tribe, and the Three-Affiliated Tribes has completed a Cultural Resources Management Plan (CRMP) for the Big Bend Dam/Lake Sharpe project. Resources that are either on or eligible for listing on the NRHP are called historic properties. These properties could include those from any prehistoric or historic period. Those resources that do not meet the National Register evaluation criteria may be disregarded with respect to federal compliance requirements once the "not eligible" determination is made and the official determination process is complete.

In general, there are several methods for managing the historic properties on Big Bend/Lake Sharpe project land. If a significant site is not being threatened by any impacts such as erosion, vandalism, agricultural impacts, or construction, it is best to leave the site undisturbed. Sites are best protected by a thick growth of vegetation, which serves as a type of disguise for the features within the site. If a significant site is being threatened in some manner, it is pertinent to remove the threat or to protect the site.

2.19.3. Protection Of Cultural Resources

A large percentage of cultural resource sites that are listed on the NRHP, potentially eligible for the NRHP, or unevaluated are being impacted by a variety of human activities. The Omaha District acknowledges the importance of these irreplaceable cultural resources and will take the necessary steps to monitor, reduce, or eliminate impacts before the sites are destroyed. Actions to be taken include:

- Modify agricultural and grazing leases to remove fields containing cultural resource sites and potentially significant cultural resource sites;
- Allow no additional recreation development on cultural resource sites within existing recreation areas unless appropriate mitigation measures are implemented;
- Stabilize cultural resource sites being destroyed by shoreline erosion; and
- Monitor vandalism and erosion using volunteers to assist field personnel.

2.20. INTERPRETATION

The Big Bend Project Visitor Center was destroyed by a tornado in 1992. All that remains of the visitor center is the outside shell of the building. This has been preserved for future enclosure and use. It currently serves as a group picnic shelter. The Corps is working in partnership with the Crow Creek Sioux Tribe to refurbish this structure into what will be called the Crow Creek Welcome and Information Center.

2.21. DEMOGRAPHIC CHARACTERISTICS

2.21.1. Historical Perspective

The Arikara, sometimes referred to as the Ree Indians, figured prominently in the earliest recorded history of South Dakota. A long and severe drought was the major factor causing the Arikara's migration northward along the Missouri Valley from the Central Plains of Nebraska and

Kansas. It was during the sixteenth century that they moved into the central part of South Dakota. As a non-nomadic people living in a fixed habitation, the Ankara attained a high degree of self-sufficiency, supplying most of their needs from the raw materials at hand or obtaining needed items through bartering with neighboring tribes. However, by the end of the eighteenth century the Ankara had fallen into a state of decline. Reduced by warfare and disease, they moved northward in 1795 to the mouth of the Grand River. In 1831, the few remaining Arikara villages were permanently abandoned when the Arikara joined the Mandan, who lived along the Missouri in present-day North Dakota.

The Sioux first drifted into the Missouri Basin in the mid-eighteenth century after the pressure of better-armed enemy tribes (primarily the Chippewa), and dwindling food supplies caused them to abandon their settlements in the Upper Mississippi Valley. As they migrated westward, three major divisions came to be recognized in the Sioux Nation: the Teton (Western) Sioux, who were the first of the subtribes to migrate onto the plains; the more sedentary Middle Sioux; and the Santee (Eastern) Sioux, who were the last to leave the Great Lakes region. The gradual acquisition of the horse and gun enabled the Teton subtribes, in particular, to pursue the great bison herds that roamed the Missouri Basin. This eventually transformed the Teton subtribes to a migratory culture centered on the buffalo.

After the journey of Lewis and Clark from 1804 through 1806, the central plains were considered a prime area for fur traders. Many trading posts were established all along the Upper Missouri Valley. In contrast with eastern North America where smaller pelts constituted the chief items, in the region west of the Mississippi River buffalo hides were a major component of trade.

With the discovery of gold in the California territory in 1849 and the westward expansion of the United States, the Central Plains was transformed into an area of prime settlement. Most of the people who settled in South Dakota between 1860 and 1910 came from east of the Mississippi River. However, the area also attracted a great number of immigrants from northern Europe--primarily Norwegians, Germans, and German Russians.

With the advance of white settlements on the plains and in an effort to halt the hostile confrontations that resulted from the clash of cultures, the Sioux found themselves concentrated on "reserved areas." By 1889, the separate tribes of the Sioux nation had found themselves confined within the shrunken boundaries of their present reservations. The Lower Brule subtribe of the Teton was placed on the Missouri's western shore in central South Dakota just opposite the Yanktonais tribe of the Middle Sioux on the Crow Creek Reservation.

2.21.2. Current Population Trends

According to the 2000 census, the population of South Dakota is 754,844. This ranks South Dakota as number 46 of the 50 States in terms of population. With 75,897.8 square miles of area, population density is 9.9 persons per square mile for a ranking of 46th. By comparison, the 2000 population density for the entire United States was 79.6 persons per square mile.

Having declined by 2.2 percent in population in the 1960s, South Dakota enjoyed a modest increase of 3.8 percent in the 1970s. After minimal growth in the 1980s, South Dakota's population grew at 8.5 percent in the 1990s and is projected to continue growing at a steady rate. Table 2-17 lists both historical and projected census population totals through 2025.

Table 2-17. South Dakota Census Historical and Projected Population

Year	Population	% Change
1960	681,000	
1970	666,000	-2.2
1980	691,000	3.8
1990	696,000	0.7
2000	754,844	8.5
2025	866,000	14.7

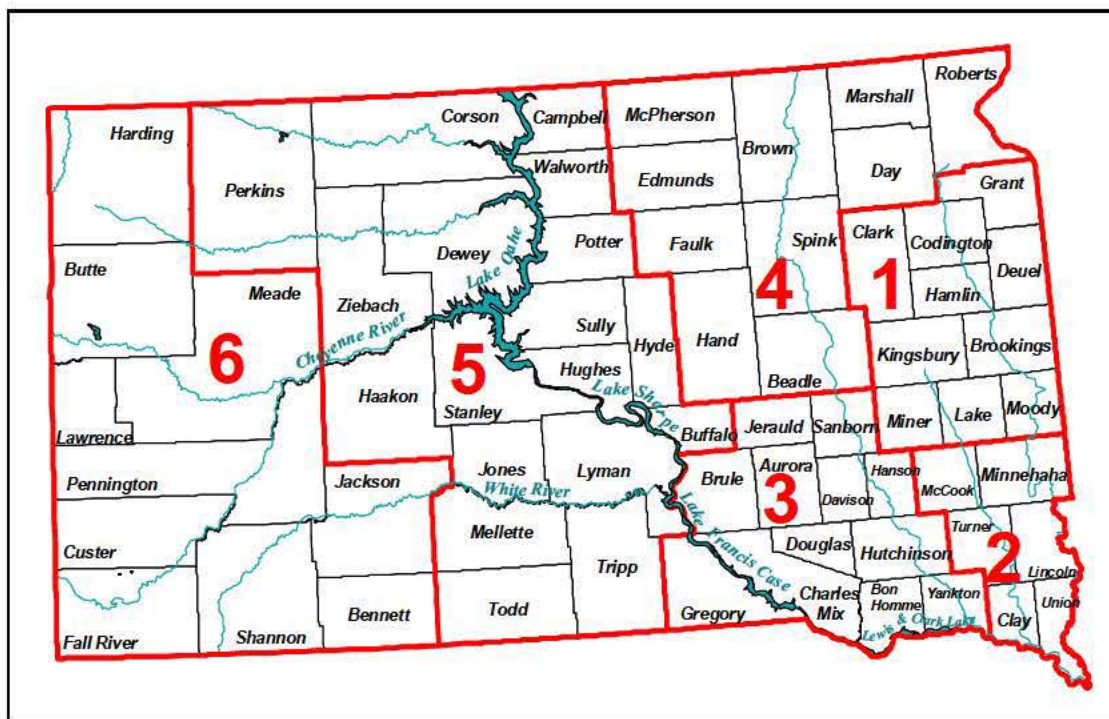
Source: 2000 U.S. Census Data.

South Dakota SCORP Designation. The SDGFP, through its Division of Parks and Recreation, prepares the Statewide Comprehensive Outdoor Recreation Plan (SCORP) in order to identify the recreation needs and desires of South Dakotans and to recommend actions to meet those needs. For this planning process, the State was divided into six Planning and Development Districts as shown in Figure 2-7. Lake Sharpe is located in Planning and Development District 5.

South Dakota SCORP District 5 consists of 18 counties and most of five Indian reservations in west-central South Dakota. This district also contains most of the reach of the Missouri River running through South Dakota. With 25,278 square miles, it is the largest of the six Planning and Development Districts. The only two major population centers in District 5 are Pierre (in Hughes County) and Mobridge (in Walworth County). In the nonurban areas, the population density is very low and decreasing, median age is rising, and per capita income is low.

In the five counties contiguous to Lake Sharpe, Hughes County was the only county that had an urban population. The city of Pierre contained 84.2 percent of the population of Hughes County in 2000. In the 18-county SCORP District 5 area the city of Mobridge is the only other city of any size, with a 2000 population of 3,574. District 5 has the largest area and the smallest population base of the six SCORP Districts in South Dakota, and, according to SCORP projections, is on a declining trend in terms of population.

Figure 2-7. South Dakota Planning and Development Districts



Source: South Dakota SCORP, 1987, South Dakota Department of Game, Fish and Parks

Place of Residence. In 1980, South Dakota ranked third behind Vermont and West Virginia for having the smallest percentage of its population (46.4 percent) classified as urban. The United States average is 73.7 percent. Despite this, today's population growth is almost exclusively in the urban areas, a trend that is expected to continue. Although nearly all the growth in South

Dakota's population occurs in urban areas, the cities are small by the national standards. Table 2-18 lists the 9 cities in South Dakota with a 2000 population greater than 10,000.

Racial and Ethnic Characteristics. The population of South Dakota is primarily of northern European ancestry. American Indians, most of whom are members of one of the State's nine Sioux tribes, are numerically the only significant minority. In 2000, American Indians accounted for 62,283 or 8.3 percent of South Dakota's population. All other racial groups together totaled 1.7 percent.

The 2000 U.S. Census found the South Dakota American Indian population to be 62,283, an increase of 38.7 percent over the 1980 population figure. This compares to population growth for the state of 9.3 percent during the same period. In counties that contain portions of American Indian reservations or have scattered tribally owned land, there are contradictory population trends--the non-Indian population is declining while the Indian population is increasing. The probable reasons for this phenomenon are increased reporting of Indian ancestry, higher birth rates in the American Indian population than the white population, and fewer opportunities for successful out-migration in the American Indian population as a result of socioeconomic limitations.

Table 2-18. 2000 Populations for Major South Dakota Cities

City	Population
Sioux Falls	123,975
Rapid City	59,607
Aberdeen	24,658
Watertown	20,237
Brookings	18,504
Mitchell	14,558
Pierre	13,876
Yankton	13,528
Huron	11,893

Source: 2000 U.S. Census data

Figure 2-8 shows that South Dakota includes parts of 6 Indian reservations. In addition, 10 counties in the State were formerly reservations or parts of reservations that still contain scattered tribal holdings. District 5 contains parts of five Indian reservations. The five counties contiguous to Lake Sharpe contain two Indian reservations, Crow Creek and Lower Brule. These two reservations have a combined area of 486,654 acres, a 2000 population of 3,578, and a population

density of 4.7 per square mile. As shown in Table 2-19, tribal lands in District 5 total 1,903,114 acres. In addition to the reservations, many Indian people live on scattered tribal holdings throughout the state. A significant number also reside in cities and other places away from reservation populations.

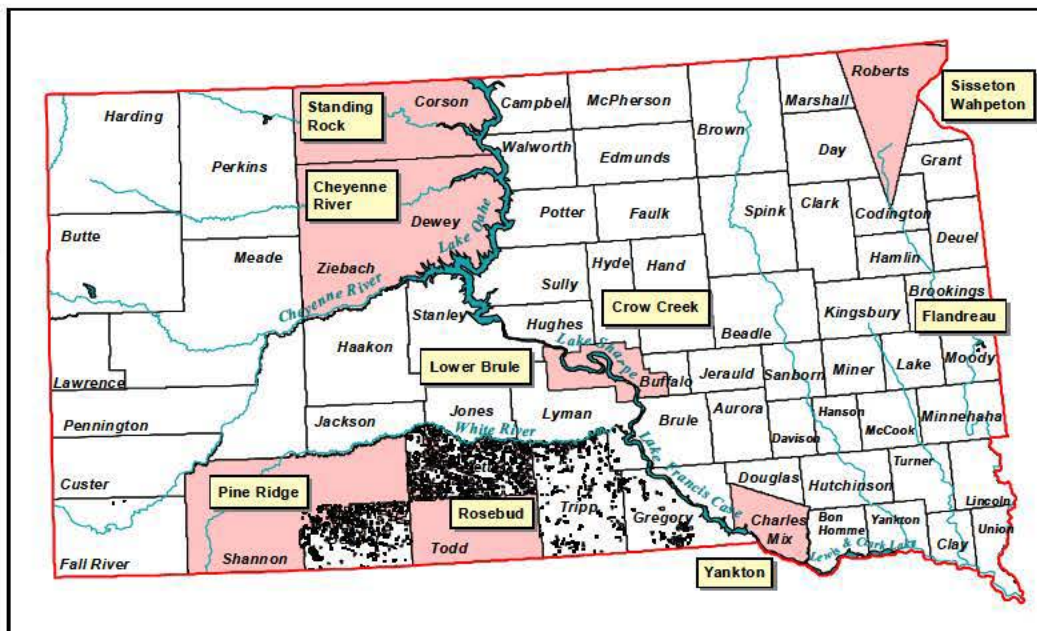
Crow Creek ("Hunkpati") Sioux Tribe. The Crow Creek Sioux reservation is located on the eastern bank of Lake Sharpe and Lake Francis Case in Buffalo, Hyde, and Hughes Counties. It comprises roughly 240,000 acres of which approximately 130,000 acres is tribal and trust land.

According to the 2000 census, 1,936 Native Americans lived on the Crow Creek Sioux reservation. Located 58 miles southeast of Pierre, Fort Thompson is the largest population center within the reservation. Other communities include Shelby, Stephan, and West Bend.

The Crow Creek Sioux Tribe has a constitution and bylaws that were approved in 1949. The Tribal Chairman and the Tribal Council make up the governing body of the reservation. The reservation is divided into 3 tribal districts - Fort Thompson, Crow Creek, and Big Bend. The tribal headquarters is located in Fort Thompson.

Figure 2-8. South Dakota Indian Reservations

*Black outlines in Gregory, Tripp, Mellette, and Bennett counties are current
scattered tribal holdings*



Lower Brule ("Kul Wicasa") Sioux Tribe. The Lower Brule Sioux reservation is located on the west side of Lake Sharpe within Stanley and Lyman Counties. It is composed of approximately 232,000 acres of tribal and trust lands with roughly 80 miles of Missouri River shoreline.

According to the 2000 census, the total population living within the Lower Brule reservation is 1,353 with 994 (or 84 percent) being enrolled tribal members. Within the reservation, the town of Lower Brule is the largest population center and is located 16 miles north of Reliance.

The Lower Brule Sioux Tribe operates under a charter which was ratified in 1936 and a constitution and bylaws approved in 1960. The Tribal Council, headed by the Tribal Chairman, is the sole governing body within the exterior boundaries of the Lower Brule Sioux reservation. The reservation is divided into 5 tribal districts - Lower Brule, Iron Nation, Fort George, Fort Hale, and Little Bend. The tribal headquarters is located in the town of Lower Brule.

Table 2-19. Tribal Trust Land in Planning and Development District 5¹

Indian Reservation	Number of Acres
Cheyenne River	954,398

Rosebud	520,040
Standing Rock	258,979
Lower Brule	104,679
Crow Creek	65,018
Total	1,903,114

¹ Source: South Dakota SCORP, 1987, South Dakota Department of Game, Fish and Parks

Age. The birth rate in South Dakota was 14.0 births per 1,000 population in 1998, which is similar to the national rate of 14.5. However, the birth rates on the reservations are much higher than the South Dakota rate. On average, the birth rate between 1996-1998 in Buffalo County was 35.3 births per 1,000 population. This difference is apparent in the comparison of median age. While the median age for the state has risen from 28.9 in 1980 to 32.5 in 1990 and 35.6 in 2000, the median age for the Lower Brule Reservation in Lyman County in 2000 was 21.8.

The fastest rising median ages are found in rural counties where no substantial Indian population exists. This is attributable to low birth rates and out-migration of the young, either to cities or to other states. For example, McPherson County in north-central South Dakota had a 2000 median age of 47.6.

Education. Educational levels in South Dakota have steadily increased over the past 40 years and are expected to continue to increase at a slower rate. A rise in the proportion of South Dakota college graduates from 3.8 percent in 1940 to 25.7 percent in 2000 is a significant educational trend.

The educational level attained by residents of South Dakota increased dramatically between 1970 and 2000. The percentage of adults at least 25 years of age who had graduated from high school increased from 53.3 percent to 84.6 percent and the percentage of college graduates rose from 8.6 percent to 21.5 percent. In the United States as a whole in 2000, of adults at least 25 years of age 80.4 percent were high school graduates and 24.4 percent were college graduates, similar to the numbers for South Dakota. The number of high school graduates within the Indian population in Buffalo, Hughes, and Lyman Counties averaged 52.0 percent in 1980 and the number of college graduates was 4.2 percent.

2.22. ECONOMIC CHARACTERISTICS

2.22.1. Area Of Influence

Visitation Survey. The visitation survey is an important source for understanding the significance of a project area such as Lake Sharpe and an essential tool to indicate future demand for recreational opportunities. Results of a 1980 visitation study titled “Recreational Data Analysis for 1980” were published in 1981 by Roy F. Weston, Inc., under contract with the Omaha District. According to the Weston report, visitation to Lake Sharpe is largely by South Dakota residents--nearly 84 percent of visitation originates within the State of South Dakota. Because of the abundance of recreational opportunities in South Dakota, including riverine- and reservoir-related activities similar to those found around Lake Sharpe, this could reasonably be expected. Of the 354 visitors surveyed who were not from South Dakota, 102 were from Iowa, 52 were from Nebraska, and 200 were from other states.

Contiguous Counties. The five contiguous counties of Buffalo, Hughes, Hyde, Lyman, and Stanley accounted for 23.7 percent of visitation, with 516 of the total 2,173 visitors surveyed. These contiguous counties are shown in Figure 2-9. Estimates in 2002 indicate the five contiguous counties accounted for about 46 percent of all the fishermen that originated in South Dakota.

Hughes County, which is on the upstream portion of Lake Sharpe and contains the South Dakota state capital of Pierre, provided 383 of the visitors or 17.6 percent of the total. Altogether, the other four counties bordering Lake Sharpe contributed only 6.1 percent or 133 of the total visitors.

Travel Patterns. According to the Weston survey, just three South Dakota counties together accounted for 42.7 percent of the visitors surveyed. These counties are Hughes, with 383 visitors; Minnehaha, which contains Sioux Falls and accounted for 348 visitors; and Beadle, which contains Huron and provided 197 visitors. Because South Dakota is so sparsely populated, visitation by county is largely determined by the existence of cities rather than being primarily a function of distance. Hughes County borders Lake Sharpe and contains Pierre, the state capitol and seventh largest city. Visitors from Minnehaha County traveled an average of 170 miles to visit Lake Sharpe but had the second largest number of visitors surveyed because of the location of Sioux Falls, the state’s largest city, within its borders. Visitors from Beadle County, which contains the city of Huron, traveled an average of 105 miles. Likewise, the two counties of Pennington and Brookings are the fourth and fifth largest contributors to visitation, have the major cities of Rapid City and Brookings, and have average traveling distances of 197 and 183 miles, respectively.

Table 2-20 lists the number of visitors for the 29 South Dakota counties from which 10 or more visitors traveled. Also listed, when significant, are major South Dakota cities within the counties, the percent of total visitation, and the average mileage traveled each way. Visitation from outside these 29 counties has also been included. All 5 of the contiguous counties are listed but only 9 of the 18 SCORP District 5 counties contributed enough visitation to be included in the list. Together, these 29 counties were responsible for nearly 77 percent of total visitation.

Figure 2-9. Lake Sharpe Contiguous Counties

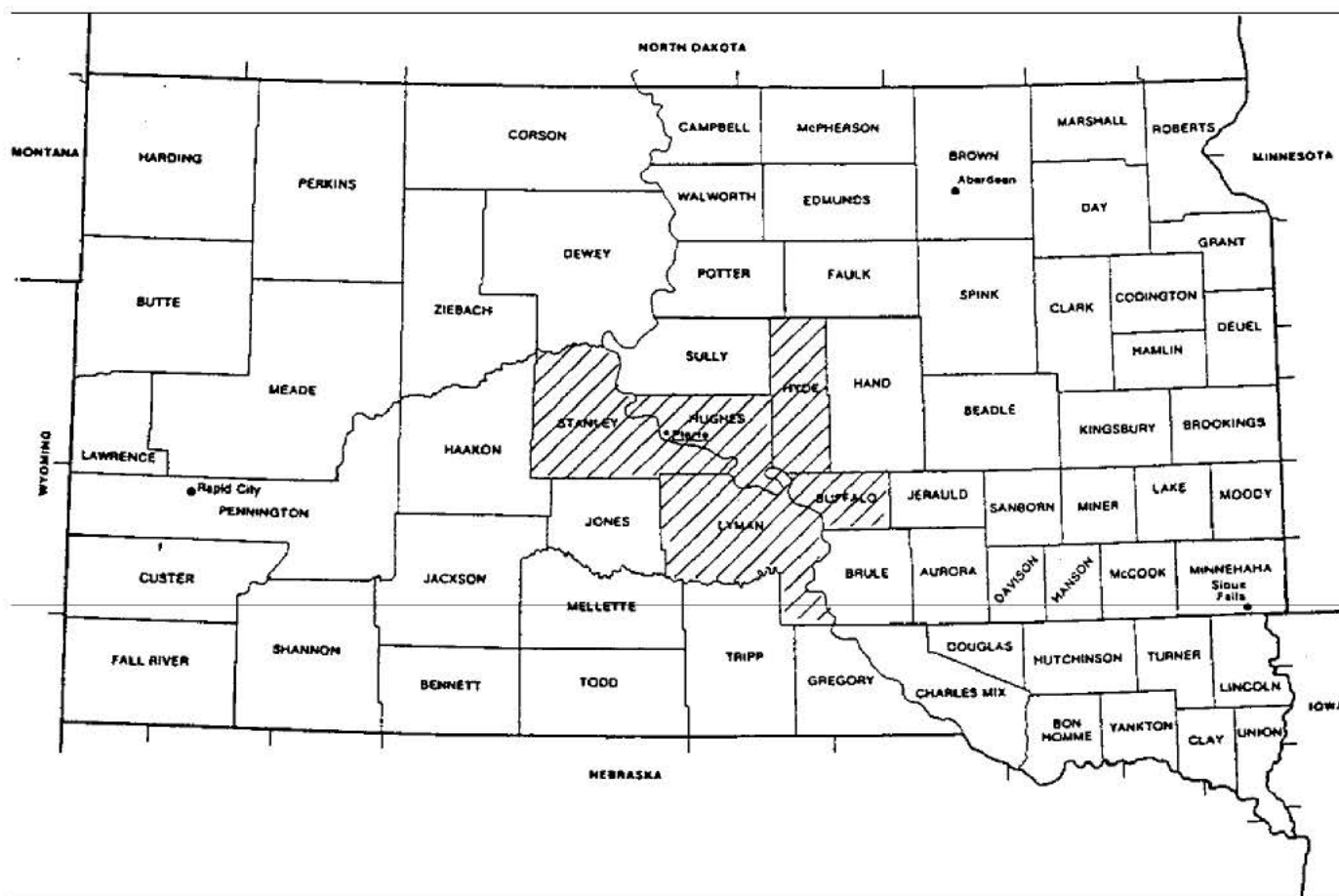


Table 2-20. Origin of Lake Sharpe Visitors

County Of Origin (and major city, if applicable)	Number of Visitors	Percent of Total Visitation	Average Miles Traveled
Hughes (Pierre)	383	17.6	8
Minnehaha (Sioux Falls)	348	16.0	170
Beadle (Huron)	197	9.1	105
Pennington (Rapid City)	58	2.7	197
Brookings (Brookings)	56	2.6	183
Stanley	53	2.4	10
Hand	51	2.3	59
Davison (Mitchell)	50	2.3	109
Brule (Chamberlain)	48	2.2	42
Sully	41	2.0	33
Brown (Aberdeen)	40	1.8	151
Lyman	35	1.6	30
Hyde	33	1.5	37
Jerauld	30	1.4	49
Spink	29	1.3	108
Jones	23	1.1	55
Sanborn	22	1.0	71
Lake	20	.9	143
Codington (Watertown)	17	.8	182
Lincoln	16	.7	205
Union	15	.7	232
Kingsbury	14	.6	137
McCook	14	.6	151
Turner	14	.6	185
Walworth	14	.6	86
Buffalo	12	.6	18
Dewey	12	.6	110
Moody	12	.6	143
Yankton (Yankton)	11	.5	191
Remaining South Dakota	<u>151</u>	<u>7.0</u>	
Total South Dakota	1819	83.7	
Iowa	102	4.7	
Nebraska	52	2.4	
Other States	<u>200</u>	<u>9.2</u>	
Total	2,173	100	

¹ Source: Roy E. Weston, Inc., Recreational Data Analysis for 1980, Contract No. DACW45-81-M-1006, 13 May 1981.

² Additional designation as one of the five contiguous counties. Designates SCORP District 5 county.

2.22.2. Employment

Table 2-21 lists average employment by category and the percent of the total represented for 1985 and 1990. Based on 1990 employment totals, the employment categories that are most significant in South Dakota are services (24.1 percent), retail trade (17.5 percent), government (17.0 percent), and farming (10.5 percent). These numbers reflect the importance of agriculture and tourism to the economy. Also listed is the percentage of change over the time period from 1985 to 1990. Two things are especially worth noting. Following a national trend, fewer people were farming. Going against a national trend of decreased or stagnant manufacturing employment, however, South Dakota showed the largest percentage of job growth in manufacturing (a 24.0-percent increase over 1985).

There are several economic trends that affect outdoor recreation in South Dakota. The state, especially in the face of the agricultural recession, continues to lag behind the rest of the nation in income. Traditionally, South Dakota has been dependent on agriculture but the economy is undergoing a structural change to a more diversified one in which services and manufacturing play more important roles. This change is one that favors the growth of the larger communities in the state at the expense of the rural areas and small towns.

South Dakota is still highly dependent on agriculture as the basis of its economy. Therefore, an economically successful year is dependent on the agricultural harvest. This is reflected in per capita income, which is higher as a percent of the national average whenever the state has enjoyed relatively good agricultural harvests. This percentage is lower whenever agricultural harvests are below normal. As an agricultural state, South Dakota ranked 31st among the 50 states in agricultural employment in 1980, although it was ranked 23rd in farm income. This indicates the importance of wheat, which is a primary crop and not a very labor-intensive agricultural product. Although wheat farming does not directly provide numerous jobs, the revenue that it brings into the state is very important to the economy of South Dakota. South Dakota is a successful agricultural state, producing a high mean farm crop value with a small employment base.

From 1974 to 1982, the total number of farms in the five contiguous counties decreased by 10 percent, but farm acreage also decreased by 10 percent. The total value of agricultural production in South Dakota in 1982 was approximately \$2.5 billion. Of this total, Buffalo County produced \$8 million; Hughes County, \$18 million; Hyde County, \$15 million; Lyman County, \$28 million; and Stanley County, \$17 million.

The five-county total of \$86 million represented approximately 3.5 percent of the state's total 1982 value of agricultural production. In the contiguous counties, 55 percent of the annual agricultural production is raising livestock. The remaining 45 percent is crop production.

Table 2-21. South Dakota Employment by Category, 1985 and 1990¹

Category	1985	Percent²	1990	Percent²	Change (percent)
Farming	46,988	13.0	42,146	10.5	-10.3
Agriculture, Forestry, Fishing	3,129	0.9	3,328	0.8	6.4
Mining	2,753	0.8	2,877	0.7	4.5
Construction	15,714	4.3	18,580	4.6	18.2
Manufacturing	28,800	7.9	35,700	9.0	24.0
Transportation & Utilities	15,980	4.4	17,009	4.2	6.4
Wholesale Trade	17,868	4.9	20,204	5.0	13.1
Retail Trade	61,701	17.0	70,553	17.5	14.3
Finance, Insurance, & Real Estate	23,343	6.4	26,516	6.6	13.6
Services	81,950	22.6	97,185	24.1	18.6
Government	64,510	17.8	68,484	17.0	6.2
Total	362,736	100.0	402,582	100.0	11.0³

¹South Dakota Business Research Bureau, School of Business, University of South Dakota.

²Percent of total employment.

³Total percent changed - not cumulative total of the column.

Manufacturing is a major contributor to the high national per capita income but plays a relatively minor role in South Dakota. In 1980, South Dakota ranked 45th among the 50 states in total manufacturing employment and 45th in manufacturing income. Because of the state's agricultural emphasis, most business and industrial activity has been oriented towards providing services for the state with little orientation towards the nation as a whole.

South Dakota possesses a varied visitor market. Different resources within the State have proven to appeal to different markets in the overall vacation travel industry. Visitors are attracted to different parts of the state throughout the year.

For example, the western part of the state experiences a substantial peak in visitor activity in July and August, while the remainder of the state exhibits significant spring, early summer, and fall activity corresponding to fishing and hunting activities.

About 75 percent of the employment expansion in the travel industry occurs in the sectors directly impacted by visitor spending. These sectors include retail trade, transportation, food and beverages, lodging, and amusements. The remaining 25 percent occurs in a variety of sectors via induced employment impacts.

The smaller counties around Lake Sharpe (Stanley, Hyde, and Buffalo) are less dependent on the travel industry. In these areas, the small number of businesses that are dependent on visitor spending cause a great fluctuation in any data obtained. The addition or discontinuance of a very small number of such businesses in these counties has the potential to produce wide swings in travel-oriented spending. Therefore, it is necessary to look at long-term trends in visitor spending as opposed to year-to-year changes.

Within the past few years, both the Lower Brule Sioux Tribe and the Crow Creek Sioux Tribe have experienced an economic increase, which has decreased the unemployment rate. This is directly attributable to the establishment and success of the Golden Buffalo Casino at Lower Brule in 1990 and the Lode Star Casino in Fort Thompson in 1992. Each casino trains and employs over 150 individuals from the respective communities and the surrounding area.

In a study commissioned by the South Dakota Department of Tourism, it has been determined that the largest growth trend in visitation is in the area around the Missouri River, while the Black Hills area remains the largest market segment within the state. In 1989, the total visitor sales volume for Hughes, Lyman, and Stanley Counties was approximately \$10.9 million compared to \$5.6 million in 1984. This represents an increase of 94.6 percent in the amount of sales in the area. Visitor sales data were not available for Buffalo and Hyde Counties. This is contrasted with an increase in total visitor sales of 19.8 percent for the entire state of South Dakota.

Employment Level. The December 1990 unemployment rate was 5.9 percent nationally. South Dakota experienced a 3.2-percent unemployment rate--the third lowest of the 50 States. The female participation rate was the 10th highest in the Nation at 61.7 percent in 1989. This indicates a stable job market and nearly full employment with the exception of large numbers of people not participating in the job market.

The 1988 BIA estimate of the percent in the labor force seeking work on the Lower Brule Sioux and Crow Creek Sioux Reservations was 29 and 62 percent, respectively.

Income. There are significant differences in income between urban and rural families, between Indian and non-Indian families, and between families whose principal householder is over 60 years of age and those who are younger. The portion of families with income below the poverty level in 1989 was 56.9 in Shannon County in the Pine Ridge Reservation. In 1985, Buffalo County was 13th lowest in per capita income in the Nation, with a per capita income of \$3,572. In 1989, the Buffalo County per capita income was \$5,067 and the Minnehaha County per capita income was \$13,345. This compares to \$10,661 for South Dakota and \$13,546 for the United States.

2.22.3. Demographic Effects on Visitation

Having profiled South Dakota in terms of demographics and economics, it is possible to derive implications concerning future demand for the recreational opportunities possible with the Big Bend Dam/Lake Sharpe project. National demographic characteristics and outdoor-recreation trend analyses were provided in the National Park Service's (NPS) "1982-1983 Nationwide Recreation Survey." Some general conclusions and their applicability to recreation opportunities at Lake Sharpe are presented below.

Population. The population is expected to grow in the major urban areas and on Indian reservations and decline in rural areas for a small but fairly steady net gain. The area immediately surrounding Lake Sharpe is expected to decline in population. The nearby American Indian population could realize increased usage through increased travel from outlying urban areas and from increased usage.

Place of Residence. Except for cities with populations greater than 1 million, the size of the locality where a respondent in the 1982-83 survey lived bore little relationship to participation in or expenditures on outdoor recreation. The largest city in South Dakota, Sioux Falls, is slightly over one-tenth the size of a city of 1 million residents.

Racial and Ethnic Characteristics. In and of itself, neither race nor ethnic heritage determines the demand level for recreational opportunities, although the choice of activities may vary. For instance, in the Indian population, the holding of powwows is an extremely important cultural event.

Another reason that demand can vary with race or ethnicity is due to socioeconomic limitations. Many of the most popular activities associated with a reservoir like Lake Sharpe, notably boating and camping, usually involve an expenditure of funds not necessarily affordable to everyone equally. Travel, too, can be expensive.

Age. The "1982-1983 Nationwide Recreational Survey" discussed some of the recreational demand differences with age and compared participation rates of persons over 60 years of age with those who were younger. Recreational participation among those over 60 was significantly lower than for younger people. A paradox is that there is a greater recreational expenditure among persons over 60 than among younger people. If the current retirement age remains the same, an aging population will be one with more leisure time. With improvements in health and medical care, recreational preferences are likely to be more active ones than have traditionally been associated with "elderly" people.

According to the NPS survey, age is a major factor affecting both participation in and the amount of money spent on outdoor recreation. These trends are shown in Table 2-22. Although recreation involvement declines steadily throughout adulthood, the amount of money spent on outdoor recreation does not. Persons who are age 60 or older spend more than twice as much money per activity day than those in the 40 to 59-year age group. This relationship is demonstrated by camping expenditures. Elderly campers tend to have a moderate to high investment in camping equipment.

Table 2-22. Outdoor-Recreation Participation and Expenditures by Age Category, 1982-1983

Age Group	Number of Activities	Activity Days ¹ Per Year	Yearly Expenditure	Expense Per Activity Day
12-24	10	60	\$236	\$3.93
25-39	8	40	375	9.38
40-59	6	27	413	15.30
60 and over	3	12	391	32.58

¹An activity day represents one visitor participating in a particular recreation activity one or more times at one or more areas of a project for any length of time during a 24-hour period.

The increase in the age of the visitor is reflected in the increased use of Golden Age and Golden Access passports. The Corps issues these passports to persons who are at least 62 years of age or to those persons who are disabled. The actual number of passports issued at Lake Sharpe is not large, but the number issued elsewhere and used at Lake Sharpe is quite high. Approximately 75

percent of the campers in the Corps' fee campgrounds use Golden passports. Increases in the proportion of the elderly in the general population, increased mobility among the elderly and handicapped, and improved access to Corps camping facilities may all contribute to increased camping participation by the elderly and handicapped.

In "Summary of the 1984 Campground Receipt Study," WES Miscellaneous Paper R-86-1, comparisons are made between camping parties with Golden Age passports versus standard entry permits. Nationwide, the Golden passport camping parties were three times as likely to use motor homes or travel trailers but only one-ninth as likely to camp in tents as were the campers with standard entry permits. As a result, Golden passport holders are much more likely to use electrical hookups. The increasing popularity of developed campgrounds with electrical hookups needs to be considered in future development plans.

Market Opinion Research conducted a May 1986 study entitled "Participation in Outdoor Recreation Among American Adults and the Motivations Which Drive Participation" for the President's Commission on Americans Outdoors. This study concluded that a majority of American adults 18 years and over consider themselves "outdoors" people. Members of the "baby boom" generation, born from 1946 to 1961, are predominately individuals with active outdoor lifestyles. Because they constitute such a large portion of all adults, their interests greatly influence general trends. Although the eldest of the baby boomers are at an age when participation in active outdoor sports begins to decline, more of the baby boomers have multiple motivations to continue participating in outdoor recreation than the previous generation--being alone and observing nature, socializing with family and friends, and keeping fit and healthy.

The baby boomers' activity patterns will change with age; however, present motivations suggest these changes may occur at older ages throughout their lives. More demands will be placed on outdoor- recreation facilities in comparison to the demand of older age groups now.

Education. Some recreational activities appear to be associated with educational level. The 1982-83 NPS survey also showed that participation in outdoor recreation rises with increasing levels of education. High school graduates spent over twice as many days and college graduates over three times as many days on outdoor-recreation activities as those who did not graduate from high school.

Because education is linked to income, it is expected that higher educational levels would be associated with greater expenditures on recreational activity, both in the form of equipment

purchases and in expenditures on travel to recreational sites. Educational levels are continuing to increase, with implications for further increases in demand for outdoor-recreation facilities.

Income. Participation in outdoor recreation rises with increasing family income. The 1982-83 NPS survey indicated that the impact of income on outdoor recreation participation did not become substantial, however, until family income exceeded \$15,000. Families earning \$15,000 to \$25,000 per year spent 44 percent more time in outdoor-recreation activities than families earning less than \$15,000 per year and families with an income of at least \$50,000 per year spent 89 percent more time engaging in outdoor-recreation pursuits than families earning less than \$15,000 per year. Although these figures are not in current dollars, the positive relationship between income and time spent on outdoor recreation is clear.

In order to more accurately use the NPS survey results, the household income figures from 1979 were obtained. The median household income in South Dakota in 1979 was \$13,156. State extremes were represented in the primary market area. Buffalo County had one of the lowest median household incomes in the state at \$9,095 while Hughes County had the highest at \$17,458.

2.23. RECREATION FACILITIES

Recreation facilities at Lake Sharpe vary from primitive areas to well-developed campgrounds.

Several factors have influenced the concentrated development of intensive-use recreational facilities on the east side of the lake. These include the topography; geology; soils; sedimentation patterns; transportation patterns; relative location of the main channel; and, perhaps most importantly, market area, which is primarily to the east.

Past, present, and projected visitation does not indicate a critical need for development of new recreation areas on the east side of the lake. However, improved and increased development at some of these recreation areas is needed. Because of the high use of the area by visitors from southeastern South Dakota, a marina development on the eastern end of Lake Sharpe should be considered.

The original Lower Brule Recreation Area was located approximately 1 mile southeast of the town of Lower Brule. Because of its location on the lake and its susceptibility to erosion, the original recreation area was closed and was relocated at Lower Brule. The Lower Brule Sioux Tribe has developed additional recreation facilities in the vicinity of the town of Lower Brule to complement their casino.

The existing recreation facilities at the various areas of the project are listed in Table 2-23.

2.24. RECREATION ACTIVITIES AND NEEDS

South Dakota possesses a variety of natural and scenic resources. Because of these resources, recreation is an important part of the heritage and future of South Dakotans. The importance of outdoor recreation is demonstrated by relatively high rates of participation in fishing, hunting, and a wide variety of other outdoor activities. A combination of public and private resources, facilities, and programs provides diverse and quality outdoor-recreation opportunities for state residents and tourists.

Based on the activity mix presented later in this chapter, approximately 40 percent of the visitors to Lake Sharpe engage in water-based recreation activities, and the remaining 60 percent participate in land-based, outdoor-recreation activities that are enhanced by the proximity of the lake.

Table 2-23. Existing Recreation Facilities

Management Area No.	Recreation Area	Managing Agency ¹	Land Use Allocation ²	Boat Ramp	Boat Dock	Marina	Fish Cleaning Sta ³	Camping	Camp Pads w/Elec.	Comfort Stations	Pit/Vault Toilets	Showers	Potable Water	Dump Station	Swim Area		Designated	Non-Designated	Change House	Picnic Sites	Group Shelter	Multi-Purpose Courts	Ball Field	Amphitheater	Trails	
1	Powerhouse (Visitor Lobby)	C	O																							
2	Left Tailrace	C	R	X	X	X	S	X	X	X	X	X	X	X						X	X				X	
3	Spillway	C	M/R	X	X						X															
4	North Shore	C	R	X	X						X		X		X	X	X	X	X	X	X	X	X			
6	North bend	S	M/R	X	X		T	X			X															
8	West Bend	S	R	X	X		S	X	X	X	X	X	X	X	X					X	X					
10	Joe Creek	S	R	X	X						X		X							X	X					
49	Good Soldier Creek	C	R	X	X						X					X				X	X					
51	Right Tailrace	C	R	X			T			X	X		X							X	X					
56	Old Fort Thompson	C	R	X	X					X	X	X								X	X				X	
Notes: ¹ Managing Agency: C-COE S-SDGFP ² Land Use Allocation: R-Recreation, M-Multiple Resource Management, O-Project Operation ³ Fish Cleaning Station: S-Fish cleaning station with running water and grinder, T-Fish cleaning table only (may or may not have running water)																										

2.24.1. Fishing

Fishing is the major recreational activity participated in by visitors to Lake Sharpe. The popularity and success of fishing at Lake Sharpe is a direct result of stable lake levels and good water quality. Fishing success is also affected by adequate lake access, availability of fish habitat, and adequate aquatic plant growth. Lake Sharpe is located in a part of central South Dakota that serves as a major destination area for fishing parties from South Dakota and adjacent states. Project personnel have observed that the majority of the spring and fall fishermen are part of all-male fishing groups, while the summer fishermen are more likely to be family groups and retired couples.

The most abundant game fish in Lake Sharpe is the walleye, which can be taken virtually any time of the year. Trophy walleyes are quite common in the area from Oahe Dam downstream approximately 15 miles and in the Big Bend tailwaters. The early spring (from the middle of March through the first of May) is the best time to fish these reaches.

As the waters in Lake Sharpe warm in the spring, the fishermen move from the upper reaches downstream toward Big Bend Dam. The lower reaches of the reservoir provide the best walleye fishing during this warm-water period. Although walleye are the predominant fish in Lake Sharpe, there are small mouth bass, coho salmon, rainbow trout, northern pike, yellow perch, crappies, bluegills, channel catfish, and others.

The estimated walleye harvest for 2002 was 144,000 and a fishing pressure of 385,000 hours. Both figures are similar to the previous 10 years. Through the 1980s smallmouth bass were introduced to various areas with a goal of establishing a naturally reproducing, self-sustaining population. That goal was reached and now the state of South Dakota would like to develop a high quality population that can support a catch and release fishery.

In the fall, as the water cools, the fishing success will again increase in the Big Bend tailwaters and the upper reaches of Lake Sharpe. Fishing below both Big Bend Dam and Oahe Dam is generally good. Fish are attracted to the tailrace areas because of the turbulence and warm temperature of the water, the availability of food passing through the turbines, and the physical barrier of the dam (the fish cannot go any farther upstream so they congregate at this location). The lower reaches of Lake Sharpe are primarily fished from boats because of the more limited shoreline access.

The Corps personnel at Big Bend Dam maintain a low-frequency radio station that broadcasts repeat recordings about fishing conditions, water temperatures, and weather at Lake Sharpe. Weather conditions for the upper reaches of Lake Sharpe are broadcast by the Huron, South Dakota Office of the National Weather Service. The weather information for the area is sent by telephone line from Huron and is transmitted from the Reliance Tower located north of Presho, South Dakota. The information is routinely updated four times per day and more often if there are sudden changes in the weather pattern. Information is transmitted during the recreation season (spring, summer, and fall) but is discontinued during the winter.

A major problem for boat fishermen is the lost use of some boat ramps that are currently silting in or are already silted in. Once the use of these ramps is lost, long reaches of the lake will be difficult to access from shore. The large number of tree snags, both exposed and submerged, is another problem confronted by all boaters.

Many shoreline fishermen use the Big Bend Dam tailrace, the spillway, and LaFramboise Island not only in the spring during spawning but also year-round for fishing. Because of the large percentage of Golden Passport visitors in the tailrace campgrounds, these locations require a fishing pier for the aged and handicapped.

Very little survey data are available for the winter months and ice fishing was not surveyed as a separate activity. Ice fishing does occur in the spillway area downstream from Big Bend Dam, in the embayment at Iron Nation, and around Farm Island and LaFramboise Island.

2.24.2. Hunting

The Lake Sharpe area is a very important regional resource for hunting. According to the 1993 visitation survey, hunting accounts for about 10 percent of the overall project visitor use. However, the recreational use surveys were conducted only in designated recreational areas. Most hunters do not use these areas preferring instead more isolated and primitive areas. Hunting use during the fall and winter is probably closer to 50 percent. Hunting opportunities in this area include waterfowl, primarily Canada geese and mallard duck, sharptailed grouse, pheasant, and Hungarian partridge. Big game that is hunted includes pronghorns, white-tailed deer, and mule deer.

The Lower Brule Sioux Reservation maintains herds of elk and buffalo on 3,000 acres of rolling Missouri River breaks. The tribe offers package hunts on the buffalo range that is surrounded by a game-proof fence. The Grassrope Area is located on a 7,000-acre river bend area that is intensively managed for crop and wildlife production. This area contains approximately 5,000 acres of irrigated corn and bean fields providing ample surplus food for wildlife. The remaining 2,000 acres in the river bend are managed as wildlife habitat including shelterbelts, upland bird nesting cover, and year-round food plots.

The Lower Brule Sioux Tribe maintains the Lower Brule Goose Camp (formerly Clark's Ranch), which is comprised of a 2,500-acre ranch managed for goose hunting. Another goose-hunting area is the Big Bend Ranch, a private hunting ranch located northeast of the Lower Brule Goose Camp on the east shore of Lake Sharpe.

2.24.3. Camping

On a statewide basis, South Dakota appears to be adequately supplied with camping facilities; however, surpluses and shortages occur in various parts of the state. The 1992 SCORP shows that the West Region, which includes Lake Sharpe, has approximately 54 percent of the state's public campgrounds and that one-third of all travelers to the State of South Dakota stay in campgrounds. The West Region also has 39 privately owned campgrounds located mainly in the Black Hills, Badlands, and along major tourist travel routes. Developed public campgrounds account for approximately 53 percent of the camping facilities while primitive camping accounts for approximately 1 percent of the facilities. About 35 percent of the campers favor developed campgrounds with only 8 percent of the users preferring primitive camping.

Campgrounds around Lake Sharpe are available for all levels of camping and provide a variety of facilities. There is a demand for more campsites and improved facilities at various recreation areas around Lake Sharpe, especially for developed campsites that offer all the amenities at existing recreation areas. This will lead to better use at these areas.

As a high resource-oriented activity, primitive camping takes place often in areas where large amounts of undeveloped public recreation land are available. Most primitive camping at Lake Sharpe is associated with hunting and fishing trips, but a few individuals seek a primitive camping experience to enjoy solitude and nature. These people are not highly visible, vocal, or

easily identified; therefore, their needs are easily overlooked. Although their requirements are minimal, it is important to consider their needs. Opportunities for primitive camping should be preserved where they already exist at sites such as Joe Creek.

2.24.4. Boating

The majority of the visitors coming to Lake Sharpe enjoy boating activities. With the excellent fishery at Lake Sharpe, much of the boating is related to fishing activities. However, sailboating, waterskiing, and powerboating are also popular activities. These activities most often occur near Pierre, Farm Island, Hipple Lake, and Good Soldier Creek where few obstructions are present and the water is relatively warm and protected.

The increasing popularity of larger boats with deep-draft hulls designed to remain in the water during the recreation season is creating a demand for expanded marina facilities. Fuel and harbor accommodations in the vicinity of Pierre are planned to permit and encourage pleasure-craft navigation on Lake Sharpe. The Oahe Yacht Club, headquartered in Pierre, operates on both Lake Oahe and Lake Sharpe. The club buoys snags in the river and in the channel out of Hipple Lake to improve lake access and boating safety. Because of the visitation to the recreation areas around Big Bend Dam shown later in this chapter, there may be a need for marina development near the dam.

The central South Dakota portion of the Missouri River main stem reservoirs region serves as a major destination area for weekend fishing and camping trips by residents from all over the State. Local residents comprise from 30 to 50 percent of the visitors to the Missouri River recreation areas with some 8 to 19 percent coming from out of state. The remainder of the visitors is from other parts of the state. Because from 50 to 70 percent of the total visitors originate outside the immediate local area, it appears that the supply of boat ramps is less than adequate. This lack of boat ramps is compounded when the poor condition of some boat ramps and embayments at Lake Sharpe is considered. Improved maintenance and repair on existing boat ramps and a program to construct new boat ramps to replace lost ones must be aggressively pursued in order to satisfy increasing visitor demands for more and better access to Lake Sharpe.

Jet skiing, windsurfing, and scuba diving activities attract small numbers of participants. A few people jet ski in Good Soldier Bay, windsurf around Farm Island, or scuba dive in the Big Bend tailrace. Existing facilities appear adequate to accommodate these few participants.

Water-skiing, popular on Hipple Lake and in some protected embayments, sometimes conflicts with swimming. In areas with high levels of use by both water-skiers and swimmers, ski beaches have been added for convenience, enjoyment, and safety. It is not feasible to provide combined swimming and ski beaches at all Lake Sharpe recreation areas, but it is desirable to give preference to swimmers because of the greater number of participants.

2.24.5. Trail Activities

Recreation trails have emerged as one of the most popular outdoor-recreation facilities in South Dakota. The wide variety of activities that the trails facilitate contributes to their popularity. Walking; jogging; bicycling; cross-country skiing; snowmobiling; and using off-road vehicles, all terrain vehicles, and off-road motorcycles are common activities. These trail activities can be done alone or in groups for pleasure or transportation in areas separated from normal vehicle traffic.

Non-motorized Trails. Most trails in the State are located in the Southeast Region, the Black Hills, and the Badlands. Therefore, the area in the vicinity of Lake Sharpe has a need for trails that is recognized in the 1992 SCORP.

Up to 72 percent of the population participates in walking, jogging, bicycling, and hiking activities. Trails for pedestrian/bicycling should be developed in and around the Pierre area because this is where the demand exists. One such trail begins at the Farm Island Recreation Area, follows State Highway 34 into Pierre, and then follows the riverfront from Griffin Park to the U.S. Highway 14 Bridge across the Missouri River. This trail is located both on and off public land throughout its 6-mile length. However, because of its close proximity to Highway 34, this trail only receives limited use by families with small children. The possibility exists to move the trail away from the highway and closer to the river. In addition, the potential exists to extend the hiking/biking trail from Farm Island east to the Rousseau Recreation Area thus adding an additional 10 miles to the existing trail.

Two hiking trails, now joined together, were developed in 1990 as Eagle Scout projects. This 1.5-mile-long trail runs from the Isaak Walton League Area east of Pierre through the Golf Course Area and ends at the west end of the Farm Island Recreation Area. There is moderate use of this trail by individuals and family groups.

Nature Trails. There are three nature trails on or in the vicinity of the Big Bend Dam/Lake Sharpe project. The one-half-mile long Good Soldier Creek nature trail is located in the Old Fort Thompson Recreation Area. A second trail is located on LaFramboise Island. The LaFramboise Island trail sprawls over the length and breadth of the island and is an 8-mile network that crisscrosses in all directions. Only foot traffic, including cross-country skiers and snowshoers, is allowed. A majority of the hikers are from the local Pierre communities. A third trail, located on Farm Island, is 3.5 miles long and has been designated as a National Recreation Hiking Trail by the NPS. Again, only foot traffic is allowed.

Offroad Vehicle Trails. Offroad vehicles (ORVs) are becoming more popular and may create new recreational demands and problems. At the present time, the state has no designated or developed ORV trails. The impact of ORVs on the resources and on other users should be assessed in order to determine appropriate management policies. There are no areas around Lake Sharpe that are designated for ORV use.

2.24.6. Picnicking

Picnic facilities are generally available at the more popularly used recreation areas. The creation of new picnic areas and improvement of existing ones with facilities such as shelters, playgrounds, comfort stations, vault toilets, and potable water are recommended.

2.24.7. Sightseeing

Many of the visitors to Lake Sharpe participate in sightseeing, sometimes as a secondary or tertiary activity but for many visitors, also as a primary activity. The solitude and beauty of the area, combined with opportunities to view native wildlife in a natural setting, make the Lake Sharpe area attractive to sightseers.

The Native American Tour Loop is a self-guided driving tour through the Crow Creek Sioux and Lower Brule Sioux Indian Reservations. The route follows State Highway 50 north out of Chamberlain to Fort Thompson. From there, it follows State Highway 47 to Big Bend Dam, a major focal point for the tour loop. From Big Bend Dam, the loop follows State Highway 47 south to Reliance where it meets Interstate 90 for the return trip to Chamberlain or for continuation toward the Black Hills. Although the route is well marked, there may not be enough

attractions, sufficient local interest, or support to encourage visitors. Development of a first-class Cultural Learning Center at the North Shore Recreation Area with special exhibits on Native American history and an aggressive advertising campaign about the Native American Tour Loop would attract more visitors because more people would hear about it. The advertising campaign would need to promote special events, such as powwows and fishing tournaments, and have the assistance and cooperation of all agencies, such as the Corps, BIA, various state agencies, Chambers of Commerce for Chamberlain and Oacoma, and local businesses that would benefit from the Cultural Learning Center.

2.24.8. Swimming

Swimming is a popular activity at Lake Sharpe with 11.4 percent of the visitors participating on an annual basis. Designated swimming areas, marked with buoys, are located in the North Shore and West Bend recreation areas. In other areas around the lake, many visitors swim and sunbathe along the shoreline in undesignated locations at their own risk. Water quality is always a concern and must be monitored regularly to assure public health and safety. One problem with maintaining the beaches is the proliferation of sandburs in some areas. At times the maintenance staff will pull the sand burs by hand. Also, the maintenance staff is currently required to drag the designated beaches on an average of once per week.

2.24.9. Powwows

Both the Lower Brule Sioux and the Crow Creek Sioux Tribes regularly hold powwows and other recreation-related activities that help to build social cohesiveness in their community. Both tribes maintain powwow grounds close to project boundaries. Even though the powwow is not held on Corps property, many people attending the events as participants and tourists do use the campground facilities at the Old Fort Thompson and Left Tailrace Recreation Areas.

2.25. VISITATION PROFILE - TRENDS AND DEMANDS

The Missouri River reservoirs are each unique in their own way. The amount of recreation facility development, diversity of topography, type of fishery, availability of big game and upland game species, proximity to population centers, and so forth varies from project to project. Accordingly,

each project attracts a different clientele. Lake Sharpe offers some of the best walleye fishing on the main stem. Because of the excellent habitat and food plots located throughout the project, hunting opportunities are outstanding. The central location of the project provides easy access for South Dakota residents and visitors to enjoy hiking, photography, and sightseeing. Each of these factors contributes to the visitation patterns observed at the Big Bend Dam/Lake Sharpe project.

2.25.1. Project Visitation

Table 2-24 shows the annual visitation to the Big Bend Dam/Lake Sharpe project from 1987 through 2000. As can be seen, the 2000 project visitation for the Big Bend Dam/Lake Sharpe project was 5,261,800 visitor-hours. Visitation to designated recreation areas accounted for 99.3 percent. The remaining 0.7 percent of the visitation is the estimated amount of dispersed recreational use. (Dispersed use is that type of recreation that occurs in those parts of the project that are not designated recreation areas).

Overall visitation at the Big Bend Dam/Lake Sharpe project showed a steady increase up to 1990. Since then the visitor-hours have been relatively steady at roughly between 4.1 and 5.3 million visitor-hours each year. Abundant fishing and hunting opportunities, as well as improved day use and camping facilities, have all contributed to the steady rate of visitation.

When compared to the other reservoirs on the Missouri River main stem during 2000, the Big Bend Dam/Lake Sharpe project recorded the lowest use in terms of visitor-hours as shown in Table 2-16. In fact, visitation to the Big Bend Dam/Lake Sharpe project accounted for only 9.0 percent of the total visitation to the main stem system.

However, when taking into account the number of shoreline miles, Big Bend ranks second only to the Gavins Point project as having the greatest number of visitor-hours per shoreline mile. This indicates that for the size of Lake Sharpe, it is used quite extensively.

Table 2-24. Big Bend Dam/Lake Sharpe Annual Project Visitation¹

Year	Visitor-Hours
2003	6,286,971
2002	5,561,729
2001	5,057,411
2000	5,261,800

1999	5,204,100
1998	5,107,500
1997	4,196,400
1996	4,886,700
1995	4,779,200
1994	4,829,900
1993	3,537,100
1992	5,310,100
1991	5,709,600
1990	5,809,800
1989	4,119,900
1988	3,489,800
1987	2,634,700
1 Rounded to nearest hundred.	

Table 2-25. Main Stem Visitation

	RT PECK	Garrison	Oahe	Big Bend	Fort Randall	Gavins Point
2000 Main Stem Visitor-Hours	5,946,100	16,555,900	14,623,200	5,261,800	9,752,300	8,756,400
Percent of Total 2000 Visitor-Hours	10.0	27.0	24.0	9.0	16.0	14.0
Miles of Shoreline	1,520	1,340	2,250	200	540	90
2000 Visitor-Hours per Shoreline Mile	3,900	12,400	6,500	26,300	18,100	97,300

2.25.2. Visitation Surveys

The Corps conducted the most recent survey at Lake Sharpe in 1992 and 1993. Survey questions were divided into two specific types - those pertaining to the Big Bend Dam/Lake Sharpe project as a whole and those pertaining to specific recreation areas.

The final product was analyzed by WES and is the most accurate data about visitor use at Lake Sharpe and the other main stem projects. This survey not only provides information as to the place of residence and destination of visitors, but also records the length of stay, the average number of visitors per vehicle, and the specific type of recreation activity in which visitors participated.

Visitation has increased with visitors coming from farther away. These visitors travel farther, on the average; stay longer; and spend more than local users. Much of the use of the project is by travelers en route to the Black Hills, Yellowstone, or other destination recreation attractions. A more aggressive marketing campaign by state and local agencies along with diversified recreation facilities and opportunities could aid in increasing the visitation to the project.

2.25.3. Visitor Distribution

In order to analyze the distribution of visitors at Lake Sharpe, the lake was divided into three areas: the Big Bend Dam area, the Central Area, and the Pierre/Fort Pierre area. Table 2-17 shows the amount of visitation received at each recreation area during 2000 and that area's percent of the total visitation.

The recreation areas around Big Bend Dam accounted for approximately 44 percent of the visitation at Lake Sharpe. Visitors to this area were primarily fishermen and campers who were not seeking the variety of facilities and other activities and attractions that are available in the Pierre/Fort Pierre area. The origin of the majority of these visitors was from south and east of the project, including southeastern South Dakota, Iowa, and Nebraska.

The greatest numbers of visitors were from Minnehaha County, South Dakota.

The central recreation areas accommodated roughly 12 percent of the project visitation during 2000. A large majority of the visitors to the North Central area were from east-central South Dakota with roughly one-third from Beadle County (Huron). The majority of the visitors to the South Central area were from the southeastern portion of South Dakota with the largest number from Minnehaha County (Sioux Falls). Fishing and hunting were the primary activities enjoyed in the entire central area.

The Pierre/Fort Pierre area accounted for approximately 43 percent of the total visitation. This significant percentage is attributable to several factors--an abundance of facilities, a variety of activities, the proximity to an urban center, and the proximity to the state capitol. The greatest numbers of the visitors to the Pierre area are from Hughes County, South Dakota, but the remaining visitors to the Pierre/Fort Pierre recreation area come from all over the State, as well as other parts of the United States.

2.25.4. Carrying Capacity

Carrying capacity is a concept that denotes the limit of use for some particular purpose. A pasture will "carry" only a limited number of animals for a given time without suffering damage sufficient to reduce future capacity. Similarly, the recreational carrying capacity of an area is thought of in two ways, as "social" capacity and as "resource" capacity.

Social capacity is the level of density beyond which the user does not achieve a reasonable level of satisfaction. For example, the social capacity of a given area is typically much greater for a swimming beach than a golf course. Resource capacity is the level of use beyond which irreversible biological deterioration takes place or degradation of the resource makes it unsuitable or unattractive for recreational use. Resource capacity is usually a seasonal or long-term issue, as most areas will tolerate some short-term overuse without significant adverse effect.

The resource capacity at Lake Sharpe is typically controlled by factors such as the presence of nesting sites, highly erodible soils, or steep terrain. Resource capacity must be accommodated in the design and location of facilities, as well as the regulation of use. Areas with low resource capacity are classified as environmentally sensitive areas, mitigation lands, or multiple resource management lands.

The social capacity is most frequently limited by the level of recreational facility development, such as parking spaces and restrooms, or by the expectations of the different recreational users. The density of the existing facilities at Lake Sharpe is generally appropriate for the region and social capacity limits are rarely reached. Areas where additional facilities are needed to increase capacity are primarily in the vicinity of the dam. The sites with higher carrying capacity and accessibility are ordinarily classified as recreation or project operations lands.

Table 2-26. 2000 Visitation to Lake Sharpe Recreation Areas¹

Recreation Area	2000 Visitor-Hours	Percent of Total Visitation
BIG BEND DAM AREA		
Left Tailrace	1,684,500	32.0
Right Tailrace	124,800	2.4
North Shore (ramp & beach)	287,800	5.5

Good Soldier	65,600	1.2
Spillway	80,900	1.5
Old Fort Thompson	70,900	1.3
Visitor Center ^{2,3}	17,200	0.1
Powerhouse ²	<u>1,000</u>	<u><0.1</u>
Subtotal	2,332,700	44.0
CENTRAL AREA		
<u>South Central</u>		
West Bend	494,700	9.4
Iron Nation South	33,000	0.6
North Bend	2,300	<0.1
Lower Brule	21,000	0.4
Iron Nation North	65,900	1.2
Lower Brule Boat Ramp	9,500	0.2
Counselor Creek	1,700	<0.1
Narrows	4,400	<0.1
<u>North Central</u>		
Joe Creek	4,400	<0.1
Fort George	6,100	0.1
DeGrey	5,400	0.1
Rousseau Overlook	26,400	0.5
Arikara ⁴	7,100	0.1
Cedar Creek	2,400	<0.1
Antelope Creek	<u>2,300</u>	<u><0.1</u>
Subtotal	686,600	13.0
PIERRE/FORT PIERRE AREA		
Pierre Waterfront	537,900	10.2
Farm Island	1,340,300	26.2
Fort Pierre Waterfront	23,600	0.4
LaFramboise Island	<u>298,800</u>	<u>5.7</u>
Subtotal	2,200,600	41.8
TOTAL	5,220,100	98.8⁵

NOTES:

¹Rounded to the nearest hundred.

² In Chapter 6, these facilities are included in the North Shore Recreation Area (Management Area #3) and the Dam Embankment, Powerhouse (Management Area #1), respectively.

³The Visitor Center was destroyed by a tornado in June 1992.

⁴Not managed as a recreation area but rather as a wildlife area with limited lake access.

⁵The remaining percent is the estimated dispersed recreation use.

Site-specific carrying capacities need to be determined for designing specific improvements at those areas with the highest visitation and for those sites that may be used more extensively in the future. Detailed information on the resource base is being obtained and mapped as part of the OMP process. As improved visitation and user information is obtained through surveys, the data can be combined with the OMP resource data to calculate site-specific carrying capacities.

2.25.5. Activity Mix

The relative frequency of participation in various activities at Lake Sharpe is estimated each year. The annual activity mix is presented in Table 2-27.

Table 2-27. Activity Mix, Lake Sharpe

Activity	Annual Participation Rate (percent)
Fishing	23.3
Powerboating	19.5
Waterskiing	1.3
Swimming	11.4
Camping	5.5
Picnicking	11.9
Hunting	0.1
Sightseeing	46.7
Other	18.3
Total	138.0

The total is greater than 100 percent because many people participated in more than one activity at a given recreation area. The annual participation rate for fishing at Lake Sharpe is quite high compared to other projects. Although the annual participation rate for hunting is listed as 0.1 percent, hunting participation around Lake Sharpe in the fall and winter months is probably closer to 50 percent.

2.26. RELATED RECREATIONAL, HISTORICAL, AND CULTURAL AREAS

The major recreation areas and tourist attractions located within a 60-minute drive of the Big Bend Dam/Lake Sharpe project are listed in Table 2-28. These attractions tend to be grouped at both ends of the lake and are either directly or indirectly related to the history of the Great Plains.

The largest group of visitors to Lake Sharpe is fishermen, who make up 65 percent of all visitors. Fishermen are generally not interested in sightseeing. The second largest group of visitors to the lake is classified as sightseers, who may be interested in visiting area attractions. Nearby recreation areas and attractions could also constitute side trips for campers during inclement weather and to vary their recreational experience.

Recreation activities similar to those offered at Lake Sharpe are also available at the two adjacent Corps projects, Lake Francis Case and Lake Oahe. The Weston visitation survey conducted in 1980 indicated that the market areas of all three projects have a significant overlap. An advantage of recreating at Lake Sharpe is the stable pool that is relatively unaffected by flooding or drought.

Table 2-28. Major Tourist Attractions, Events, and Recreation Areas Within 60-Minute Drive

Attraction	County	Type
South Dakota State Capitol, Pierre	Hughes	Historical
South Dakota Cultural Heritage Center, Pierre	Hughes	Historical, Cultural
Verendrye Monument & Museum, Fort Pierre	Stanley	Historical
South Dakota Cowboy and Western Heritage Hall of Fame, Chamberlain	Brule	Historical
Pari-mutuel Horse Racing, Fort Pierre	Stanley	Sporting
Oahe Dam - Lake Oahe	Hughes, Stanley	Recreational
Lower Brule Sioux Powwow, Lower Brule	Lyman	Cultural
Crow Creek Sioux Powwow, Fort Thompson	Buffalo	Cultural
St. Joseph's Indian School Powwow, Chamberlain	Brule	Cultural
Native American Loop	Brule, Buffalo, Lyman	Cultural, Historical
Lake Francis Case	Brule, Lyman	Recreational

2.27. REAL ESTATE

2.27.1. Land Acquisition History

Under the authority of the Flood Control Act of 1944, Public Law 534, 78th Congress, 2nd session, the Corps acquired large acreages of land for the Big Bend Dam/Lake Sharpe project. It was the general desire of the Administration at the time of acquisition that new project lands be restricted to the minimum operation and maintenance requirements and meet the readily foreseeable public access demand. The original acquisition criteria followed by the Corps were generally consistent with that policy.

Fee simple acquisition of land for the Big Bend project was established by delineating all land lying below elevation 1,420 feet m.s.l. plus that land lying 300 feet horizontally from the edge of the pool. Additional lands were acquired in fee title beyond this elevation to accommodate the effects of seepage, erosion, and wave action.

2.27.2. Title VI

Following is a brief description of some of the actions resulting from legislation sponsored by Senator Tom Daschle in the Water Resource Development Act of 1999 (WRDA) 106-53, and Water Resource Development Act of 2000 106-541, commonly called Title VI.

Under the provisions of Title VI, the Government retains fee title to lands and structures necessary for continuation of the operation, maintenance, repair, replacement, rehabilitation, and structural integrity of the dam and related flood control and hydropower structures, including land below the top of the exclusive flood control pool and can lease into perpetuity all or part of certain recreation areas associated with the dams to the State of South Dakota.

For the remaining lands acquired for the Pick-Sloan Missouri River Basin program, located outside the external boundaries of Tribal Reservations, fee title of recreation areas was transferred to the State of South Dakota on 26 January 2002. Fee title of other lands that are above the top of the exclusive flood control pools are to be transferred to the State of South Dakota no later than 1 year after the South Dakota Terrestrial Wildlife Habitat Restoration Trust Fund is fully capitalized.

In respect to Big Bend, Title VI establishes the South Dakota Terrestrial Wildlife Habitat Restoration Trust Fund and the Lower Brule Sioux Tribe Terrestrial Wildlife Habitat Restoration Trust Fund. These trust funds are defined as fully capitalized after the funds contain at least \$108,000,000 and \$14,924,000 respectively. After these trust funds are fully capitalized, interest from these trust funds can be used by the state of South Dakota and the Lower Brule Sioux Tribe to develop, submit and carry out plans for the restoration of terrestrial wildlife habitat loss that occurred as a result of flooding related to the projects carried out as part of the Pick-Sloan Missouri River Basin Program. The interest can also be used for protecting archeological, historical, and cultural sites, and for funding cost associated with lease, ownership, management, operation, administration, maintenance, or development of recreation areas and other land transferred or to be transferred by the Secretary of the Army.

2.27.3. Flowage Easements

The flowage easements acquired for the project give the Government a perpetual right to overflow or flood the land when necessary as a result of construction, maintenance, and operation of the project. The Government also has the right to enter the easement lands as needed and to remove any natural or manmade obstructions or structures that, in the opinion of the Government, may be detrimental to the operation and maintenance of the project. The flowage easements were acquired subject to "existing easements for public roads and highways, public utilities, railroads, and pipe lines."

Historically, it has been Corps policy to prohibit structures for human habitation on flowage easements acquired by the Corps of Engineers. Construction and/or maintenance of uninhabitable structures on the flowage easement are subject to prohibition or regulation by the District Engineer.

2.27.4. Current Landholdings

- There were four types of land tenure acquired for the Big Bend project.
- Land owned by private parties in their own right or by State or local governments;
- Land owned by the United States on behalf of the Tribes (trust lands);

- Land owned by the United States on behalf of Indian individuals (allotted trust lands); and
- Land owned by the United States in its own right or as public domain.

Generally, the Government acquired a fee simple estate from private and public landowners within the project boundaries. The Government rights are subject only to certain existing easements or rights on the land prior to purchase by the Government.

The United States bought or condemned land from non-Indians on both sides of the river. However, as lands owned by the Lower Brule Sioux and Crow Creek Sioux Tribes and their members were held in trust by the United States, such lands could only be transferred to the Corps by an act of Congress. Congress passed two laws to accomplish this purpose. Public Law 87-734, approved 3 October 1962, acquired 14,372 acres of land from the Lower Brule Sioux Tribe and individual members of the Tribe. Public Law 87-735, also approved 3 October 1962, acquired 6,284 acres of land from the Crow Creek Sioux Tribe and individual members of the Tribe. These Public Laws, however, reserved certain rights, title, interest, and privileges in the acquired land for the Tribes and their members.

Approximately 13 acres used for the project were public domain lands held in the possession of the U.S. Government since the Louisiana Purchase. By Public Land Order 3270 dated 20 November 1963, the Secretary of the Interior withdrew, permanently set aside, and reserved these lands for the Army for use in connection with the Big Bend project.

In addition to the fee lands that were purchased, Indian lands that were transferred, and public domain lands that were withdrawn, was land that had been acquired previously for the construction of the Fort Randall project. The land included 10,609 acres of land acquired from the Lower Brule Sioux Tribe and its members under the provisions of Public Law 85-923 approved 2 September 1958. Land acquired from the Crow Creek Sioux Tribe and its members under the provisions of Public Law 85-916 approved 2 September 1958 amounted to 4,179 acres.

Table 2-29 reflects the approximate acreages currently owned by the Government at the project. This section reflects lands transferred in fee title under Title VI to the Department of the Interior/Lower Brule Sioux Tribe and to the State of South Dakota in 2002. These lands are not included in this Master Plan as noted in Table 1-1. Additional lands will be transferred upon capitalization of the trust funds for each entity (Table 1-1). These lands will be managed in perpetuity for the restoration of terrestrial wildlife habitat loss that occurred as a result of flooding related to the

Oahe project and other reservoir projects carried out at part of the Pick-Sloan Missouri River Basin Program.

2.27.5. Executive Order Surveys

Executive Order 12512 dated 25 April 1985 and the Federal Property Management Regulations contained in 41 Code of Federal Regulations (CFR) 101-47 require periodic review of project landholdings to determine if federal lands are being either overused or underused or are not being put to optimum use. To meet this requirement, the Omaha District conducts annual use inspections of all projects, including the Big Bend Dam/Lake Sharpe project. An Executive Order Survey is usually conducted every fifth year and forwarded to the General Services Administration (GSA) through Headquarters, U.S. Army Corps of Engineers (HQUSACE) for approval and acceptance. This Executive Order Survey replaces the use inspection for that year.

Table 2-29. Government-Owned Lands, Big Bend Project (acres)

County	Buffalo	Hughes	Hyde	Lyman	Stanley	Big Bend Project
Acquisition Lands						
Fee	631.25	14,171.30	--	2,929.08	3,710.59	21,442.22
Easement/Licenses	166.14	4.61	--	--	4.00	174.75
Public Domain	--	7.20	--	--	5.63	12.83
Indian Owned	1,529.07	6,428.02	752.57	13,670.06	1,589.70	23,969.42
Total Acres Acquired	2,326.40	20,611.13	752.57	16,599.14	5,310.02	45,599.22
Disposal Lands						
Fee	--	184.19	--	111.11	0.06	295.36
Easement	1.57	2.14	--	--	0.84	4.55
Transfer to BIA/State	559.00	2,578.32	--	6,000.62	1,213.11	10,351.05
Total Acres Disposed	560.57	2,764.65	--	6,111.73	1,214.01	10,650.96
Currently Managed						34,948.26*
* Does not include any Fort Randall Lands						

2.27.6. Encroachments

The majority of encroachments on project lands are associated with agricultural/grazing leases and adjacent landowners. Lessees and adjacent landowners sometimes expand their farming/ranching operations onto Corps-managed land without the appropriate authorization. Small portions of project lands are sometimes grazed or farmed. Occasionally, adjacent landowners will store machinery, construct corrals, or erect storage buildings on Government land.

2.27.7. Boundary Monumentation and Fencing

The entire Big Bend project boundary has been surveyed and monumented. This was accomplished under an interagency agreement with the Bureau of Land Management (BLM) in the late 1970s and early 1980s. Project personnel have monitored the boundary "as needed" to resolve encroachments. Where appropriate, the original survey has been retraced to establish the property line before constructing boundary fences. The project boundary should be inventoried, resurveyed, and monumented, as needed.

2.27.8. Relocation Contracts

A relocation contract is an agreement that provides substitute facilities for those acquired facilities that will interfere with project development.

State and county roads, a portion of the Chicago and North Western Transportation Company railroad, school facilities for Rousseau School District No. 14, telephone and electric lines, and a cemetery were relocated during the construction of the dam and reservoir.

2.27.9. Outgrants

An outgrant document is any real estate instrument used to convey an interest in or temporary use of project land. The types of outgrant issued at Big Bend are leases, licenses, permits, and easements. The Corps has issued 237 outgrants on project land.

Leases. A lease is a contract between the owner (lessor or landlord) and the tenant (lessee) setting forth the term of occupancy and the conditions under which the tenant may occupy and use the property. A lease conveys an interest in the property for a set term. There are 6 public park and recreation leases, 17 agricultural/grazing leases, and 1 miscellaneous lease for the project. The 6 public parks and recreation leases were assigned and/or transferred to the State of South Dakota and the Lower Brule Sioux Tribe pursuant to Title VI.

Licenses. A license grants authority to enter or use another's land or property without having ownership in it. It is revocable at will. Action without a license constitutes trespass. This type of outgrant includes Archeological Resources Protection Act permits issued pursuant to 32 CFR 229. There are 19 licenses issued for the project, one of which was assigned and/or transferred to the State of South Dakota pursuant to Title VI.

Permits. A permit is a revocable privilege granted to another federal agency to use real property for a specific purpose without conferring possession. There are 8 permits issued to various federal agencies on the project, all of which are within the Lower Brule Sioux Tribe boundaries and were transferred to the tribe pursuant to Title VI.

Easements. An easement allows one party to use certain lands of another party. An easement conveys an interest in the property. Rights-of-way are the most frequent easement request for public land. There are 186 easements for rights-of-way for waterlines, roads, and gas pipelines on the project. All of the areas disposed to the DOI and the State of South Dakota pursuant to Title VI were transferred subject to these existing easements.

2.27.10. Special Considerations

Grazing Rights within the Lower Brule and Crow Creek Indian Reservations. Section 10 of Public Law 87-735 dated 3 October 1962 provided that "the Crow Creek Sioux Tribe shall be permitted, after the Big Bend Dam gates are closed and the waters of the Missouri River impounded, to graze stock without charge on such of the land described in this section as lies between the level of the reservoir and the taking line as described in section 16 of this Act and as the Secretary of the Army determines is not devoted to other beneficial uses and to lease such land for grazing purposes to members or nonmembers of the tribe on such terms and conditions as the Secretary of the Interior may prescribe."

Section 10 of Public Law 87-734 restates the same condition in relation to grazing privileges to the Lower Brule Tribe.

Section 5 of Public Laws 85-923 and 85-916 provides that the Lower Brule Sioux and the Crow Creek Sioux Tribes, respectively, shall be given exclusive permission without cost to graze livestock on land between the water level of the Fort Randall Dam/Lake Francis Case project and the exterior boundary of the taking area. Some of these lands originally acquired for the Fort Randall Project are now part of the Big Bend project for its construction and operation.

2.28. PERTINENT PUBLIC LAWS

2.28.1. Civil Authority

Except as otherwise provided by federal law or regulation, state and local laws and ordinances apply on project lands and waters. These include, but are not limited to, state and local laws and ordinances governing the following:

- Operation and use of motor vehicles, vessels, and aircraft;
- Hunting, fishing, and trapping;
- Display or use of firearms or other weapons;

- Camping, starting or tending fires, and use of fireworks;
- Civil disobedience and criminal acts; and
- Littering, sanitation, and pollution.

2.28.2. Corps Authority

Rules and regulations governing public use of water resources development projects administered by the Corps are contained in 36 CFR 327. Persons designated by the District Engineer have the authority to issue citations for violations of rules and regulations governing public use of Corps water resources projects. If a citation is issued, the person charged with the violation may be required to appear before a U.S. Magistrate for trial.

2.28.3. Federal Authority

The following federal public laws, Executive Orders, and cooperative agreements pertain to authorization of the project, present and future development, and operation of project lands and waters.

General Laws and Authorities

Public Law 534, 78th Congress (58 Stat. 887), 22 December 1944, Flood Control Act of 1944, as amended. This act authorizes the construction of certain public works on rivers and harbors for flood control and other purposes. Section 4 authorized providing facilities at reservoir areas for public use, including recreation and fish and wildlife conservation. As amended in 1962 by section 207 of Public Law 87-874, the act authorized the Corps to develop and maintain park and recreation facilities at all water resources projects controlled by the Secretary of the Army. Section 9 authorized the Big Bend project. Senate Document 247, 78th Congress, 2nd session, is the congressional document of the project. The Big Bend project is part of the multipurpose reservoir system on the Missouri River and provides for flood control, navigation, irrigation, hydropower, recreation, and fish and wildlife conservation.

Public Law 1028, 84th Congress (70A Stat. 150), 10 August 1956, (United States Code, (U.S.C.) Title 10 and Title 32). Section 2667 of this law authorizes the Secretary of a military department

to lease nonexcess land when it is advantageous to the United States. Grazing leases are also authorized under this provision. Sections 2668 and 2669 authorize the granting of easements and rights-of-way for many purposes, including transmission lines and gas, water, and sewer pipelines.

Public Law 85-923 (72 Stat. 1773), 2 September 1958, (Lower Brule Sioux Tribe, South Dakota). This law provides for additional payments to the Indians of the Lower Brule Sioux Reservation, South Dakota, whose lands were acquired for the Fort Randall Dam and Reservoir project and for other purposes. Section 3 of this law reverted in the former owners all rights in minerals, including oil, gas, and gravel. Section 5 provides that the Lower Brule Sioux Tribe be given exclusive permission without cost to graze livestock on land between the water level of the reservoir and the boundary of the project. This law also retained permission to have shoreline access and to hunt and fish on acquired lands by the former owners of the land.

Public Law 85-916 (72 Stat. 1766), 2 September 1958, (Crow Creek Sioux Tribe, South Dakota). This law provided for additional payments to the Indians of the Crow Creek Sioux Reservation, South Dakota, whose lands were acquired for the Fort Randall Dam and Reservoir project and for other purposes. The provisions in this law are the same as the provisions in Public Law 85-923 for the Lower Brule Sioux Tribe.

Public Law 87-734 (76 Stat. 698), 3 October 1962, (Lower Brule Sioux Reservation, South Dakota). This law provides for the acquisition of approximately 14,372 acres of land within the Lower Brule Sioux Reservation in South Dakota as required by the United States for the Big Bend Dam and Reservoir project on the Missouri River and for the rehabilitation, social, and economic development of the members of the Tribe and for other purposes. Section 7 reserved all minerals of any kind, including oil and gas, but excluded gravel in the lands acquired in accordance with this law to the benefit of the Lower Brule Sioux Tribe or to individual Indian owners. Section 10 provides that the Lower Brule Sioux Tribe be permitted to graze livestock without charge on the lands acquired that lie between the level of the reservoir and the boundary of the project. These grazing privileges only extend to land that the Secretary of the Army determines is not devoted to other beneficial uses.

Public Law 87-735 (76 Stat. 704), 3 October 1962, (Crow Creek Sioux Reservation South Dakota). This law provides for the acquisition of approximately 6,284 acres of land from within the Crow Creek Sioux Reservation in South Dakota as required by the United States for the Big Bend Dam and Reservoir project on the Missouri River and for the rehabilitation, social, and economic development of the members of the Tribe and for other purposes. Section 5 of this law addressed which facilities would be relocated or reconstructed because of the construction of the Big Bend project. The provisions in sections 7 and 10 of this law are the same as the provisions in Public Law 87-734.

Public Law 88-578 (78 Stat. 897), 3 September 1964, Land and Water Conservation Fund Act of 1965 as amended. This act established a fund from which Congress can make appropriations for outdoor recreation. The fund derives revenue from entrance and user fees, the sale of surplus Federal property, and the Federal motorboat fuel tax. Entrance and user fees at reservoirs were made possible by section 2(a).

Public Law 89-72 (79 Stat. 213), 9 July 1965, Federal Water Project Recreation Act, as amended. This act requires that full consideration be given to opportunities for recreation and fish and wildlife enhancement; that recreation planning be based on coordination of use with existing and planned Federal, State, and local recreation; and that non-Federal administration of recreation and enhancement areas be encouraged. It requires that no facilities for recreation and fish and wildlife enhancement be provided without cost-sharing except those justified to serve other project purposes or as needed for public health and safety. If lands are acquired in the absence of a local sponsor to preserve the recreation and fish and wildlife potential of the project and if there is still no local sponsor 10 years after the initial project operation, the lands may be sold or used for other purposes. The views of the Secretary of the Interior regarding the extent to which the proposed recreation and fish and wildlife development conforms to and is in accordance with the SCORP shall be included in any project report.

Public Law 90-483 (82 Stat. 731), 13 August 1968, River and Harbor Act of 1968, as amended. This act authorizes the construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and other purposes. Section 210 restricted the collection of entrance fees at Corps lakes and reservoirs after 31 March 1970 to users of highly developed facilities requiring the continuous presence of personnel.

Public Law 99-662 (100 Stat. 4082), 17 November 1986, Water Resources Development Act of 1986. This legislation sets forth non-Federal cost-sharing requirements for all water resources projects. Section 906 of this act supplemented the responsibility and authority of the Secretary of the Army pursuant to the Fish and Wildlife Coordination Act.

Public Law 106-53, August 17, 1999, Title VI of the Water Resources Development Act of 1999. Cheyenne River Sioux Tribe, Lower Brule Sioux Tribe, and State of South Dakota Terrestrial Wildlife Habitat Restoration. Under this provision, the Government retains fee title to lands and structures necessary for the continuation of the operation, maintenance, repair, replacement, rehabilitation, and structural integrity of the dam and related flood control and hydropower structures, including land below the top of the exclusive flood control pool, and can lease in perpetuity all or part of certain recreation areas associated with the dams to the State of South Dakota or to the Lower Brule Sioux Tribe at the Big Bend/Lake Sharpe project. Title VI establishes the South Dakota and Lower Brule Sioux Tribe Terrestrial Wildlife Habitat Restoration Trust Fund.

After these funds are fully capitalized the interest may be used for costs associated with the restoration and management costs associated with the transferred lands.

This legislation also requires the Secretary to arrange for the U.S. Geological Survey to complete a comprehensive study of the potential impacts of the transfer of lands under this title on water flows in the Missouri River and prohibits such transfers until the secretary determines that the transfers will not significantly reduce the amount of water flow to the downstream states of the Missouri River.

Public Law 106-541, December 11, 2000, Title VI of the Water Resources Development Act of 2000. Section 540 of this act amended public law 106-53. The section applied a deadline of 1 January 2002 for land transfers; included direction on the lease of specific recreation areas to the State of South Dakota; and a requirement to clean up each open dump and hazardous waste site. The Act also established a Cultural Resources Advisory Commission as well as a requirement to inventory and stabilize each cultural and historic site on land to be transferred.

Environmental Quality Statutes.

Public Law 85-624 (72 Stat. 563), 12 August 1958, Fish and Wildlife Coordination Act. This law amends and renames the Fish and Wildlife Coordination Act of 10 March 1934. The 1958 act requires that fish and wildlife conservation receive equal consideration with other features of water resources development programs; that proposals for work affecting any body of water be coordinated with the USFWS and the State Wildlife Agency; that recommendation of the USFWS and the State Agency be given full consideration; and that justifiable means and measures for wildlife purposes, including mitigation measures, be adopted. It also requires that adequate provisions be made for the use of project lands and waters for the conservation; maintenance; and management of wildlife resources, including their development and improvement. The act provides that the use of project lands primarily for wildlife management by others be in accordance with a General Plan approved jointly by the Department of the Army, Department of the Interior, and State wildlife agencies.

Public Law 86-717 (74 Stat. 817), 6 September 1960, Conservation of Forest Lands in Reservoir Areas. This law provides for the development and maintenance of forest resources on Corps-managed lands and the establishment and management of vegetative cover so as to encourage future resources of readily available timber and to increase the value of such areas for conservation.

Public Law 87-88 (75 Stat. 204), 20 July 1961, Federal Water Pollution Control Act Amendments of 1961 as amended. Section 2(b)(1) of this act gives the Corps responsibility for water quality management of Corps reservoirs. The Federal Water Pollution Control Act Amendment of 1972, Public Law 92-500, amended this law.

Public Law 89-80 (79 Stat. 244), 22 July 1965, Water Resources Planning Act. This act is a Congressional statement of policy to meet rapidly expanding demands for water throughout the Nation. The purpose is to encourage the conservation, development, and use of water-related land resources on a comprehensive and coordinated basis by the Federal Government, States, local governments, individuals, corporations, business enterprises, and others concerned.

Public Law 90-583 (82 Stat. 1146), 17 October 1968, Noxious Plant Control. The law provides for the control of noxious weeds on land under the control of the Federal Government.

Public Law 91-190 (83 Stat. 852), 1 January 1970, National Environmental Policy Act of 1969. Section 101 of this act establishes a national environmental policy. Section 102 requires that all Federal agencies shall, to the fullest extent possible, use a systematic, inter-disciplinary approach that integrates natural and social sciences and environmental design arts in planning and decision making; study, develop, and describe appropriate alternatives to recommend courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources; use ecological information in the planning and development of projects; and include an Environmental Impact Statement (EIS) in every recommendation or report on proposals for major Federal actions significantly affecting the quality of the human environment.

Public Law 91-224 (84 Stat. 114), 3 April 1970, Water Quality Improvement Act of 1970 and Environmental Quality Improvement Act of 1970. The Water Quality Improvement Act mandates that each Federal agency having jurisdiction over any property or facility or engaged in any Federal public works activity will comply with applicable water quality standards.

Public Law 92-500 (86 Stat. 816), 18 October 1972, The Federal Water Pollution Control Act Amendments of 1972, as amended. This law amends the Federal Water Pollution Control Act and establishes a national goal of eliminating pollutant discharges into waters of the United States. Section 404 authorizes a permit program for the disposal of dredged or fill material in the Nation's waters that is to be administered by the Secretary of the Army acting through the Chief of Engineers. This law was later amended by the Clean Water Act of 1977 (Public Law 95-217) to provide additional authorization to restore the Nation's water.

Executive Order 11752, 19 December 1973, Prevention, Control, and Abatement of Environmental Pollution at Federal Facilities. The purpose of this Executive order is to assure that the Federal Government provides leadership in the design, construction, management, and operation and maintenance of its facilities in the nationwide effort to protect and enhance the quality of air, water, and land resources through compliance with applicable standards and in full cooperation with State and local governments.

Public Law 93-205 (87 Stat. 884), 28 December 1973, Conservation, Protection, and Propagation of Endangered Species Act of 1973, as amended. This law repeals the Endangered Species

Conservation Act of 1969. It also directs all Federal departments/agencies to carry out programs to conserve endangered and threatened species of fish, wildlife, and plants and to preserve the habitat of these species in consultation with the Secretary of the Interior. This act establishes a procedure for coordination, assessment, and consultation. This act was amended by Public Law 96-159.

Public Law 93-523 (88 Stat. 1660), 16 December 1974, Safe Drinking Water Act, as amended.

This act amends the Public Health Service Act to assure that the public is provided with safe drinking water. This law states that all potable water at civil works projects will meet or exceed the minimum standards required by law. The Safe Drinking Water Act Amendments of 1986, Public Law 99-339, amended this act.

Public Law 93-629, 3 January 1975, Federal Noxious Weed Act of 1974, as amended. Section 15, added to the act in 1990, requires noxious weed control management on Federal lands and sets forth the process by which it is to be accomplished.

Executive Order 11988, 24 May 1977, Floodplain Management. This order outlines the responsibilities of Federal agencies in the role of floodplain management. Each agency shall evaluate the potential effects of actions on floodplains and should not undertake actions that directly or indirectly induce growth in the floodplain, unless there is no practical alternative. Agency regulations and operating procedures for licenses and permits should include provisions for the evaluation and consideration of flood hazards. Construction of structures and facilities on floodplains must incorporate flood proofing and other accepted flood protection measures. Agencies shall attach appropriate use restrictions to property proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties.

Executive Order 11990, 24 May 1977, Protection of Wetlands. This order directs Federal agencies to provide leadership in minimizing the destruction, loss, or degradation of wetlands. Section 2 states that agencies shall avoid undertaking or assisting in new construction located in wetlands unless there is no practical alternative.

Public Law 95-217 (91 Stat-1566), 27 December 1977, Clean Water Act of 1977, as amended. This act amends the Federal Water Pollution Control Act of 1970 and extends the appropriations authorization. The Clean Water Act is a comprehensive Federal water pollution control program that has as its primary goal the reduction and control of the discharge of pollutants into the Nation's navigable waters. The Water Quality Act of 1987, Public Law 100-4, has amended the Clean Water Act of 1977.

Executive Order 12088, 13 October 1978, Federal Compliance with Pollution Control Standards. The purpose of this order is to ensure Federal compliance with applicable pollution control standards. Toxic substance and solid waste disposal and the control of noise, air, and water

pollution will be in accordance with this Executive order on prevention, control, and abatement of air and water pollution at Federal facilities.

Public Law 95-632 (92 Stat. 3751), 10 November 1978, Endangered Species Act Amendments of 1978. This law amends the Endangered Species Act of 1973. Section 7 directs agencies to conduct a biological assessment to identify threatened or endangered species that may be present in the area of any proposed project. This assessment is conducted as part of a Federal agency's compliance with the requirements of Section 102 of the National Environmental Policy Act (NEPA) of 1969.

Public Law 96-159 (93 Stat. 1225), 28 December 1979, Endangered Species Act of 1973, as amended. This amendment expanded the act to protect endangered plants. This amendment requires the publishing of a summary and map when proposing land as critical habitat and requires Federal agencies to ensure projects "are not likely" to jeopardize an endangered species. In addition, it authorized all those seeking exemptions from the act to get permanent exemptions for a project unless a biological study indicates the project would result in the extinction of a species.

Public Law 96-366 (94 Stat. 1322), 29 September 1980, Fish and Wildlife Conservation Act of 1980. This law enables States to obtain funds to conduct inventories and conservation plans for nongame wildlife. It also encourages Federal departments and agencies to use their statutory and administrative authority to conserve and promote conservation in accordance with this act.

Public Law 99-339 (100 Stat. 642), 19 June 1986, Safe Drinking Water Act Amendments of 1986. These amendments provided further regulation regarding national primary drinking water, enforcement of these regulations, and variances and exemptions to the act. These amendments also provide for the protection of underground sources of drinking water and provide grants to Tribes in addition to contract assistance to carry out the function of these amendments.

Public Law 100-4 (101 Stat. 7), 4 February 1987, Water Quality Act of 1987. This act amends the Federal Water Pollution Control Act to not only provide for renewal of the quality of the Nation's waters but also provide construction grant amendments, standards, enforcements, permits, and licenses.

Cultural Resource Statutes.

Public Law 209, 59th Congress (34 Stat. 225), 8 June 1906, The Antiquities Act. This act makes it a Federal offense to appropriate, excavate, injure, or destroy any antiquity, historic ruin, monument, or object of scientific interest located on lands owned or controlled by the United States without having permission from the Secretary of the Department having jurisdiction thereof.

Public Law 86-523 (74 Stat. 220), 27 June 1960, Reservoir Salvage Act as amended. This act provides for (1) the preservation of historical and archaeological data that might otherwise be lost or destroyed as the result of flooding or any alteration of the terrain caused as a result of any Federal reservoir construction projects; (2) coordination with the Secretary of the Interior whenever activities may cause loss of scientific, prehistorical, historical, or archaeological data; and (3) expenditure of funds for recovery, protection, and data preservation.

Public Law 89-665 (80 Stat. 915A-0), October 1966, Historic Preservation Act, as amended. This act states a policy of preserving, restoring, and maintaining cultural resources and requires that Federal agencies: (1) take into account the effect of any undertaking on any site on or eligible for the National Register of Historic Places (NRHP); (2) afford the Advisory Council on Historic Preservation the opportunity to comment on such undertaking; (3) nominate eligible properties to the NRHP; (4) exercise caution in the disposal and care of Federal property that might qualify for the NRHP; and (5) provide for the maintenance of federally owned sites on the NRHP.

Public Law 96-95 (93 Stat. 721), 31 October 1979, Archaeological Resources Protection Act of 1979. This act protects archeological resources and sites that are on public lands and Indian lands, and fosters increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals. It also establishes requirements for issuance of permits by the Federal land managers to excavate or remove any archeological resource located on public lands or Indian lands.

Cooperative Agreements.

Memorandum of Agreement, 17 June 1964. The Memorandum of Agreement (MOA) between the BIA and the Corps of Engineers identified the Crow Creek town site facilities to be relocated because of the construction of the Big Bend project. Construction of the facilities described in the MOA was completed in March 1966.

Memorandum of Understanding for Fire Protection, 31 October 1974. This MOU is between the Corps of Engineers and the Crow Creek Agency, BIA. The agreement requires that the agency fight any fires occurring on the east side of Lake Sharpe within the reservation boundaries with the Corps only assisting in the effort.

Memorandum of Understanding for Fire Protection, 17 May 1976. This MOU is between the Corps of Engineers and the Lower Brule Agency, BIA. The agreement requires that the agency fight any fire occurring on the west side of Lake Sharpe within the reservation boundaries with the Corps only assisting in the effort.

Cooperative Agreement, 23 January 1989. This is a Cooperative Agreement between the Department of the Interior and the Department of the Army regarding waterfowl habitat conservation opportunities associated with Corps of Engineers civil works projects and activities consistent with the North American Waterfowl Management Plan (NAWMP). In May 1986, the United States and Canada signed the NAWMP. The goal of this plan is to restore the Nation's waterfowl population to the same numbers as in the early 1970s.

General Plans for Use of Project Lands - Waters Draft submitted to MRD, 24 July 1990. The General Plan is required pursuant to the Fish and Wildlife Coordination Act (Public Law 85-624) for lands and waters where the fish and wildlife resources are to be developed and managed by another agency and for authorized mitigation lands managed by the Corps. The Secretary of the Army, the Secretary of the Interior, and the head of the State Fish and Wildlife agency jointly approve plans.

2.29. MANAGEMENT PLANS

There are several management plans that provide the direction of activities and expenditures for the Big Bend Dam/Lake Sharpe project. These plans that are discussed below include: the General Plan, the Cultural Resource Management Plan (CRMP), the Shoreline Management Plan, the North American Waterfowl Management Plan (NAWMP), the Operational Management Plan (OMP). All of these plans are interrelated and each must be considered when planning for the future.

- General Plan. Guidelines for General Plans are found in Section 663(b) of the Fish and Wildlife Coordination Act (Public Law 85-624). The use of Lake Sharpe lands and waters for wildlife conservation purposes must be in accordance with a General Plan approved jointly by (1) the Corps of Engineers, (2) the Secretary of the Interior, and (3) the Director of the SDGFP. The signature by the Secretary of the Interior represents coordination with the USFWS and the BIA.
- Cultural Resource Management Plan. For more information on the CRMP for the Lake Sharpe project contact the Omaha District Office. When completed, the HPMP (historic properties management plan) will provide detailed information on a comprehensive program to direct historic preservation compliance activities and the effective and responsible management of historic properties and other cultural resources at the Big Bend Dam/Lake Sharpe project.

- Shoreline Management Plan, Design Memorandum (DM) MB-16B, Big Bend Dam-Lake Sharpe, June 1977. An update of the Shoreline Management Plan is scheduled for the near future.
- North American Waterfowl Management Plan (NAWMP), U.S. Department of the Interior, Fish and Wildlife Service, May 1986, and U.S. Prairie Pothole Joint Venture Implementation Plan, a component of the NAWMP, April 1989. In 1989, the Department of the Interior and the Corps of Engineers signed an MOU in support of the NAWMP. The NAWMP is a guideline for cooperation between public and private groups for restoring waterfowl habitat and populations to the same numbers as the early 1970s. The NAWMP will be implemented through "Joint Ventures" of public and private groups. The NAWMP identified 34 key areas to focus on for the Joint Ventures. The Prairie Pothole region was one of the areas identified and the Prairie Pothole Joint Venture (PPJV) was formed. Lake Sharpe will be included in the PPJV.
- Operational Management Plan. The OMP is a management action document that describes in detail how resource objectives and concepts prescribed in the Master Plan will be implemented and achieved. It replaces the Master Plan appendices. The OMP for Lake Sharpe was completed in Fiscal Year 1990. The OMP will be consistent with the Master Plan.

2.30. SUMMARY - IMPLICATIONS FOR PLANNING

The preceding discussion of the natural and historic resources identified the following important implications for the use, management, and development of land and water resources at the Big Bend Dam/Lake Sharpe project.

2.30.1. Description of the Reservoir

- Lake Sharpe is roughly 80 miles long running from Fort Thompson to near Pierre.
- The shoreline is approximately 200 miles long and the reservoir surface area is about 57,500 acres.
- Snags in Lake Sharpe can be a problem for boaters in some areas and are the source of driftwood found along the shoreline.

2.30.2. Lake Operation

- Lake Sharpe is regulated as an integral component of the Missouri River main stem reservoir system.
- The pool elevation in Lake Sharpe is held near elevation 1,420 feet m.s.l. except for weekly cycling in response to high power load periods. During these times, lake levels fluctuate approximately 1 foot from 1,420 feet m.s.l.

2.30.3. Hydrology and Ground Water

- The prominent feature of the Big Bend drainage area is the Bad River, the confluence of which is located at Fort Pierre.
- The total fall of the Missouri River from the Oahe Dam, near Pierre, to the Big Bend Dam, near Fort Thompson, is about 75 feet, averaging about 0.8 feet per river mile.

2.30.4. Ice-Affected Flows

- The combination of aggradation and ice-affected flow conditions has dramatically increased the potential for flooding along the shoreline of Pierre and Fort Pierre during the wintertime.
- The occasional peaking operations at the Oahe powerplant cause rapid changes in river stages in the Pierre and Fort Pierre areas.

2.30.5. Sedimentation

- The major sedimentation processes affecting Lake Sharpe are the transport and deposition of watershed sediments into the reservoir, littoral drift, and erosion of banks along the shoreline.
- The major delta area of Lake Sharpe is located from Farm Island to the DeGrey Area.

- Growing delta formation in the upstream reaches of the reservoir and tributary inlets creates a rising ground water table and can decrease boating activity.
- Because of the sedimentation, Lake Sharpe has undergone a 9-percent reduction in the original storage capacity of 1,979,968 acre-feet by 1997.
- Sediment accumulation impacts both the flora and fauna found in backwater areas of the reservoir.
- Alongshore currents and wave action contribute to shoreline erosion. This produces littoral drift that results in sediment deposition across embayments making the embayments shallower and more difficult to navigate.

2.30.6. Shoreline Erosion

- The constant pool levels on Lake Sharpe ensure that the same bank elevations are under year-round attack by wind, wave, and ice.
- The relatively constant pool elevation of Lake Sharpe allows the use of less costly bank protection measures than at other projects on the Missouri River where the pool elevations fluctuate to a greater extent.
- Several experimental programs to control erosion with vegetative plantings and driftwood have been undertaken with some success.

2.30.7. Water Quality

- Monitoring has detected several parameters that exceed South Dakota water quality standards.
- The municipalities of Fort Thompson and Lower Brule obtain their drinking water from Lake Sharpe.

2.30.8. Accessibility

- Interstate 90, the only east/west interstate crossing South Dakota, easily accesses the Big Bend Dam/Lake Sharpe project.
- Major highways provide excellent access to the recreation areas, but access to project lands other than designated recreation areas can be difficult in some locations.

2.30.9. Climate

- The Big Bend Dam/Lake Sharpe project is located in a region noted for seasonal contrasts (extremes of weather conditions during the summer and winter months).
- The hot summers create a demand for water-related recreation activities.
- The length of time for ice cover is long and is due to the low volume of water in Lake Sharpe. As a result, ice fishing is excellent in many parts of the lake.

2.30.10. Topography, Geology, And Soils

- The area to the east of Lake Sharpe is characterized by gently rolling hills with drainage systems that are not well established. Numerous small, hilly areas, high buttes, rough canyons and numerous streams characterize the area to the west of Lake Sharpe.
- Soils have limitations for road construction, facility development, and vegetative plantings.

2.30.11. Land Use

- Agricultural use accounts for 95 percent of the use of the land in the five counties adjacent to Lake Sharpe; and of that, 55 percent is used for pasture and range.

2.30.12. Borrow Areas And Utilities

- There are no active borrow areas located within the boundaries of the Big Bend Dam/Lake Sharpe project.

2.30.13. Vegetation Resources

- Aquatic vegetation is most extensive in the upstream reach from the Bad River confluence to the mouth of Medicine Creek.
- Mixed prairie vegetation dominates the landscape around Lake Sharpe; however, stands of eastern deciduous woodland are found in the larger draws and on the floodplains along the larger intermittent drainageways.
- Bottomland woodlands are best developed on LaFramboise Island, Farm Island, and scattered small tracts along the upper reach of Lake Sharpe.
- As a result of a rising water table, the bottomland forest at Farm Island has deteriorated since 1966.
- Woodland draws are located primarily in the southern part of the Big Bend project.
- An extensive amount of tree planting has been conducted for the purposes of providing shade and wind protection, developing wildlife habitat, and improving site aesthetics.
- Observations suggest that submerged aquatics are increasing in aerial cover.
- In total, over 1,000 acres of marsh exist along the shorelines of the lake.

2.30.14. Fish And Wildlife Resources

- Hipple Lake and the numerous embayments represent important nursery and adult habitat for a number of fish species, including walleye and white bass.

- There is a demand for sportfishing opportunities in the Lake Sharpe area.
- The Big Bend project is in the Central Flyway of the United States and, therefore, provides excellent opportunities for hunting, wildlife viewing, and photography during the spring and fall migrations.
- Areas with the highest migratory goose concentrations include Antelope Island, the Clark Ranch/DeGrey area, and the West Bend area.
- The common upland game birds in the project area are wild turkey, prairie chicken, sharptail grouse, ring-necked pheasant, mourning dove, and Hungarian partridge.
- The demand for land-based recreation, such as hunting, is high during the fall and winter months.
- Regionally important big game species include white-tailed deer and mule deer. Elk and bison are managed as a hunting resource on a game range operated by the Lower Brule Sioux Tribe.

2.30.15. Rare Species And Communities

- Federally endangered species that may be observed in the project area include the interior least tern, whooping crane, black-footed ferret, and the pallid sturgeon. Federally threatened species that may occur in the project area include the bald eagle and piping plover. In addition, the black-tailed prairie dog is a candidate for federal listing.

2.30.16. Lake Sharpe Fish And Wildlife Mitigation

- Inundation of wildlife habitat brought about by the construction of the Oahe and Big Bend projects is considered to have adversely affected nearly 400 species of animals that inhabited or migrated through the area.
- Food plots and dense nesting cover have been established and trees and shrubs have been planted in several areas around Lake Sharpe.

2.30.17. Visual Qualities

- With 200 miles of rolling prairie shoreline largely unobstructed by civilization, Lake Sharpe retains a frontier atmosphere and furnishes an excellent setting for various kinds of outdoor recreation.

2.30.18. Paleontology

- The Missouri River trench is internationally known for fossil vertebrate and invertebrate remains.
- Vertebrate fossils include shark, bony fishes, diving birds, plesiosaurs, and masseurs.

2.30.19. Cultural Resources

- The Big Bend Dam/Lake Sharpe project area contains the highest concentration of cultural resource sites per linear mile of all of the Missouri River reservoirs.
- Cultural resource inventories of the project indicate that it was inhabited during five main periods -- Paleo-Indian, Archaic, Woodland, Plains Village, and Historic.

2.30.20. Demographics

- According to the 2000 census, South Dakota ranks number 46 of the 50 States in terms of population.
- American Indians account for 8.3 percent of the State's population.
- The 5 counties contiguous to Lake Sharpe contain 2 Indian reservations, Crow Creek on the east side of Lake Sharpe and Lower Brule on the west side.

2.30.21. Economic Characteristics

- The five contiguous counties of Buffalo, Hughes, Hyde, Lyman, and Stanley accounted for 23.7 percent of the visitation to the project.
- Hughes, Minnehaha, and Beadle Counties together accounted for 42.7 percent of the project visitation.
- In the five contiguous counties, livestock raising accounted for 55 percent of the annual agricultural production with crop production accounting for the remaining 45 percent.

2.30.22. Recreation Facilities

- Recreation facilities at the Big Bend Dam/Lake Sharpe project vary from primitive areas to well-developed campgrounds.

2.30.23. Recreation Activities And Needs

- Fishing is the major recreational activity participated in by visitors to the Big Bend Dam/Lake Sharpe project.
- Lake Sharpe is a very important regional resource for hunting, and, during the fall and winter, hunting can account for roughly 50 percent of the overall project visitation.
- Much of the boating is related to fishing activities; however, sailboating, waterskiing, and powerboating are also popular activities.
- The draft 1992 South Dakota SCORP recognized the need for trails in the vicinity of Lake Sharpe.
- The relatively unspoiled nature of the resources provides unique opportunities for the outdoor enthusiast.

2.30.24. Visitation Profile - Trends And Demands

- The central location of the project within South Dakota provides for easy access.
- Both water-based and land-based recreational activities are in high demand by area users.
- The Big Bend project accounted for only 9.0 percent of the total visitation to the Missouri River main stem system. However, when taking into account the number of shoreline miles, the Big Bend project ranks third as having the greatest number of visitor-hours per shoreline mile.
- Since 1964, the overall visitation at the Big Bend project has shown a steady increase.
- The recreation areas receiving the highest visitation are located adjacent to major transportation routes and population centers.

2.30.25. Related Recreational, Historical, And Cultural Areas

- Numerous recreational areas are present in central South Dakota and offer recreation activities that are both similar to and different from those at the Big Bend project.

2.30.26. Real Estate

- The Big Bend Dam/Lake Sharpe project is comprised of approximately 45,296 acres of land.
- There are a total of 237 outgrants consisting of leases, licenses, easements, and permits on the project.
- There are six major park and recreation leases on the project, which were transferred and/or assigned to the State of South Dakota and the Lower Brule Sioux Tribe pursuant to Title VI.
- All project land available for interim grazing use within the Crow Creek and Lower Brule Indian Reservations has been deferred to the tribal councils and BIA.

3. SPECIAL PROBLEMS

3.1. WATERFOWL REFUGES

The refuge system was first initiated on Lake Sharpe in 1966, shortly after the filling of the lake. At that time, the refuge placement was determined primarily on where the waterfowl congregated. The hope was to provide a secure resting area for the waterfowl as well as providing some recreational opportunities. In 1985, the entire State refuge system along the Missouri Basin was reviewed and in 1986, changes were made to the refuges. These changes included expanding some refuges, opening (undesignating) others, and closing (designating) new refuges.

Four State-designated waterfowl refuges were established along Lake Sharpe and all are located within the Crow Creek Sioux Reservation. The Big Bend Dam, North Shore, and DeGrey Waterfowl Refuges are takeline refuges. The Joe Creek Waterfowl Refuge is a waterline refuge. (A takeline refuge is a refuge whose border corresponds to the Corps project boundary takeline. A waterline refuge is one whose boundary is the water's edge).

The biological basis for the establishment of the current waterfowl refuges along Lake Sharpe is currently being reexamined. Participating in this review are representatives from the Crow Creek Sioux and Lower Brule Sioux Tribes; South Dakota Game, Fish and Parks; Bureau of Indian Affairs; U.S. Fish and Wildlife Service; and the Corps of Engineers. If, after the review of these areas, the Management of the refuges would change, an addendum to this Master Plan will be submitted.

3.2. LAKE ACCESS

Lake access and population locations are the primary factors that have influenced recreation use and development at Lake Sharpe. The project's size and remoteness from major transportation corridors, especially on the west side of the lake, significantly reduce the opportunity for quick and easy access. These same factors limit the recreation user from venturing to many parts of the lake because of the lack of essential services.

Recreation areas at the Big Bend Dam/Lake Sharpe project are dispersed. All-weather gravel roads lead to most of the recreation areas.

Because of decreasing operation and maintenance budgets, the availability of Corps funds for road construction and maintenance has been limited. Although the Corps will continue to participate in necessary road construction and maintenance when funds are available, the only viable means of improving roads at the project is to pursue alternate funding sources and partnership arrangements with all of the affected Federal, State, and local agencies.

In the well-used recreation areas near Pierre and the dam, the ramps cannot accommodate the number of boats in the lake. People, therefore, launch their boats from the low-bank areas rather than waiting in long lines at the boat ramps. Also, many of the boat ramps are in poor condition and are often not usable because of the silt that covers the ramps or that is deposited in the embayments.

3.3. CAMPING

In some cases, existing camp pads are not being used even though visitation may be high in a particular area. Oftentimes, fishermen desire to camp close to the water's edge where boats and equipment are visible from the campsite. This ensures protection against loss, damage, or theft. Some areas have been or can be modified to accommodate the need to be close to the water's edge. Other areas require modification because campers are using unauthorized locations. Unauthorized use includes camping in parking lots and the creation of makeshift roads in nondesignated areas.

Day use visitors also face problems when they visit these recreation areas. In areas adjacent to the lake, campers often use picnic facilities and shelters. This results in a lack of available day use facilities.

These problems could be lessened or eliminated through education as well as the minor redesigning of several camp pads to allow more ready access to boats and equipment.

3.4. FISH-CLEANING FACILITIES

Inadequate fish-cleaning facilities have created problems with the sanitary and garbage disposal in some areas. Sanitary facilities and garbage cans are often used as alternate disposal sites after cleaning fish.

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4. PUBLIC INVOLVEMENT AND COORDINATION WITH OTHER AGENCIES

In the fall of 1988, the Corps began the update of the approved 1964 Master Plan for the Big Bend Dam/Lake Sharpe project. Letters were mailed announcing the beginning of the Master Plan process and requesting a list of topics and issues that should be addressed. Federal, State, and local agencies, organizations, and individuals having an interest in recreation development and natural resources management at the Big Bend Dam/Lake Sharpe project were contacted during the planning process.

Open-house workshops were held during April 1990 at Fort Thompson, Chamberlain, Lower Brule, Pierre, and Huron, South Dakota. The purpose of these workshops was to seek public input regarding the (1) long-range goals for the Big Bend Dam/Lake Sharpe project and (2) management and development of project lands and water.

After coordination with both public and private entities, a draft Big Bend Dam/Lake Sharpe Master Plan was circulated for comment in December 1990. To the extent possible, the information obtained and the ideas and concerns expressed have been incorporated into this final Master Plan.

The general comments and recommendations received, along with the actions taken to address them, are summarized in the following paragraphs.

- U.S. Department of the Interior, Fish and Wildlife Service – The USFWS expressed concern that (1) there would be no assurances that actions would be carried out because no General Plan has been signed; (2) the discussion of the fish and wildlife mitigation plan implied compliance and satisfaction of Section 3 of the Fish and Wildlife Coordination Act regarding mitigation for the project-incurred wildlife losses; (3) Category I and II projects lands noted on plates 2 through 6 of the draft 1991 update are not all wildlife mitigation lands; and (4) inconsistencies exist in the amount of land available for wildlife mitigation purposes.

To date no General Plan has been approved.

Title VI land transfers to the South Dakota Department of Game Fish and Parks (SDGFP) and the Department of Interior/Lower Brule Sioux Tribe (DOI-LBST) constitutes the mitigation that satisfies Section 3 of the Fish and Wildlife Coordination Act, as these lands will be managed in perpetuity for the restoration of terrestrial wildlife habitat loss that occurred as a result of flooding related to the Big Bend project and the other projects in the Pick-Sloan programs. There are currently no lands on the Big Bend/Lake Sharpe Project classified as Mitigation.

- South Dakota Department of Agriculture – The South Dakota Department of Agriculture requested that the laws concerning noxious weed control on Federal lands be referenced in the Master Plan and that noxious weed control be incorporated into the general resource management objectives for the project.

Public Law 90-583 (82 Stat. 1146), Noxious Plant Control, and Public Law 93-629, the Federal Noxious Weed Act of 1974, as amended, have been added to the list of Public Laws that are pertinent to this Master Plan.

The noxious weed most commonly encountered at the Big Bend project is the Canada thistle. Although small isolated patches of this weed are present on the project lands, it is found primarily at the DeGrey Recreation Area and the Old Fort Thompson Recreation Area. The Corps is responsible for weed control on project lands. The State is responsible for noxious weed control on project lands that are outgranted to them. Specific management practices for the control of noxious weeds will be addressed in the Big Bend OMP.

- South Dakota Department of Game, Fish and Parks – The draft Master Plan reviewed by the SDGFP resulted in the following comments: (1) a General Plan must be completed as soon as possible; (2) a breakwater should be included as a development need if the boat ramp is relocated at a North Bend Recreation Area; (3) the recurring maintenance problem caused by ice heaving along the shoreline and by large trees drifting up on the beach at the West Bend Recreation Area should be addressed; and (4) potable water is needed at the Joe Creek Recreation Area.

No General Plan has been approved.

The existing boat ramp at the North Bend Recreation Area is located in Chaney Rush Creek Bay. However, this bay is silting in and it is difficult to launch boats from the boat ramp. If the boat ramp were relocated to the south, a breakwater could be installed to facilitate launching. The installation of a breakwater has been included as a development need in the resource plan for the North Bend Recreation Area.

The shoreline along the embayment at the West Bend Recreation Area is exposed to fetch from the main channel of the lake. During the winter, ice that forms in the bay and lake is pushed into the embayment and, subsequently, onto the shore. The movement of this ice causes the soil to heave along the shoreline in some areas. As a result, beaches must be cleared of debris, additional sand is needed to reconstruct some beaches, and adjacent areas often require grading and reseeding each spring. This issue is addressed in the resource plan for the West Bend Recreation Area.

Potable water is now available at Joe Creek Recreation Area. In 1992, the State of South Dakota financed the construction of a new, deeper well that is now operational.

- South Dakota Department of Water and Natural Resources (now known as the Department of Environment and Natural Resources) – The two major concerns noted by this agency were (1) the water supplies for the cities of Pierre and Fort Pierre are obtained from wells in the surficial aquifer and not from Lake Sharpe and (2) the protection of cultural resources should continue; however, agricultural and recreational development should not be halted indefinitely for unevaluated cultural resource sites.

The statement in the Water Quality section of Chapter 2 regarding water supplies taken from Lake Sharpe has been corrected to omit the cities of Pierre and Fort Pierre.

Unevaluated cultural resource sites will not prevent the development of additional recreation resources or agricultural uses. However, prior to any development at or near the cultural resource sites, an evaluation must be made to determine if these resources would be affected. However, if the proposed activities were found to affect the cultural resource sited, a determination would be made as to whether any mitigation measures would be necessary.

- South Dakota State Historical Society – During review of the draft Master Plan, this agency questioned why no discussion of any site stabilization was included.

Protection and interpretation of cultural resources is listed as one of the Big Bend Dam/Lake Sharpe project resource objectives. In chapter 6, Resource Plan, preservation and protection of cultural resources is listed as a site-specific resource objective, where applicable. Specific plans for the site stabilization are not included in the Master Plan. They are, however, included as an integral part of the Historic Properties Management Plan for Lake Sharpe. The Corps has also completed a Cultural Resource Management Plan (CRMP) for the Big Bend Dam/Lake Sharpe project.

Prior to finalizing this Master Plan, additional meetings were held with representatives of the Crow Creek Sioux and Lower Brule Sioux Tribe, the City of Pierre, and the State of South Dakota. These meetings were held to ensure that any plans for future development being made by any agency would be consistent with the proposals in the Master Plan and vice versa. The Master Plan for Recreation and Business Development as proposed by the Crow Creek Sioux Tribe has been incorporated as an appendix to this Master Plan by reference. The Master Plan for Development of the Pierre Waterfront has been similarly incorporated.

5. LAND USE ALLOCATION, LAND CLASSIFICATIONS, AND RESOURCE OBJECTIVES

This chapter presents the land use plan for the Big Bend Dam/Lake Sharpe project area. In the plan, specific parcels of land are zoned into land use categories based on resource capability. Combined with the project-wide and site-specific resource objectives presented in this chapter and Chapter 6, respectively, the land use plan provides a conceptual guide for the use, management, and development of all project lands. Together, these elements are the heart of this Master Plan.

The project is divided into management areas. Division of the project into individual areas was an integral part of the planning process and facilitated identification of the most appropriate land and resource uses of the various project areas. The boundaries of the management areas are based on physical, administrative, and/or operational characteristics.

5.1. LAND ALLOCATION

Land allocations identify the authorized purposes for which project lands were acquired. The entire Big Bend project has a land allocation of Project Operations. Project Operations lands are those lands acquired to provide safe, efficient operation of the project for its authorized purposes. These project purposes include flood control, hydropower, navigation, irrigation, municipal and industrial water supply, fish and wildlife, and recreation. Separable lands were not acquired for purposes of recreation, fish and wildlife, or mitigation.

5.2. LAND CLASSIFICATIONS

All land acquired for project purposes are classified to provide for development and resource management consistent with authorized project purposes and other Federal laws. The classification process refines the land allocations to fully use project lands and considers public desires, legislative authority, regional and project-specific resource requirements, and suitability.

Management and use of the lands assigned to each land classification must be compatible with the Project Operations allocation.

The land classifications are discussed in connection with the appropriate resource objectives in the following section. The land classifications are described below, and their locations are shown on plates 1 through 6 in Appendix A.

5.3. RESOURCE OBJECTIVES FOR SPECIFIC LAND CLASSIFICATIONS

Resource objectives are attainable goals for resource development and/or management, which are consistent with authorized project purposes, Federal laws and directives, regional needs, resource capabilities, and expressed public desires. These objectives provide a consolidation of the information presented in the previous chapters of this Master Plan. The resource objectives will be met, either wholly or partially, through the implementation of the site-specific resource objectives established for each management area described in Chapter 6. The resource objectives that were developed for each land classification at the Big Bend project and the rationale used to develop the objectives are provided below.

5.3.1. Project Operations Lands

This classification includes lands required for the dam and associated structures, operations center, administrative offices, maintenance compounds, and other areas that are used to operate and maintain the Big Bend Dam/Lake Sharpe project. Where compatible with operational requirements, Project Operations lands may be used for wildlife habitat management, recreational use, or agricultural activities. Licenses, permits, easements, or other outgrants are issued only for those uses that do not conflict with operational requirements. Approximately 400 acres of land are classified as Project Operations.

Resource Objectives. Resource objectives for Project Operations lands include the following:

- Maintain and operate project structures in a manner that allows them to effectively and safely fulfill project purposes;

- Provide for public use of project structures where such use is feasible and does not interfere with other project purposes; and
- Provide an adequate area for maintenance facilities that are required to meet overall project objectives.

Rationale. The Big Bend project is a component of the Missouri River main stem system of dams that are operated for flood control, navigation, hydropower, wildlife, recreation, municipal and industrial water supply, and irrigation.

All of the major Project Operations lands at the Big Bend project are clustered at the eastern end of the reservoir. The operation and maintenance of the Big Bend Dam is the primary purpose of these lands. Uses that interfere with operational activities, compromise the structural integrity of the project or its facilities, or create a safety hazard for visitors or project personnel cannot be allowed. Within these constraints, Project Operations lands provide important opportunities for visitor use, interpretation, and wildlife management.

Reservoir operation is outside the scope of the Master Plan. However, operation of the lake in accordance with its authorized purposes forms the basis for many of the project-wide and management area resource objectives and the management and development concepts that are presented. Future changes to the reservoir plan of operation may negatively impact some project purposes or objectives while others may benefit.

5.3.2. Recreation Lands

These lands are designated for intensive levels of recreational use to accommodate and support the recreational needs and desires of project visitors, and include about 2,633 acres. They include lands on which existing or planned major recreational facilities are located and allow for developed public recreation facilities, concession development, and high-density or high-impact recreational use.

In general, no uses of these lands are allowed that would interfere with public enjoyment of recreation opportunities. Low-density recreation and wildlife management activities compatible with intensive recreation use are acceptable, especially on an interim basis. No agricultural uses are permitted on those lands except on an interim basis for maintenance of scenic or open space values. Permits, licenses, and easements are not issued for noncompatible manmade intrusions such as

pipelines, overhead transmission lines, and non-project roads, except where warranted by public interest.

Resource Objectives. Resource objectives for Recreation lands include the following:

- Provide camping opportunities;
- Provide separate day use opportunities;
- Provide opportunities for several activities in the same general vicinity;
- Provide lake access for boats;
- Provide concessionaire marina facilities and services;
- Provide opportunities for the elderly and handicapped to participate in a variety of activities;
- Provide trees for shade and wildlife; and
- Control shoreline and soil erosion.

Rationale. The location and design of recreation areas and facilities takes into account the desired recreation experience. Criteria such as spacing, buffer zones, vegetative screening, and other considerations are used in the design of recreation facilities to ensure that visitors have adequate access to the lake and quality recreational experiences.

A basic objective of the Corps' master planning process is to provide the best possible combination of resource uses and management options to meet the needs of the public. In part, this is accomplished by emphasizing the particular qualities, characteristics, and potentials of a given area or group of areas within the project. For example, the Left Tailrace recreation Area is easily accessible from State Highway 47W, has easy access to Lake Sharpe as well as Lake Francis Case, and accommodated all kinds of motorized and non-motorized boating activities. This area also has developed campgrounds and day use areas. In contrast, the Joe Creek Recreation Area also has a day use area and campgrounds; but, because of the remoteness of the area, it lends itself to other types of resource-oriented recreational experiences.

5.3.3. Mitigation Lands

This classification includes those lands specifically designated to offset habitat losses associated with the development of the Big Bend project. No lands are currently classified as mitigation lands at the Big Bend Project.

5.3.4. Environmentally Sensitive Areas

This classification consists of areas where scientific, ecological, cultural, or aesthetic features have been identified. Development of public use on lands within this classification is normally limited or prohibited to ensure that the sensitive areas are not adversely impacted. Agricultural or grazing uses are not permitted on lands with this classification. Approximately 284 acres of Big Bend project land are classified as Environmentally Sensitive.

Resource Objectives. Resource objectives for Environmentally Sensitive lands include the following:

- Protect and preserve scientific, ecological, cultural, or aesthetic resource sites while meeting other project resource objectives;
- Ensure that no degradation or net loss of wetland areas occur;
- Preserve and/or restore wildlife habitat; and
- Provide a resource-oriented recreation opportunity in as natural an environment as possible.

Rationale. Natural areas at Lake Sharpe are so designated in order to preserve and protect their natural resource values, scenic values, historic values, fish and wildlife habitat, and/or other special qualities. Although these areas are available for public use, many possess natural features that are managed for research and educational purposes with minimal human intervention and impacts. Preservation, presentation, and interpretation are the primary management goals in these areas.

5.3.5. Multiple Resource Management Lands

This classification, which contains approximately 12,842 acres, includes lands managed for one or more of the following activities.

- **Recreation-Low Density.** These lands are designated for dispersed and/or low-impact recreation use. Approximately 1,937 acres of Big Bend project lands are included in this subclassification. Development of facilities on these lands is limited. Emphasis is on providing opportunities for non-motorized activities such as walking, fishing, hunting, or nature study. Site-specific, low impact activities such as primitive camping and picnicking are allowed. Some limited facilities are permitted, including boat ramps, trails, parking areas and vehicle controls, vault toilets, picnic tables, and fire rings.

Manmade intrusions, including power lines, non-project roads, and water and sewer pipelines, may be permitted under conditions that minimize adverse effects on the natural environment. Vegetation management, including agricultural activities that do not greatly alter the natural character of the environment, are permitted for a variety of purposes, including erosion control, retention and improvement of scenic qualities, and wildlife management. Where not in conflict with the safety of visitors and project personnel, hunting and fishing are allowed pursuant to State and/or tribal fish and wildlife management regulations.

- **Wildlife Management General Lands.** These lands are designated for wildlife management, although all project lands are managed for fish and wildlife habitat in conjunction with other land uses. Approximately 10,905 acres of Big Bend project lands are included in this subclassification. Wildlife management lands contain valuable wildlife habitat components that are maintained to yield habitat suitable for a designated wildlife species or groups of species.

These lands may be administered by other public agencies under a lease, license, permit, or other formal agreement. Licenses, permits, and easements are not allowed for such manmade intrusions as pumping plants, pipelines, cables, transmission lines, or non-project roads. Exceptions to this policy are allowable where necessary for the public interest. Wildlife lands are available for sightseeing, wildlife viewing, nature study, and hiking. Consumptive uses of wildlife, including hunting, fishing, and trapping, are allowed when compatible with the wildlife objectives for a given area and with Federal, State, and tribal fish and wildlife management regulations.

- **Vegetative Management.** Management activities in these areas focus on the protection and development of forest resources and vegetative cover. The Big Bend Dam/Lake Sharpe project has no project lands with this subclassification, but all project lands are managed to protect and develop vegetative cover in conjunction with other land uses.
- **Inactive and/or Future Recreation Areas.** This subclassification consists of lands for which recreation areas are planned for the future or lands that contain existing recreation areas that have been temporarily closed. The Big Bend Dam/Lake Sharpe project has no project lands with this subclassification.
- **Easement Lands.** This classification consists of lands for which the Corps did not acquire fee title but did acquire (1) the right to enter onto the property in connection with the operation of the Big Bend project and (2) the right to occasionally flood the property. Planned use and management of easement lands will be in strict accordance with the terms and conditions of the easement estate acquired for the project. The Government has acquired easements on approximately 173.69 acres of land at Lake Sharpe.

Resource Objectives. Resource objectives for Multiple Resource Management lands include the following:

- Provide trail opportunities for interpretive hiking;
- Accommodate and support use of the land for hiking, bird watching, photography, nature study, wildlife observation, and/or the pursuit of peace and solitude;
- Employ good stewardship practices by increasing the use of soil conservation measures;
- Ensure successful natural propagation of diverse fish and wildlife species;
- Provide sites for future development that are adjacent to existing recreation areas and within the project boundary and that meet anticipated outdoor-recreation demands. These sites must be appropriate for that area of the project and must not adversely impact project operations or other project purposes.

Rationale. In addition to the intensively developed recreation areas, less developed recreation areas are available for a wide variety of low-density, dispersed recreation uses. Boating, fishing, hunting, hiking, and other such uses support and complement this objective.

The project area provides many opportunities for a variety of dispersed recreation activities. Given the excellent walleye fishing at Lake Sharpe, fishing pressure is expected to increase. Hunting is

allowed in the project area in accordance with State and tribal regulations for licenses, seasons, and bag limits. The project area contains a diversity of habitat types and wildlife species, including waterfowl, upland game birds, and big game species. The same diversity of habitats and wildlife make the Big Bend Dam/Lake Sharpe project an excellent location for wildlife viewing and photography.

6. RESOURCE PLAN

The resource plan detailed in this chapter describes development and use of the natural and manmade resources at the Big Bend Dam/Lake Sharpe project. This plan considers a variety of factors, including physical characteristics, compatibility with adjacent land uses, land and lake access, existing and projected visitation levels and visitor-use patterns, the economics of operation and maintenance, and state and local initiatives.

The majority of the Big Bend project lands are classified as Multiple Resource Management. Title VI has changed the ownership and management responsibilities of much of the land along Lake Sharpe above the exclusive flood control elevation (1,423 m.s.l.). During the construction of Big Bend Dam and the subsequent filling of the Lake Sharpe pool, grassland, woodland, and brush habitats were inundated. The nine areas that comprised the mitigation lands are currently owned by the BIA/LBST and are managed by the Lower Brule Sioux Tribe for the conservation of wildlife resources including the restoration of lost riparian habitat as an integral part of the Big Bend project.

There are also 14 primary recreation areas located around Lake Sharpe (7 still in COE ownership). These areas range from fully developed campgrounds to primitive access points. The existing recreation areas, along with the management agency/agencies responsible for the individual areas, are listed in Table 6-1. The areas have been divided into two categories based on the land classification system described in Chapter 5.

This Chapter identifies the resource objectives (ROs) for areas still managed by the COE. The location of the management areas and recreation areas prior to Title VI can be found on plates 1 through 6. The management area ROs reflect site-specific application of the project-wide ROs established in the previous chapter. Implementation of the ROs will help to satisfy identified regional needs and desires of other agencies and the public within the limits and capabilities of the project resource base.

Table 6-1. All Management Units

MU#	Name	Land Use Classification	Ownership	Management	Other
1	Dam Embankment, Powerhouse, Administration Building, Maintenance Yard, and Sewage Lagoons	Project Operations	COE	COE	
2	Left Tailrace Recreation Area	Recreation ¹	COE	COE	(to LBST upon request)
3	Spillway Area	Multiple Resource – RLD ²	COE	COE	
4	North Shore Recreation Area	Recreation	COE	COE	
5	East Bend Area	Multiple Resource – WM ³	COE	COE	
6	North Bend Recreation Area	Multiple Resource – RLD	COE	SDGFP	
7	Gregg Area	Multiple Resource – WM	COE	COE	
8	West Bend State Recreation Area	Recreation	COE	SDGFP	
9	Mint Farm	Multiple Resource – WM	COE	COE	
10	Joe Creek Recreation Area	Recreation	COE	SDGFP	
11.1.	Bisson Area (adjacent to Crow Creek)	Multiple Resource – WM	COE	COE	
11.2.	Bisson Area (not adjacent to Crow Creek)	Multiple Resource – WM	COE	COE	Future Transfer
12	DeGrey Recreation Area	Multiple Resource – RLD	SDGFP	SDGFP	Title VI Transfer
13	Whistling Elk Area	Multiple Resource – WM	COE	COE	Future Transfer
14	Fort George Recreation Area	Multiple Resource – RLD	SDGFP	SDGFP	Title VI Transfer
15	Medicine Knoll Creek Area	Multiple Resource – WM	COE	COE	Future Transfer
16	Rousseau Overlook Recreation Area	Multiple Resource – RLD	SDGFP	SDGFP	Title VI Transfer
17	Arikara Area	Multiple Resource – WM	COE	SDGFP	Future Transfer
18	Hipple Lake Wildlife Area	Multiple Resource – WM	COE	SDGFP	Future Transfer
19	Nyoda Girl Scout Camp	Recreation	SDGFP	SDGFP	Title VI Transfer
20	Farm Island Recreation Area	Recreation	SDGFP	SDGFP	Title VI Transfer
21	Farm Island Natural Area	Environmentally Sensitive	SDGFP	SDGFP	Title VI Transfer
22	Golf Course Area	Recreation	SDGFP	SDGFP	Title VI Transfer
23	Isaak Walton League Area	Recreation	SDGFP	SDGFP	Title VI Transfer
24	Pierre Waterfront East Area	Multiple Resource – RLD	City of Pierre	City of Pierre	Title VI Transfer
25	Pierre Marina and Waterfront Area	Recreation	City of Pierre	City of Pierre	Title VI Transfer
26	LaFramboise Island	Environmentally Sensitive	SDGFP	SDGFP	Title VI Transfer
27	Fort Pierre West Area	Multiple Resource – RLD	SDGFP	SDGFP	Title VI Transfer

Table 6-1 (continued). All Management Units

MU#	Name	Land Use Classification	Ownership	Management	Other
28	Fort Pierre Waterfront	Recreation	SDGFP	SDGFP	Title VI Transfer
29	Schomer Area	Multiple Resource – WM	COE	COE	Future Transfer
30	Antelope Creek	Multiple Resource – RLD	SDGFP	SDGFP	Title VI Transfer
31.1	Clark Ranch (upstream of LBST)	Multiple Resource – WM	COE	COE	Future Transfer
31.2	Clark Ranch (on LBST)	Mitigation	LBST	LBST	Title VI Transfer
32	Cedar Creek	Multiple Resource – RLD	LBST	LBST	Title VI Transfer
33	Langdeau Area	Mitigation	LBST	LBST	Title VI Transfer
34	Iron Nation North	Multiple Resource – RLD	LBST	LBST	Title VI Transfer
35	Medicine Creek	Mitigation	LBST	LBST	Title VI Transfer
36	Iron Nation South	Recreation	LBST	LBST	Title VI Transfer
37	Buffalo Pasture	Mitigation	LBST	LBST	Title VI Transfer
38	Narrows RA	Recreation	LBST	LBST	Title VI Transfer
39	Grassrope Area	Mitigation	LBST	LBST	Title VI Transfer
40	Jiggs RA	Multiple Resource – RLD	LBST	LBST	Title VI Transfer
41	Grassrope South	Mitigation	LBST	LBST	Title VI Transfer
42	Pheasant Haven	Mitigation	LBST	LBST	Title VI Transfer
43	Lower Brule Boat Ramp	Multiple Resource – WM	LBST	LBST	Title VI Transfer
44	Lower Brule RA	Recreation	LBST	LBST	Title VI Transfer
45	No Name Dam Area	Mitigation	LBST	LBST	Title VI Transfer
46	Counselor Creek RA	Multiple Resource – RLD	LBST	LBST	Title VI Transfer
47	Cedar Breaks Area	Mitigation	LBST	LBST	Title VI Transfer
48	Corps Storage Yard	Project Operations	COE	COE	
49	Good Soldier Creek	Recreation	COE	COE	(to LBST upon request)
50	Lake Sharpe Islands	Environmentally Sensitive	COE	COE, SDGFP, and LBST	Future Transfer
51	Right Tailrace RA	Recreation	COE	COE	(to LBST upon request)
52	Fort Hale Bottom Area	Multiple Resource – WM	LBST	LBST	Title VI Transfer
53	Walking Cliff	Multiple Resource – WM	COE	COE	
54	Crow Creek	Multiple Resource – WM	COE	COE	
55	Campbell Creek	Multiple Resource – WM	COE	COE	
56	Old Fort Thompson	Recreation	COE	COE	

¹/Recreation = high-intensity recreation areas

²/RLD = recreation (low density) areas

³/WM = wildlife management

⁴/ Future Transfers will be completed within 1 year of capitalizing the SDTF

Table 6-2. Recreation Areas and Management Agencies

Recreation Area	Management Agency
(INTENSIVE USE)	
Left Tailrace	COE (to LBST upon request)
North Shore	COE
West Bend	SDGFP
Joe Creek	SDGFP
Nyoda Girl Scout Camp ¹	Nyoda Girl Scout Council
Farm Island ¹	SDGFP
Isaak Walton ¹	Isaak Walton League
Pierre Marina and Waterfront ¹	City of Pierre
Fort Pierre Waterfront ¹	City of Fort Pierre
Iron Nation South ¹	LBST
Lower Brule ¹	LBST
Good Soldier Creek	COE (to LBST upon request)
Right Tailrace	COE (to LBST upon request)
Old Fort Thompson	COE
Narrows	LBST
(LOW DENSITY USE)	
Spillway	COE
North Bend	SDGFP
DeGrey ¹	SDGFP
Fort George ¹	SDGFP
Rousseau Overlook ¹	SDGFP
Pierre Waterfront East ¹	City of Pierre
Fort Pierre West ¹	SDGFP
Antelope Creek ¹	SDGFP
Cedar Creek ¹	LBST
Iron Nation North ¹	LBST
Jiggs ¹	LBST
Lower Brule Boat Ramp ¹	LBST
Counselor Creek ¹	LBST
Crow Creek	COE

¹Areas transferred under Title VI.

The discussion of each management area contains the following components.

- Classification - The designated land use classification category for each recreation area. The five classification categories are described in detail in Chapter 5.
- Management Agency - The agency directly responsible for the management of a particular area.
- Location - A brief description of the location of the area, including access to the area.
- Description - A brief description of the area, focusing on the natural and cultural resources that affect use of the area.
- Area Use - The predominant use of the area.
- Visitor Use - Where the majority of the visitation originates.
- Resource Objectives - A brief list of the objectives for each recreation area. Each recreation area has more than one RO, and the ROs are not prioritized. In some areas, the ROs may not be implemented for some time.
- Development Needs - Summary descriptions of the techniques that can or should be undertaken to implement the area ROs. The concepts discussed under this component are not all-inclusive; rather, they convey an understanding of the range of development and management strategies that could be used to implement the ROs. The development needs will be further refined and detailed in subsequent planning and design documents, including Operational Management Plans (OMPs) and future Design Memorandums (DMs). The ultimate decisions regarding the methods that are actually implemented will result from coordination between the Corps, state and local agencies, and the private sector, where appropriate and as opportunities arise.
- Rationale - A discussion of the need for and the intent of the identified ROs and the development concepts recommended to implement them.

An environmental assessment (EA) addressing the impacts of the implementation of this Master Plan has been included as Exhibit A.

6.1. DAM EMBANKMENT, POWERHOUSE, ADMINISTRATION BUILDING, MAINTENANCE YARD, AND SEWAGE LAGOONS

Classification. Project Operations

Management Agency. Corps of Engineers

Location. Big Bend Dam is located 25 miles north of Interstate 90 and the city of Chamberlain and 60 miles southeast of Pierre. The dam is approximately 2 miles south of the town of Fort Thompson on State Highway 47, which crosses the embankment. The Buffalo and Lyman County line splits the dam embankment between the powerhouse and the spillway.

Description. This area covers 390 acres. The embankment creates a bridge between the Crow Creek Sioux Reservation on the left bank of the lake and the Lower Brule Sioux Reservation on the right bank. The powerhouse is located on the southern end of the dam embankment and the spillway is on the northern end. The sewage lagoons are located between the dam embankment and the Left Tailrace Recreation Area. The administrative building and maintenance yard are located north of the dam and can be accessed from State Highway 47 and the North Shore Recreation Area. These buildings sustained some damage from a tornado in June 1992.

The dam embankment is approximately 10,570 feet long and 95 feet high. The 2-mile-long embankment of Big Bend Dam is distinguished by its unusual S-shape design. In contrast to the straight bluff-to-bluff design of the other main stem dams, one end of Big Bend Dam was constructed farther upstream than originally planned in order to avoid disturbing an Indian cemetery.

Facilities in this area include parking lots, toilets, potable water, and various visual displays.

Nine historic properties are located in this area. Three sites need to be evaluated for eligibility for listing on the NRHP. One site needs to be monitored periodically, and the remaining two sites do not require any action. Prior to any future development, an evaluation must be made to determine if the development would affect these historic properties and whether any mitigation measures would be necessary.

Area Use. Many visitors pass through this area to reach other recreation areas operated by the Lake Sharpe project office. Visitation to the limited facilities offered at the dam embankment area has been low. However, many visitors now stop at the Spirit of the Circle Monument, built on the Big Bend Dam overlook. The Dakota Sioux Tribes at this site constructed the monument in 2002.

At the powerhouse, the lobby and observation balcony provide interpretive displays about the mission and function of the Corps on the Missouri River. Daily tours of the powerhouse are

conducted throughout the summer recreation season when tourists, school groups, special interest groups, and local residents visit the dam. During the remainder of the year, tours are available by prior arrangement. Powerhouse tours are conducted to promote interest and understanding of the role the Corps plays in meeting project purposes.

The tailrace and the area around the intakes are good fisheries because the turbulent waters in the tailrace attract many species of fish. The cool, deep water in the intake area makes this a good area for trout fishing. Fishermen to gain access to the turbulent waters immediately downstream from the dam use the right abutment wall of the powerhouse. Access is through a gate at the end of a parking lot and warning signs are posted about the dangers of wet, slick pavement. A guardrail has been installed along the top of this wall and an additional low barrier has been installed to prevent visitors from sliding under the guardrail.

Resource Objectives.

- Accomplish power generation, sewage treatment, and maintenance of the project;
- Provide opportunities for visitors to learn about the role of the Corps in the operation of the Missouri River main stem system through the tours and displays in the powerhouse; and
- Protect and preserve the cultural resource sites.

Development Needs.

- Upgrade displays at the powerhouse; and
- Upgrade day use facilities at the Big Bend Dam overlook.

Rationale. This area is classified as Project Operations because the facilities located here are essential for the operation and maintenance of the Big Bend Dam/Lake Sharpe project.

6.2. LEFT TAILRACE RECREATION AREA

Classification. Recreation

Management Agency. Corps of Engineers (may be leased to Lower Brule Sioux Tribe upon request)

The area may be leased in perpetuity to the Lower Brule Sioux Tribe under the provision of Title VI. Under this provision, the Corps of Engineers maintains fee ownership to lands necessary for project operations but may lease recreation areas associated with the dams. At this site, the left tailrace area is essential to the operation and maintenance of the project.

Location. The Left Tailrace Recreation Area is located east of the Big Bend Dam powerhouse. Access is from State Highway 47, the spillway road, and the powerhouse road.

Description. The Left Tailrace Recreation Area covers 65.8 acres of land located immediately downstream from Big Bend Dam. The entire recreation area was constructed on a fill area resulting from the construction of the dam. Waste material such as concrete, gravel, and clay were used as fill and covered with chalky surface soils. These same fill materials hinder plant growth in some areas. The terrain is flat grassland with sparse tree cover. An annual tree-planting program is in effect in order to provide shade and visual appeal. This area provides an excellent view of the powerhouse and Eagle Island to the southeast.

There is no major bank erosion or sedimentation in this area. The shoreline is protected from wind and wave action by riprap and the releases from Big Bend Dam are essentially sediment free.

Day use area facilities include parking lots, picnic tables, a multipurpose court, group picnic areas, grills, an amphitheater, playground equipment, a public telephone, a comfort station, a fish-cleaning station, security light, a three-lane boat ramp with two floating docks, and a courtesy dock to the right of the boat ramp. Camping facilities include concrete pads with electrical hookups, primitive campsites, several double-wide campsites for groups, comfort stations with showers, potable water, vault toilets, a sanitary dump station, and a shade shelter with table and grill for each camp pad. In 1989, the campground was renovated to bring it up to industry standard. No historic properties are located in the Left Tailrace Recreation Area because it is a fill area.

Visitor Use. The Left Tailrace Recreation Area is heavily used for both day use and camping. It is a prime area for fishing, boating, camping, and picnicking. Approximately 90 percent of the campers come to this recreation area because of the excellent fishing opportunities. Motorhomes are the primary users of the camping area; however, tent campers occasionally occupy the grassy area in the southwest portion of the campground.

This area is the first recreation area on the southern end of the project to reach capacity. Springtime visitation is especially heavy, but year-round, open waters on Lake Francis Case attract winter users as well. During the recreation season, the area is fully occupied on the weekends and from 30 to 50 percent occupied during the week. When the carrying capacity is reached, campers are directed to

the Old Fort Thompson Recreation Area. There is a demand for additional camping in this area; however, the existing facilities may not be able to accommodate them.

Resource Objectives.

- Provide a lake access point to Lake Francis Case for boating and fishing; and
- Provide recreation facilities for day use and camping.

Development Needs.

- Upgrade the amphitheater to a more central location for day use and camping participation;
- Plant trees for shade and shrubs for screening between the day use and camping areas;
- Add additional overhead security lighting;
- Replace existing 30 amp pedestals with 50 amp pedestals; and
- Maintain the current activity diversity.

Rationale. The Left Tailrace Recreation Area is a natural attraction for destination campers and resident day users. This area accounts for over 29 percent of the total project visitor-hours recorded. The majority of these visitors originate from areas south and east of the project, including Iowa and Nebraska. The greatest numbers of visitors are from Minnehaha County.

The nearby project structures, such as the dam, powerhouse, and spillway; the powerhouse tours and displays; the access to Lake Francis Case; and the nearby access to Lake Sharpe contribute to the diversity and quality of attractions that draw visitors to the Left Tailrace Recreation Area. A land use classification of Recreation is appropriate for the Left Tailrace Recreation Area because of high visitation, easy accessibility, the extensive existing development in the area, and the long-term suitability for intensive use.

6.3. SPILLWAY AREA

Classification. Multiple Resource Management: Recreation - Low Density

Management Agency. Corps of Engineers

Location. The Spillway Area is located on the right bank of the spillway in Buffalo County north of the Left Tailrace Recreation Area. Access is from State Highway 47.

Description. This area covers 114.9 acres of land downstream from Big Bend Dam. It is relatively flat and grass-covered with a few scattered trees and silty clay soils. Vegetation is denser on the southeastern end of the peninsula.

The original soil structure was destroyed by earthmoving equipment during construction of the dam. A small inlet at the eastern tip of the peninsula provides good waterfowl habitat and attracts wood ducks and mallards.

Facilities at the Spillway Area include parking areas, picnic sites, a picnic shelter, a vault toilet, and a two-lane boat ramp with a dock and solar-powered security light.

Two historic properties are located in the Spillway Area. One site is not eligible for listing on the NRHP. The other site has not been evaluated and has been impacted by erosion and the construction of the dam. Prior to any future development at or near this recreation area, an evaluation must be made to determine if the development would affect the historic properties and whether any mitigation measures are necessary.

Visitor Use. Visitation to the Spillway Area is moderate with most of the visitors originating from areas south and east of the project. The primary activities enjoyed by visitors to this area are fishing and boating. Both picnickers and campers routinely use some of the more shaded areas of the Spillway peninsula. During the winter, ice fishermen frequently use the Spillway Area because it provides convenient access to Lake Francis Case.

Resource Objectives.

- Provide recreation opportunities for day use and camping;
- Provide lake access to Lake Francis Case for boating, fishing, and hunting;
- Provide opportunities for dispersed water-oriented recreation;
- Maintain and protect the cultural resources located in this area; and
- Maintain and manage the existing vegetation to provide habitat for upland game birds, waterfowl, and other wildlife species.

Development Needs.

- Repair and improve the access and circulation roads;
- Construct fish cleaning station with grinder;
- Develop the area with additional shelters, vault toilets, playground equipment, and potable water for group picnickers and/or campers; and
- Provide additional shade by planting trees or building shelters.

Rationale. A land use classification of Multiple Resource Management: Recreation - Low Density is appropriate for the Spillway Area. This area forms a buffer between the spillway channel and the more intensively used Left Tailrace Recreation Area. The organized development of limited facilities would lessen the potential negative impact of wildlife habitat.

6.4. NORTH SHORE RECREATION AREA

Classification. Recreation

Management Agency. Corps of Engineers

Location. Located in Buffalo County, the North Shore Recreation Area is north of the left abutment of Big Bend Dam. This recreation area is 1 mile southwest of the town of Fort Thompson and approximately 25 miles north of Chamberlain.

Access is from State Highway 47. Circulation throughout the area is by both paved and gravel roads.

Description. The North Shore Recreation Area is located along a 3.5-mile stretch of shoreline. This recreation area is approximately 341 acres of which roughly 308 acres are developed. The terrain ranges from relatively flat on the northern end to steep cutbanks along the shoreline on the south. Very few drainages are present.

Facilities in this area consist of a day use area, campground, and boat ramp. Day use facilities include picnic shelters, a playground, softball field, horseshoe pits, sand volleyball court, basketball court, vault toilets, and a swimming beach. The first beach area has a separate access road from State Highway 47 and is often frequented by children and family groups from the Fort Thompson area. In 1990, floating docks were anchored in this area for use by the swimmers.

The campground west of the first swim beach has potable water and camp pads. During the 1980s, the use of this camping area declined because of the increased demand for areas with more highly developed facilities. After a series of budget cuts in 1986, a decision was made to no longer maintain the campground. The area was reopened in 1998 and is used by campers seeking primitive conditions or by campers wanting to get away from the crowded areas at the Left Tailrace Recreation Area.

The two-lane North Shore boat ramp, complete with courtesy dock, is the most popular ramp on the lower end of Lake Sharpe. In 1990, a safety light was installed at the boat ramp. The boat basin was dredged in 1987 and the material was deposited in the little-used campground to the west of the boat ramp. This campground has since been closed.

Minor to moderate shoreline erosion is occurring in this area; however, no facilities are threatened. Some minor erosion was experienced near the boat ramp, in the boat basin, prior to the construction of the dikes at the mouth of the basin in 1986. In the late 1980s, an upstream sediment-detention dam was breached. The dam was repaired in 1995.

There is evidence of littoral transport of sand on the boat ramp and a sandbar at the mouth of the boat basin. Excessive turbidity in the basin indicates shallow depths and some redistribution of the bottom sediments.

The Lake Sharpe Visitor Center was located one-fourth of a mile west of State Highway 47 and immediately east of the administration building. Constructed in 1972, the visitor center was listed as a stopping point in the Native American Loop tour and offered a panoramic view of Big Bend Dam and Lake Sharpe. Numerous displays provided opportunities to learn about local history and the area's natural resources. Many school children as well as visitors to the Big Bend project toured the center each year. Unfortunately, the visitor center was destroyed by a tornado in June 1992. It now serves as a group picnic shelter.

Seven cultural resource sites are located in the North Shore Recreation Area. Five of these sites are listed on the NRHP. Two sites were inundated when the reservoir was filled. Prior to any future development at or near these locations, an evaluation must be made to determine how the development would affect a particular site and the possible mitigation measures necessary.

Visitor Use. Visitation at the North Shore Recreation Area is highest during the summer. Roughly 6.5 percent of the total project visitation occurs at this recreation area. Visitors to this area are primarily local residents from Buffalo and Lyman Counties. Because the area is near the town of Fort Thompson and is close to the dam, it attracts frequent visitors for day use activities. The excellent boat ramp, swimming beach, ball fields, and picnic shelters are heavily used and add to the area's appeal.

The North Shore Recreation Area is used for both water-oriented and landbased recreation activities. The primary activities include fishing, boating, picnicking, swimming, and group activities. This recreation area is the primary lake access for the southern end of Lake Sharpe.

Over the last 10 years, the area has seen an increase in visitation. This trend can be attributed to improvement of facilities at the swimming beach, sightseers on the Native American Loop tour, the constant pool elevation of Lake Sharpe, and warm summer temperatures.

Resource Objectives.

- Provide lake access for water-oriented recreation;
- Provide recreation facilities for family and group day use and camping activities;
- Provide educational opportunities for regional and local history, as well as wildlife management and observation;
- Provide opportunities to explain and/or interpret the history and cultures of the Crow Creek and Lower Brule Tribes;
- Provide educational opportunities about the Corps' mission, purpose of the Missouri River main stem projects, and history on the Big Bend project;
- Protect and preserve the cultural resources located in this area.

Development Needs.

- Reopen and upgrade the eastern-most campground with full modern amenities;
- Expand the developed area to the west to include additional camping areas, swimming beach, playground area and marina.
- Provide a fish-cleaning facility equipped with a grinder near the boat ramp;
- Construct security lighting at the North shore swimming area;
- Construct dump station;
- Develop cultural learning center in cooperation with the Crow Creek Sioux Tribe;
- Provide development opportunities to concessionaires for water related activities;

- Provide marina facilities such as slips, fuel, supplies, and dry dock storage space to serve powerboats and sailboats; and
- Improve and sign internal circulation roads and parking areas.

Rationale. The North Shore Recreation Area can be expected to remain a primary recreation area at Lake Sharpe. The proximity of population centers, the paved access, and the diversity of the existing and planned recreational facilities and activities will all contribute to the area's continuing attraction. The nearby project structures, such as the dam, powerhouse, and spillway; the powerhouse display area; and the access areas to two lakes (Lake Sharpe and Lake Francis Case) also contribute to the diversity and quality of attractions that draw visitors to the area. Thus, a land use classification of Recreation is appropriate for the North Shore area.

Because of its location on the lake, the North Shore Recreation Area should be developed into a major destination recreation area. The development of a marina in this area would complement future development at the West Bend Recreation Area and the Pierre Marina and Waterfront Recreation Area by offering supplies and fuel for those recreationists visiting the eastern portions of the Big Bend Dam/Lake Sharpe project. This "water trail" linkage between the three areas would contribute to a redistribution of visitation, but also would contribute to the economic viability of other concessions. In addition, it would expose visitors to the outstanding recreation opportunities and attractions inherent to the other project resources.

The easily accessible shoreline in the North Shore Area makes it attractive for water-oriented activities. In addition, the boat ramp provides a significant water access point to other recreation areas and reaches of Lake Sharpe. Visitors to the Left Tailrace Recreation Area often use this ramp in order to take advantage of the Lake Sharpe fisheries.

The Lake Sharpe Visitor Center was one of the focal points of the Native American Loop discussed in Chapter 2. The center was visited by many of the local school children, as well as visitors to the dam. The exhibits on display ranged from Native American artifacts, prairie wildlife, and the early fur trade to the westward migration and settlement of the area.

In addition, this facility offered the opportunity to present the story of the Big Bend Dam/Lake Sharpe project.

Reconstruction of this facility would provide an excellent forum to expand on these ideas. The visitor center is the ideal location to fully explain the purpose of the Big Bend Dam/Lake Sharpe project and its role in the Pick-Sloan Plan. Topics should include why this particular site was selected, the overall environmental effects of the project, and how the project has affected local economies. Special public use values and opportunities at Lake Sharpe should also be addressed.

Another of the major factors to be considered in the development of a new visitor center is the presence of a Sioux Indian Reservation on each bank of Lake Sharpe and the numerous other Indian tribes located all around the State. There are many similarities and dissimilarities between the tribes. The social, political, cultural, and historical environments for each tribe are unusual when compared to other Corps projects. The visitor center would provide an avenue to demonstrate and explain these different environments. In addition, the visitor center could also interpret how traditional values of the local Indian people survived or were modified through the reservation period and how the project relates to modern Sioux values, needs, and opportunities.

The severe damage to the Lake Sharpe Visitor Center, caused by the June 1992 tornado, may afford an opportunity for any interested agency to develop a "Cultural Learning Center." Such a center could provide displays and/or materials to educate, answer questions, and invoke curiosity among the visitors. Establishing a multi-agency Cultural Learning Center in the Fort Thompson area and/or Lower Brule area could result in an increase in visitation by school children and tribal members from all over South Dakota, as well as visitors from the Big Bend Dam/Lake Sharpe project.

6.5. EAST BEND AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The East Bend Area is a 15-mile-long reach located in northwestern Buffalo and southwestern Hyde Counties between the North Shore and North Bend Recreation Areas.

Description. This area covers 2,071 acres and is characterized by rolling prairie hills that meet the river in a cutbank or a draw in the southeast. Rough cedar breaks characterize the northwest. The area between contains a mixture of rough breaks with some native prairie grassland and gumbo-type alluvial lands. Eastern red cedar woodlands have developed in several of the upland draws. Native trees, primarily eastern red cedar and ash, grow on the upper terraces and benches and on the nearly flat bottomlands along entering tributaries.

The southern portion of the area is readily accessible to the public. It consists primarily of tallgrass prairie with woody vegetation in some draws. The majority of soils is sandy loam and is suitable for the establishment of trees.

The remainder of the East Bend Area experiences extensive erosion because of the steep sloping terrain with rock outcrops, gumbo-type alluvial lands, and native prairie grassland. Runoff from nearby irrigated fields contains weed seeds, nutrients, pesticides, and sediment that have caused stands of cool-season nonnative grasses to grow in many of the draws.

The many bays along this 15-mile reach of shoreline provide a resting and loafing area for migrating waterfowl, while the cedar breaks and chokecherry and plum thickets provide a food source for these species. Many draws are beginning to form silt deposits across the mouth, forming small wetlands ideal for waterfowl. The southern portion of the area experiences intensive hunting activity from October to December for deer and waterfowl.

There are 38 cultural resource sites located in the East Bend Area. Of these, 11 sites are either listed or eligible for listing on the NRHP. The remaining sites have either not been evaluated or are not eligible for listing on the NRHP. Many of the remaining 27 sites have been impacted by inundation, erosion, or collection.

Area Use. The area is currently managed to upgrade the habitat for upland and big game species. Aerial and broadcast seeding and planting of cottonwood, green ash, willow, Russian olive, eastern red cedar, plum, and chokecherry, as well as native grasses, have helped to replace riparian habitat destroyed at the time of the reservoir filling. Through plantings and monitoring the succession and degradation of habitat, there has been an increase in the amount of available winter cover and dense nesting cover. Food plots of milo, millet, sunflower, and cane have also been established to supplement existing food sources.

This area is managed for upland game as well as a variety of waterfowl. The North Shore Waterfowl Refuge is a state-designated refuge within this management area. The North Shore refuge is located upstream from the North Shore Recreation Area.

This area has numerous leases and easements for irrigation pipelines, powerlines, agriculture, and grazing. Much of the tallgrass prairie was originally leased for grazing. However, because of the center-pivot irrigation of adjacent lands to improve crop production, grazing in the area has declined.

Resource Objectives.

- Upgrade the quality of habitat for upland and big game species and waterfowl; and
- Maintain and protect the cultural resource sites located in this area.

Development Needs.

- Plant trees and shrubs to increase the amount of woody vegetation and winter cover for upland and big game species; and
- Supplement the native food sources for upland and big game species and waterfowl.

Rationale. A land use classification of Wildlife Management is assigned to the East Bend Area because it serves as valuable habitat for upland and big game species as well as waterfowl. The area is suitable for additional wildlife plantings.

6.6. NORTH BEND RECREATION AREA

Classification. Multiple Resource Management: Recreation - Low Density

Management Agency. South Dakota Department of Game, Fish and Parks

Location. The North Bend Recreation Area is located approximately 30 miles northwest of Fort Thompson and 48 miles southeast of Pierre in Hughes County. Access to the area is from State Highway 34 and a 4-mile improved gravel road. Although the county improved the gravel road in 1987, it is sometimes difficult to maneuver during periods of heavy rain and snow because of steep hills and numerous curves.

Description. The North Bend Recreation Area is located in a flat drainage area at the mouth of Chaney Rush Creek. This area covers 161.4 acres of land, 10 acres of which have been developed for recreation. The area is scenic and remote ranging from level terrain to gently rolling shale hills. The area is sparsely vegetated with native grasses. Trees are mostly nonexistent, with only a few located along the creek. Clayey soils at the site are derived from the accumulated sediments of soft shale from the surrounding hills.

Active erosion does occur in this area; primarily from winter ice jams which cause heaving along the shoreline. Since the reservoir was filled, the shoreline in this area has receded approximately 20 feet. Bank sloughing and erosion have also been observed along Chaney Rush Creek. Sediment from the creek is deposited in the bay near the boat ramp and, as a result, the bay is very shallow.

Facilities at the North Bend Recreation Area include picnic tables, grills, vault toilets, primitive campsites, a parking area, and a one-lane boat ramp. A pump house is present that would provide

potable water to the recreation area. However, because of the low visitation and the cost of operating and maintaining the pump, the state closed the facility prior to 1976.

The one cultural resource site located at the North Bend Recreation Area has been nominated for listing on the NRHP. Prior to any future development at or near this recreation area, an evaluation must be made to determine if the development would affect the cultural resource site and whether any mitigation measures are necessary.

Visitor Use. Visitation to the North Bend Recreation Area is low and less than 0.6 percent of the total project visitation. Over 80 percent of these visitors participate in boating and fishing. Visitation is high in proportion to the available facilities.

The area receives heavy use during peak periods of fishing, especially in the springtime, and relatively little use the remainder of the year.

In addition to its recreational aspect, North Bend is also managed for upland game and big game species. Stands of cottonwood, willow, green ash, and Russian olive have been planted to increase the amount of winter cover in the area for the big game species. Upland game species have benefited from a program to increase the amount of dense nesting cover through plantings of chokecherry and plum thickets. Food plots of milo and millet have benefited both game species by providing a supplemental source of food.

Resource Objectives.

- Provide lake access for boating and fishing;
- Provide for day use activities and primitive camping;
- Promote non-consumptive activities such as hiking, photography, and sightseeing;
- Preserve and protect the cultural resource site; and
- Upgrade the quality of habitat for upland and big game species.

Development Needs.

- Control shoreline erosion to protect existing facilities;
- Provide a potable water source;

- Relocate the boat ramp; and
- Improve circulation roads.

Rationale. The North Bend Recreation Area should be maintained as a lake access point with limited facility development. This area serves primarily the people of Hyde, Hughes, and Buffalo Counties.

This area could provide excellent access to the "big bend" area of the lake for boaters and fishermen but, because Chaney Rush Bay is silting in, it is difficult to launch boats from the boat ramp. Relocating the ramp farther to the south, but within the same recreation area, would remove it from the proximity of the creek and the silt problem, thereby allowing for lake access.

The potential for excellent upland and big game hunting exists if wildlife habitat could be improved. The organized development of limited facilities would lessen the potential negative impact on wildlife habitat in the area.

A land use classification of Multiple Resource Management: Recreation - Low Density is appropriate for the North Bend Recreation Area because of the limited facilities, the current wildlife management program, the distance from paved roads, and the wildlife and resource orientation of traditional use.

6.7. GREGG AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The Gregg Area is located in Hughes County between the North Bend and West Bend Recreation Areas.

Description. This area covers 449 acres of land and is characterized by rough gumbo breaks with limited access. The shoreline in this reach is approximately 20 miles long with 3- to 4-foot-high banks. The soils are poor. Primary vegetation consists of native grasses with red cedars located in the draws.

No historic properties are known to be located in the Gregg Area.

Area Use. The Gregg Area is managed to provide quality habitat for upland species such as the sharp-tailed grouse. The amount of woody vegetation of such species as eastern red cedar, Russian olive, and green ash has been increased through aerial and broadcast seeding and planting. Stands of native grasses and sweet clover have also been developed for nesting cover, and milo, millet, sunflower, and cane have been planted for food sources. Available grasslands are leased for agriculture, haying, and grazing.

Resource Objective. The site-specific RO for this area is to upgrade the quality of habitat for upland game species.

Development Needs.

- Plant trees and shrubs to increase the amount of woody vegetation for winter and nesting cover; and
- Establish food plots to supplement existing food sources for upland game species.

Rationale. A land use classification of Wildlife Management is assigned to the Gregg Area because it serves as valuable habitat for upland game species. The area is suitable for additional wildlife plantings.

6.8. WEST BEND STATE RECREATION AREA

Classification. Recreation

Management Agency. South Dakota Department of Game, Fish and Parks

Location. The West Bend State Recreation Area is located in Hughes County approximately 35 miles southeast of Pierre. Access is from State Highway 34 via 9 miles of all-weather gravel road.

Description. The West Bend State Recreation Area covers 172.8 acres of land, 103 acres of which is developed. Silty and loamy soils that formed in loess and alluvium are characteristic of the site. It is a flat, fertile area surrounded by bluffs. Many stands of native and nonnative trees are found throughout the site along with extensive tree plantings such as cottonwood, willow, and green ash that provide windbreaks and shade around the campground area. The native burr oak forest adjacent to the north campground is a natural community that is considered a significant resource by the South Dakota Natural Heritage Program. Prior to acquisition for the Big Bend project, the

area was used for haying, grazing, and farming. Adjacent lands are still used for agricultural purposes.

In 1983, a major renovation was undertaken by the state at West Bend. Facilities now include a fee booth, parking lots, picnic sites, playground equipment, 128 camp pads with 68 pads having electrical hookups, a primitive camping loop, a sanitary dump station, potable water, vault toilets, 2 comfort stations, a swim beach, a three-lane boat ramp with 2 courtesy docks, an amphitheater, an interpretive shelter, and a fish-cleaning station with a grinder.

The boat ramp is located in a manmade harbor with depths from 8 to 10 feet. In 1987, the harbor was dredged and a tributary entering the harbor near the boat ramp was rerouted to enter the lake just north of the harbor to prevent future siltation problems. Some littoral deposition across the harbor entrance may have caused the 6-foot depths here, but the area is still excellent for boat launching.

The shoreline along the embayment at West Bend is exposed to fetch from the main channel of the lake. During the winter, ice that has formed in the bay and the lake is pushed into the embayment and subsequently onto the shore. The movement of this ice causes soil heaving along the shoreline in some areas. As a result, beaches need to be cleared of debris, additional sand is sometimes necessary for reconstruction of the beaches, and areas adjacent to the beaches often need to be graded and reseeded each spring.

Eight cultural resource sites are located in the West Bend Recreation Area. Two of these sites may be eligible for listing on the NRHP. Two sites were inundated when the reservoir was filled. The remaining four sites had not been evaluated. Prior to any future development at or near this recreation area, an evaluation must be made to determine if the development would affect any of the cultural resource sites and whether any mitigation measures would be necessary.

Visitor Use. Accounting for roughly 9.4 percent of the total project visitation, the West Bend State Recreation Area is a recreation fee area that provides an aesthetically pleasing environment with excellent facilities. The area is used for both water-oriented and land-based recreation activities. The primary activities include fishing, boating, camping, swimming, water sliding, and picnicking. With the increase in number and quality of recreation facilities offered, more family groups are being attracted to this area along with the fishermen. Visitors originate from Huron, Chamberlain, Pierre, and the communities in eastern South Dakota. A full-time SDGFP park ranger lives on the site during the summer months to provide information, assistance, and security. Some waterfowl hunting occurs in the fall.

Walleye fishing is very popular and important to the success of the West Bend Recreation Area. Between Memorial Day and the end of July, this is considered one of the best fishing spots in

the state. Several fishing tournaments are held in May and June with each sponsoring organization wanting its own reserved weekend. So many organizations have requested permission to host fishing tournaments that there are not enough facilities available to accommodate all of the requests.

Resource Objectives.

- Provide lake access for fishing and boating;
- Provide recreation facilities for day use activities and camping;
- Provide the opportunity for general recreation and intensive facility development;
- Provide interpretation of the unique natural resources in the area;
- Promote non-consumptive uses of resources such as hiking, photography, and sightseeing;
- Protect and preserve the cultural resource sites; and
- Upgrade the quality of wildlife habitat for both upland and waterfowl species.

Development Needs.

- Provide marina facilities including slips for overnight or extended docking, rentals, and supplies;
- Develop more camp pads along the shoreline;
- Develop an area for campers to beach their boats and tie up overnight;
- Provide separate day use facilities including additional picnic shelters, a designated swim beach, and attendant facilities;
- Provide playground facilities at each of the campground loops;
- Provide vegetative plantings in campgrounds;
- Provide interpretation of the native bur oak forest; and
- Improve the signage along the access road.

Rationale. The West Bend State Recreation Area is one of the major regional recreation areas on the east side of Lake Sharpe. This area receives considerable use from residents of eastern South Dakota. The easily accessible shoreline makes it attractive for water-oriented recreational activities. The variety of land-based resources also contributes to the area's appeal.

Constructing separate facilities for the day use and camping areas will increase the usability of the respective areas as well as providing a distinction between day use and camping use. Establishing vegetation in the campgrounds and day use areas will provide shade and shelter, as well as other benefits to the visitors and resident wildlife.

Construction of additional marina facilities has been identified as a need for this recreation area. Even if campers are staying for an extended period of time, they must either take their boats out of the lake each night or beach them along the shoreline. Construction of boat slips would allow for temporary, overnight, or extended docking facilities.

Because of its location on the lake, the West Bend State Recreation Area plays an important role in water-oriented recreation on Lake Sharpe. Any development in this area would complement future development at the North Shore and Pierre Marina and Waterfront Recreation Areas by offering supplies and fuel for those recreationists visiting the middle reach of Lake Sharpe.

The West Bend Recreation Area supports a land use classification of Recreation because of the aesthetic qualities, suitable resources, and the diversity of the existing recreational facilities.

6.9. MINT FARM AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. This area is located in Hughes County between the West Bend and Joe Creek Recreation Areas.

Description. The Mint Farm Area covers approximately 1,412 acres of land. The topography of this reach ranges from level to gently sloping in the east to rough gumbo breaks intersected by several large woody draws in the west. The shoreline has undergone extensive erosion.

The nearly level lands in the eastern portion of the area contain a mixture of native and field grasses and noxious weeds that provide an excellent habitat for upland game and migrating waterfowl. In the western portion, short grass prairie with rough gumbo breaks intersected by cedar draws predominate.

Twenty-three cultural resource sites are located in the Mint Farm Area. Four sites are either listed or eligible for listing on the NRHP and eight sites are potentially eligible for listing on the NRHP. The remaining sites are either not eligible for listing or have not yet been evaluated.

Area Use. The eastern portion of the Mint Farm Area is managed to upgrade the habitat for upland game and waterfowl. This makes the area popular for hunting. Food plots of alfalfa have been scattered throughout the area to supplement existing food sources. Cottonwood, willow, Russian olive, and Chinese elm have been planted on the uplands and along the shoreline to increase woody vegetation for winter cover. There are 24 easements for irrigation lines, rights-of-way, and a powerline. The six agricultural leases provide for amounts of grain to be left in the fields as an additional wildlife food source.

To control shoreline erosion, the construction of several breakwaters has been proposed to allow the establishment of a new shoreline and aquatic vegetation. Some bankline stabilization has already been successful with the anchoring of snags, logs, and hay bales to break the wave action against the banks and allow siltation between the barrier and bankline.

Resource Objectives.

- Upgrade the quality of habitat for upland species; and
- Maintain and protect the cultural resource sites located in this area.

Development Needs.

- Plant trees to provide winter cover and food plots to supplement existing food sources; and
- Construct breakwaters; anchor logs and snags; grade the existing bank slope; and plant cattails, bulrushes, and trees along the shoreline for erosion control.

Rationale. A land use classification of Wildlife Management is assigned to the Mint Farm Area because it serves as valuable habitat for upland species. The area is suitable for additional wildlife plantings.

6.10. JOE CREEK RECREATION AREA

Classification. Recreation

Management Agency. South Dakota Department of Game, Fish and Parks

Location. Joe Creek Recreation Area is located in Hughes County on the east shore of the lake. It is approximately 38 miles southeast of Pierre and approximately 48 miles northwest of Big Bend Dam. An 11-mile all-weather road provides access to the recreation area from State Highway 34.

Description. The Joe Creek Recreation Area covers approximately 141 acres, of which 62 acres are developed. According to legend, Joe Creek is named after a person named "Joe" who was critically wounded by Indians, and as he lay dying, wrote his name in blood on a rock. The bloodstained rock supposedly is still located in the hills above the creek.

Prairie grasses grow on the steep, clay hills surrounding the inlet to Joe Creek. Emergent vegetation found in the creek provides excellent waterfowl habitat. A relatively large amount of woody vegetation grows in this area, including elm trees and Ponderosa pines. The area contains the third largest elm tree in South Dakota.

Silty and loamy soils that formed in the glacial drift and glacial till and alluvium are found in the uplands. Prior to acquisition for the Big Bend project, the area was used for haying and grazing. Adjacent lands are still used for these purposes.

Facilities at Joe Creek Recreation Area include vault toilets, picnic shelters, picnic tables, a fish-cleaning table, primitive campsites, a parking area, and one lane boat ramp and dock. The boat ramp and adjacent parking area are protected with riprap, and the ramp is not experiencing any silting problems. The bay is generally from 10 to 15 feet deep. A bar is forming at the mouth of the bay off the north bank, but the entrance of the bay is wide and the buildup should not cause significant problems. Some minor shoreline erosion is occurring north of the boat ramp and could affect a picnic shelter in the future.

There is potable water available at Joe Creek. The former potable water supply at this recreation area was of poor quality and the well casing was in a state of disrepair. In 1992, the state financed the construction of a new and deeper well. The new well system is now operational.

Five cultural resource sites are located in the Joe Creek Recreation Area. One site has been evaluated and is not eligible for the NRHP. The remaining four sites have not been evaluated. Prior to any future development at or near these historic properties, an evaluation must be made to

determine if the development would affect any of these sites and whether any mitigation measures are necessary.

Visitor Use. The main uses of the Joe Creek Recreation Area include both water-oriented and land-based recreation activities. These activities include boating, fishing, hunting, and camping. Because of the remote location of the camping sites from the water, most campers utilize the picnic shelters and parking area. If visitation increases and camping becomes a more prominent activity, a new camping area should be constructed closer to the water.

Because there is no fee to use the boat ramp and because of the less crowded conditions, many visitors prefer to launch their boats from Joe Creek instead of the West Bend State Recreation Area. In addition to serving as an alternate access to the lake, the Joe Creek Recreation Area experiences a considerable amount of shoreline fishing. Walleye of all sizes are taken from spring through fall on a variety of baits.

Resource Objectives.

- Provide resource-oriented development;
- Provide lake access for boating and fishing;
- Provide opportunities for hunting;
- Provide recreation opportunities for day use activities and primitive camping;
- Promote non-consumptive uses of the natural resources such as hiking, photography, and sightseeing;
- Maintain and manage the existing vegetation to provide habitat for waterfowl, upland game birds, and other wildlife species; and
- Maintain and protect the cultural resource sites in this area.

Development Needs.

- Establish a primitive camping area nearer to the water with vault toilet and fire rings;
- Establish a hiking trail system to interconnect various points within the Joe Creek Recreation Area;
- Provide security lighting at the boat ramp;

- Establish additional vegetation in the day use areas to provide shade and shelter; and
- Plant food plots, trees, and native grasses for wildlife food supply and habitat.

Rationale. Most visitors to the Joe Creek Recreation Area are from Pierre, Highmore, Harold, and other towns east of Lake Sharpe. This area will continue to serve as an important alternative to the nearby intensively used West Bend State Recreation Area. The diversity of wildlife habitat, along with the area's isolation, is highly valuable to wildlife. As a result, the Joe Creek area receives considerable hunting pressure. The organized development of the recreation facilities will lessen the potential negative impact on wildlife habitat in the area.

Because of its location on the lake, Joe Creek could be further developed into a major recreation area. Development in this area would complement future development at North Shore, West Bend, and the Pierre Marina and Waterfront Recreation Areas. The wide range of visitor uses, the easily accessible shoreline, the quality of the resources of the surrounding area, and the potential for increased development supports a land use classification of Recreation.

6.11. BISSON AREA

6.11.1. Bisson Area (adjacent to the Crow Creek Reservation)

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The Bisson Area is located in southeastern Hughes County between the Joe Creek and DeGrey Recreation Areas.

Description. This 15-mile-long reach covers 1,270 acres. The topography ranges from flat to rolling short grass prairie in the south to rough gumbo breaks and rugged bluffs with woody vegetation in the north. The shoreline in this area is highly susceptible to erosion.

Twenty-three cultural resource sites are located in the Bisson Area. Eleven of these sites are listed or are eligible for listing on the NRHP. The remaining 12 sites are either not eligible for listing or have not been evaluated.

Area Use. The Bisson Area is primarily managed for upland and big game wildlife, as well as a variety of waterfowl. As a result, the area is extensively used for hunting. There are two state-designated waterfowl refuges within this management area. The Joe Creek Waterfowl Refuge is a waterfowl refuge located immediately upstream from the Joe Creek Recreation Area. The other is the DeGrey Waterfowl Refuge, a takeline refuge located immediately downstream from the DeGrey Recreation Area.

Current wildlife management practices within this management area include the establishment of food plots and dense nesting cover with milo, millet, sunflower, and cane to supplement the existing food sources and nesting habitat for upland species. Cottonwood, Russian olive, green ash and willow trees, and chokecherry and plum thickets have been planted where conditions permit ready access or by aerial and broadcast seeding where rugged terrain prevents or restricts access. In the past, much of the area was leased for haying and grazing. These activities are still practiced in some portions of this reach.

Resource Objectives.

- Upgrade the quality of habitat for upland and big game species and waterfowl; and
- Maintain and protect the cultural resource sites located in the area.

Development Needs.

- Plant trees and food plots for winter and dense nesting cover and to supplement existing food sources for improved wildlife habitat for upland and big game species and waterfowl; and
- Plant shoreline vegetation and/or establish a breakwater to control erosion and improve the overall esthetic quality of the area.

Rationale. The construction of a breakwater to control erosion is among the development needs identified for this area. This would allow the establishment of a new shoreline and aquatic vegetation. Bankline stabilization using hay bales, anchored snags, and logs has been successful in other areas in allowing siltation between the barrier and the bankline. A land use classification of Wildlife Management is assigned to this area because it serves as valuable habitat for upland and big game species as well as waterfowl. The area is suitable for additional wildlife plantings.

6.11.2. Bisson Area (not adjacent to Crow Creek reservation)

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

*Ownership and Management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Bisson Area is located in southeastern Hughes County between the Joe Creek and DeGrey Recreation Areas.

Description. This 15-mile-long reach covers 1,270 acres. The topography ranges from flat to rolling short grass prairie in the south to rough gumbo breaks and rugged bluffs with woody vegetation in the north. The shoreline in this area is highly susceptible to erosion.

Twenty-three cultural resource sites are located in the Bisson Area. Eleven of these sites are listed or are eligible for listing on the NRHP. The remaining 12 sites are either not eligible for listing or have not been evaluated.

Area Use. The Bisson Area is primarily managed for upland and big game wildlife, as well as a variety of waterfowl. As a result, the area is extensively used for hunting. There are two state-designated waterfowl refuges within this management area. The Joe Creek Waterfowl Refuge is a waterfowl refuge located immediately upstream from the Joe Creek Recreation Area. The other is the DeGrey Waterfowl Refuge, a takeline refuge located immediately downstream from the DeGrey Recreation Area.

Current wildlife management practices within this management area include the establishment of food plots and dense nesting cover with milo, millet, sunflower, and cane to supplement the existing food sources and nesting habitat for upland species. Cottonwood, Russian olive, green ash and willow trees, and chokecherry and plum thickets have been planted where conditions permit ready access or by aerial and broadcast seeding where rugged terrain prevents or restricts access. In the past, much of the area was leased for haying and grazing. These activities are still practiced in some portions of this reach.

Resource Objectives.

- Upgrade the quality of habitat for upland and big game species and waterfowl; and

- Maintain and protect the cultural resource sites located in the area.

Development Needs.

- Plant trees and food plots for winter and dense nesting cover and to supplement existing food sources for improved wildlife habitat for upland and big game species and waterfowl; and
- Plant shoreline vegetation and/or establish a breakwater to control erosion and improve the overall aesthetic quality of the area.

Rationale. The construction of a breakwater to control erosion is among the development needs identified for this area. This would allow the establishment of a new shoreline and aquatic vegetation. Bankline stabilization using hay bales, anchored snags, and logs has been successful in other areas in allowing siltation between the barrier and the bankline. A land use classification of wildlife management is assigned to this area because it serves as valuable habitat for upland and big game species as well as waterfowl. The area is suitable for additional wildlife plantings.

**6.12. DEGREY RECREATION AREA – AREA TRANSFERRED TO SDGFP
UNDER PROVISIONS OF TITLE VI.**

6.13. WHISTLING ELK AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

*Ownership and Management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Whistling Elk Area is a 5.5-mile long reach between the DeGrey and Fort George Recreation Areas in Hughes County.

Description. The Whistling Elk Area covers approximately 649 acres. It is a relatively flat, short-grass prairie with shallow bluffs intersected with shallow drainages. Native woody vegetation,

such as cottonwood and willow, may be found in some of these drainages. Shoreline erosion is occurring in some areas.

Twenty historic properties are located in the Whistling Elk Area. Six sites have been evaluated and are eligible for listing on the NRHP. The remaining 14 sites have not been evaluated.

Area Use. Current management practices include the establishment of food plots using corn, milo, millet, sunflower, cane, and crops from existing agricultural leases. Dense nesting cover and woody vegetation, such as Russian olive and green ash trees, have also been established to increase and improve wildlife habitat. The one major inlet located near the center of the reach provides excellent habitat for migrating waterfowl. The area is easily accessible from State Highway 34 and offers a variety of hunting for upland species and waterfowl.

Efforts are underway to provide bank stabilization in areas susceptible to erosion. Logs have been anchored and hay bales placed to buffer wave action and allow siltation between the barrier and the shoreline. Aquatic vegetation such as marsh grasses, bulrushes, and cattails, has begun to establish in these areas. The shoreline stabilization and the establishment of aquatic vegetation have also helped to improve the fisheries habitat in the area.

Resource Objectives.

- Upgrade the quality of habitat for upland game species;
- Maintain and protect the cultural resource sites located in this area; and
- Stabilize the shoreline.

Development Needs.

- Anchor logs and snags; grade existing bank slopes; and plant cattails, bulrushes, and trees along the shoreline for erosion control; and
- Plant trees, food plots, native grasses, and marsh grasses for wildlife and fish habitat and food supply.

Rationale. A land use classification of Wildlife Management is assigned to the Whistling Elk Area because it serves as valuable habitat for upland game species. The area is suitable for additional wildlife plantings.

6.14. FORT GEORGE RECREATION AREA – AREA TRANSFERRED TO SDGFP UNDER PROVISIONS OF TITLE VI.

6.15. MEDICINE KNOLL CREEK AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

*Ownership and Management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Medicine Knoll Creek Area is adjacent to State Highway 34 in Hughes County, approximately 11 miles southeast of Pierre, and is located between the Fort George Recreation Area and the Rousseau Overlook Recreation Area.

Description. This area covers approximately 248 acres of land on the east side of Lake Sharpe. It is characterized by hills with little woody vegetation. The natural drainage and the shoreline do support some natural stands of cottonwood and willow. Red cedars may be found in some of the breaks.

Eight cultural resource sites are located in the Medicine Knoll Creek Area. Three sites have been evaluated and are eligible or have been listed for the NRHP. The remaining five sites had not been evaluated.

Area Use. The area is managed to improve the quality of habitat for big game species by increasing the amount of woody vegetation and winter cover. This is accomplished by planting cottonwood, willow, and green ash in accessible areas, where soils are suitable. As a result, some hunting for big game species does occur in this area. In areas that have poor accessibility, aerial seeding has been performed. The Medicine Knoll Creek Area experiences a considerable amount of goose hunting.

Resource Objectives.

- Upgrade the quality of habitat for big game species; and
- Maintain and protect the cultural resource sites located in this area.

Development Needs.

- Plant trees and shrubs to increase the amount of woody vegetation and winter cover for big game species; and
- Supplement native food sources for various wildlife species.

Rationale. A land use classification of Wildlife Management is assigned to the Medicine Knoll Creek Area because it serves as valuable habitat for big game species. The area is suitable for additional wildlife plantings.

6.16. ROUSSEAU OVERLOOK RECREATION AREA – AREA TRANSFERRED TO SDGFP UNDER PROVISIONS OF TITLE VI.

6.17. ARIKARA AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. South Dakota Department of Game, Fish and Parks

* Ownership and management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Arikara Area is located in central Hughes County between the Rousseau Overlook Recreation Area and the Hipple Lake Wildlife Area.

Description. This area comprises roughly 1,002 acres of gently sloping to low-lying lands. Because of the low elevation of some of the area, it is subject to flooding. Grasses and aquatic vegetation such as cattails and bulrushes abound.

There are scattered stands of trees, mostly cottonwood and willow, throughout the area. Soils are poor and rocky.

Eight cultural resource sites are located in this area. Two sites have been listed on or are eligible for listing on the NRHP. The remaining six sites have not been evaluated.

Area Use. Most of the area is leased to the state for use as a public hunting area for upland game. The current management program is to improve the wildlife habitat with the establishment of dense nesting cover, food plots, and trees for upland game species. Food plots of corn, milo, millet, sunflower, and cane and nesting cover of alfalfa and tall wheat are being bordered with rows of Russian olive, plum, chokecherry, green ash, and pear trees to increase cover for the wildlife. Aerial and broadcast seeding has been used to seed those areas that are difficult to access.

Resource Objectives.

- Upgrade the quality of habitat for upland and wetland species; and
- Maintain and protect the cultural resource sites located in the area.

Development Needs.

- Maintain/manage Arikara wetlands for wetland species especially for migratory waterfowl; and
- Supplement native food sources for wildlife.

Rationale. A land use classification of Wildlife Management is assigned to the Arikara Area because it serves as valuable habitat for upland species. The area is suitable for additional wildlife plantings.

6.18. HIPPLE LAKE WILDLIFE AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. South Dakota Department of Game, Fish and Parks

* Ownership and management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Hipple Lake Wildlife Area is located approximately 5 miles southeast of Pierre. It may be accessed from State Highway 34 and is on the north side of Hipple Lake.

Description. This area is a narrow, 59-acre strip of primarily marshy land with some woody vegetation along the shoreline of Hipple Lake. There are several easement outgrants for the area. The SDGFP has the only public parks and recreation lease.

Three cultural resource sites are located in the Hipple Wildlife Area. None of these sites is eligible for listing on the NRHP.

Area Use. The main use of the area is for hunting and, therefore, the area is managed to provide wildlife habitat. Cottonwood, willow, and Russian olive trees have all been planted in this area to establish additional wildlife habitat and winter cover. Food plots of milo, millet, corn, and sunflower have also been established to supplement the existing food supply for various wildlife species.

Resource Objectives.

- Provide a travel lane for wildlife moving between the upland areas and Hipple Lake;
- Upgrade the quality of habitat for upland species; and
- Maintain and protect the cultural resources in the area.

Development Needs.

- Establish food plots to supplement the existing wildlife food supply; and
- Plant trees and shrubs to increase the amount of woody vegetation and winter cover for upland game.

Rationale. A land use classification of Multiple Resource Management: Wildlife Management - General is assigned to the Hipple Lake Wildlife Area because it serves as a travel corridor for wildlife moving between upland areas and Hipple Lake. Much of the area is suitable for additional wildlife plantings such as trees or aquatic vegetation.

**6.19. NYODA GIRL SCOUT CAMP RECREATION AREA – AREA
TRANSFERRED TO SDGFP UNDER PROVISIONS OF TITLE VI.**

**6.20. FARM ISLAND RECREATION AREA – AREA TRANSFERRED TO SDGFP
UNDER PROVISIONS OF TITLE VI.**

**6.21. FARM ISLAND NATURAL AREA – AREA TRANSFERRED TO SDGFP
UNDER PROVISIONS OF TITLE VI.**

**6.22. GOLF COURSE AREA – AREA TRANSFERRED TO SDGFP UNDER
PROVISIONS OF TITLE VI.**

**6.23. ISAAK WALTON LEAGUE AREA – AREA TRANSFERRED TO SDGFP
UNDER PROVISIONS OF TITLE VI.**

**6.24. PIERRE WATERFRONT EAST AREA – AREA TRANSFERRED TO CITY
OF PIERRE UNDER PROVISIONS OF TITLE VI.**

**6.25. PIERRE MARINA & WATERFRONT AREA – AREA TRANSFERRED TO
CITY OF PIERRE UNDER PROVISIONS OF TITLE VI.**

**6.26. LAFRAMBOISE ISLAND – AREA TRANSFERRED TO SDGFP UNDER
PROVISIONS OF TITLE VI.**

**6.27. FORT PIERRE WEST AREA – AREA TRANSFERRED TO SDGFP UNDER
PROVISIONS OF TITLE VI.**

**6.28. FORT PIERRE WATERFRONT – AREA TRANSFERRED TO SDGFP
UNDER PROVISIONS OF TITLE VI.**

6.29. SCHOMER AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

* Ownership and Management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. This area is located in south central Stanley County between the Fort Pierre Waterfront and the Antelope Creek Recreation Area.

Description. The Schomer Area covers approximately 817 acres of land and is characterized by short-grass prairie and rough breaks with generally poor soils. Red cedar trees may be found in some of the draws.

Seven cultural resource sites are located in the Schomer Area. One site has been listed or is eligible for listing on the NRHP. A second site has been nominated for listing. The remaining five sites have not been evaluated.

Area Use. The area is known for its big game hunting. As a result, the area received a moderate amount of hunting pressure in the fall. White-tailed deer inhabit the wooded draws while pronghorns prefer the hilly prairie. Upland game is also abundant and pheasant, grouse, and prairie chicken are the primary species taken.

Aerial seeding and direct planting of cottonwood, eastern red cedar, Russian olive, and ash have been performed in some draws to reestablish woody vegetation for winter cover wildlife. Food plots of milo and millet have also been established to supplement the food sources for various wildlife species.

Resource Objectives.

- Upgrade the quality of habitat for big game species; and
- Maintain and protect the cultural resource sites located in the area.

Development Needs.

- Provide opportunities for hunting; and
- Plant trees to increase the amount of woody vegetation and winter cover for wildlife habitat for big game species.

Rationale. A land use classification of Wildlife Management is assigned to the East Bend Area because it serves as valuable habitat for big game species. The area is suitable for additional wildlife plantings.

6.30. ANTELOPE CREEK RECREATION AREA – AREA TRANSFERRED TO SDGFP UNDER PROVISIONS OF TITLE VI.

6.31. CLARK RANCH AREA

6.31.1. Clark Ranch Area (upstream of the LBST reservation)

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Ownership and Management of the area above the exclusive flood control pool will transfer to SDGFP not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. The Clark Ranch Area is located in southeast Stanley and northeast Lyman Counties between the Antelope Creek and Cedar Creek Recreation Areas.

Description. This 25-mile-long area covers 1,679.2 acres and is characterized by rough cedar breaks with poor soils in the northwest to bluff land with several wooded draws and heavy gumbo soils in the southeast. A relatively flat shortgrass prairie with fertile soils used for cropland is found in the central portion of the region. There is some active erosion along the shoreline. Public access to the area varies greatly and depends on the topographic characteristics. Those areas of rough cedar breaks and high bluffs have very limited public access while the lands in the flat, central region are readily accessible. The rolling hills are home for pheasant grouse. Deer may be found in those areas with many bluffs and breaks that are more rugged. Waterfowl congregate along the shoreline and wetland areas.

Fifty-one cultural resource sites are located in the Clark Ranch Area. Sixteen sites have been listed or are eligible for listing on the NRHP. The remaining sites had not been evaluated.

Area Use. The Clark Ranch Area is managed to upgrade the vegetation in the upland areas and to improve riparian areas for waterfowl, upland, and big game species. Aerial and broadcast seeding and direct planting of cottonwood, eastern red cedar, Russian olive, green ash, plum, and chokecherry seedlings have been undertaken to increase the amount of woody vegetation and dense nesting cover. Where conditions are favorable, milo, millet, sunflower, and cane have been planted as supplemental food sources for wildlife.

In areas of active erosion, the shoreline has been sloped and stabilized with riprap and anchored logs when possible. Cottonwood, willow and green ash, and aquatic vegetation, such as cattail and bulrush, have also been planted to further stabilize the banks.

These improved riparian stands have decreased the amount of active erosion and have improved the local fishery by providing spawning habitat and additional food supply.

This area, now operated as the Lower Brule Goose Camp, is popular for hunting geese, other waterfowl, deer, and pheasant.

Resource Objectives.

- Upgrade the quality of habitat for waterfowl, upland game, and big game species;
- Stabilize shoreline erosion; and
- Maintain and protect the cultural resource sites located here.

Development Needs.

- Plant trees and shrubs to increase winter cover and woody vegetation for wildlife;
- Establish food plots to supplement native food sources for waterfowl, big game, and upland game species; and
- Grade existing bank slopes; plant cattails and bulrushes; and anchor logs, snags, and hay bales along the shoreline for erosion control.

Rationale. A land use classification of Wildlife Management is assigned to the Clark Ranch Area because it serves as valuable habitat for upland and big game species as well as waterfowl. The area is suitable for additional wildlife plantings.

**6.31.2. CLARK RANCH AREA (on LBST reservation) – AREA TRANSFERRED
TO LBST UNDER PROVISIONS OF TITLE VI**

**6.32. CEDAR CREEK RA – AREA TRANSFERRED TO LBST UNDER
PROVISIONS OF TITLE VI.**

- 6.33. LANGDEAU AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.34. IRON NATION NORTH RECREATION AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.35. MEDICINE CREEK AREA– AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.36. IRON NATION SOUTH RA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.37. BUFFALO PASTURE AREA– AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.38. NARROWS RA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.39. GRASSROPE AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.40. JIGGS RA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

- 6.41. GRASSROPE SOUTH AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.**

6.42. PHEASANT HAVEN AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.43. LOWER BRULE BOAT RAMP – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.44. LOWER BRULE RA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.45. NO NAME DAM AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.46. COUNSELOR CREEK RA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.47. CEDAR BREAKS AREA – AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.48. CORPS STORAGE YARD

Classification. Project Operations

Management Agency. Corps of Engineers

Location. The Corps Storage Yard is located south of the Good Soldier Creek Recreation Area in Good Soldier Bay.

Description. This 14-acre tract is located on a portion of a gumbo break. The vegetation consists of native grasses with a few cedar trees. There is only incidental use by wildlife because much of the area is a gravel parking lot and storage sheds.

No known cultural resource sites are located in the Corps Storage Yard.

Area Use. The Corps uses this area as a boat and material storage facility. The floating plant and other materials are stored in buildings onsite. The area is fenced and has locked gates.

Resource Objective. The site-specific RO for this area is to provide a secure storage area for chemicals and equipment used in operation of the Big Bend Dam/Lake Sharpe project.

Development Needs.

- Plant trees and shrubs between this area and the Good Soldier Creek Recreation Area as a screening buffer.

Rationale. The Corps Storage Yard is appropriately classified for Project Operations. This area is used to store materials and equipment required for the operation and maintenance of the Big Bend Dam/Lake Sharpe project. Developing an access road between the Corps Storage Yard and Good Soldier Creek would reduce the mobilization time for Corps personnel responding to any emergency on the lake.

6.49. GOOD SOLDIER CREEK RECREATION AREA

Classification. Recreation

Management Agency. Corps of Engineers area that could be eligible to be leased to Lower Brule Sioux Tribe upon request. The area may be leased in perpetuity to the Lower Brule Sioux Tribe under the provision of Title VI. Under this provision, the Corps of Engineers maintains fee ownership to lands necessary for project operations but may lease recreation areas associated with the dams. At this site, the right dam abutment area is essential to the operation and maintenance of the project.

Location. The Good Soldier Creek Recreation Area is located on the right bank of Lake Sharpe adjacent to Big Bend Dam in Lyman County. Access is from State Highway 47 to a gravel circulation road. The town of Fort Thompson is located approximately 3 miles to the north.

Description. This area covers approximately 17 acres of land, 9 acres of which are developed. Steep draws and grassy hills characterize Good Soldier Creek Bay, with the shoreline varying from steep banks to narrow beaches. The developed portion of the area is fairly flat. Cedar breaks are scattered throughout the draws and on the uplands. Aquatic vegetation can be found in the arms of the bay where Good Soldier Creek enters the reservoir. Waterfowl such as geese, wood ducks, and mallards may be found on the northwest side of the bay.

Shoreline erosion near the recreation facilities is limited to minor sheet erosion above the existing protection. Some trees are being undercut by shoreline erosion. A hardpoint just north of the boat ramp should prevent any shoaling there. No other major sedimentation or erosion problems appear to be present at this area.

Facilities include picnic sites, campsites, group picnic shelters, grills, a vault toilet, a playground, horseshoe pits, a handicap-accessible fishing dock, large parking areas, a non-operating water treatment plant, and a two-lane boat ramp with a dock. Swimming occurs adjacent to the unmarked gravel beaches, but there is a sudden drop-off about 8 to 10 feet out from the shore.

Three cultural resource sites are located in the Good Soldier Creek Recreation Area; however, these sites were inundated when Lake Sharpe was filled.

Visitor Use. Good Soldier Creek Recreation Area is primarily a day use area. Visitors to the area are primarily from Lyman, Buffalo, Hyde, and Brule Counties, as well as other areas within central and eastern South Dakota.

Groups oftentimes prefer to use this area in order to avoid the crowds at the Left Tailrace Recreation Area.

The Good Soldier Creek Recreation Area provides both water-oriented and land-based recreation activities. Visitation is relatively heavy. The area attracts visitors desiring to participate in sightseeing, boating, swimming, fishing, picnicking, water-skiing, and occasionally jet skiing. Although the area is predominantly for day use, some camping (both individuals and groups) does take place. Small fishing tournaments are occasionally held at this location.

Resource Objectives.

- Provide opportunities for day use and camping activities; and
- Provide a lake access point for boating and fishing.

Development Needs.

- Add additional and modernize existing playground equipment;
- Provide additional security lighting;
- Provide potable water and;
- Establish additional tree cover to provide shade in the day use area and to screen the Corps' Storage Yard to the south.

Rationale. The Good Soldier Creek Recreation Area is a major lake access point for visitors from Lyman, Buffalo, Hyde, and Brule Counties, as well as other residents of central and eastern South Dakota. The protection afforded by the bay makes this a popular boat-launching/take-out spot during times of rough lake conditions.

A land use classification of recreation is appropriate for the Good Soldier Creek Recreation Area because of its outstanding scenery, relatively high visitation rate, variety of facilities, and close location to Big Bend Dam. The organized development of additional facilities would lessen the potential negative impact on area wildlife.

6.50. LAKE SHARPE ISLANDS

Classification. Environmentally Sensitive

Management Agency. South Dakota Game Fish and Parks, Corps of Engineers, and Lower Brule Sioux Tribe

* Ownership and management of the islands above the exclusive flood control pool will transfer to SDGFP or LBST not later than 1 year after the SDTF is capitalized. The Corps of Engineers will retain ownership and management below the exclusive flood control pool.

Location. This unit takes into account all the islands on Lake Sharpe between Big Bend Dam and Pierre, South Dakota, plus those islands immediately downstream from Big Bend Dam. Farm Island and La Framboise Islands are excluded from this unit because they are managed as separate areas.

Description. The topography of the islands ranges from low newly formed areas with bare sand and little vegetation to those with high banks and mature trees. Because of the deposition of sediment from the Bad River at the upstream end of the lake near Pierre, new islands are continually emerging. Vegetation on the islands varies from wetland habitat containing cattails and rushes to riparian areas with willow, Russian olive, cedar, and cottonwood trees. The total area of this island unit is approximately 245 acres.

No known cultural resource sites are located on these islands.

Visitor Use. The islands are popular for duck hunting. On the larger islands where deer may sometimes be found, bow hunting is allowed to a minor extent. Several federally listed endangered or threatened species can also be found nesting and/or roosting on the islands. These species include

bald eagles, least terns, and piping plovers. Because of the unique character of the islands and the number and kinds of floral and faunal species present, development on the islands has been limited.

Resource Objective. The site-specific RO for the island unit is to protect the environment for use by waterfowl, upland game, and big game species.

Development Needs. No development need has been identified nor is development suggested for the island unit.

Rationale. The unique character of the islands and the number and types of floral and faunal species present makes Environmentally Sensitive an appropriate land classification for these islands.

6.51. RIGHT TAILRACE RECREATION AREA

Classification. Recreation

Management Agency. Corps of Engineers (May be leased to Lower Brule Sioux Tribe upon request.)

*The area may be leased in perpetuity to the Lower Brule Sioux Tribe under the provisions of Title VI. Under this provision, the Corps of Engineers maintains fee ownership to lands necessary for project operations but may lease recreation areas associated with the dams. At this site, the right tailrace area is essential to the operation and maintenance of the project.

Location. The Right Tailrace Recreation Area is located immediately downstream and adjacent to the Big Bend Dam in Lyman County. The area is accessible from State Highway 47.

Description. This area consists of approximately 148 acres with roughly one third of the area developed. The topography ranges from sheer bluffs along the shoreline downstream from the boat ramp to gently rolling hills and flat landscaped areas in the developed portion. Cedar breaks are scattered throughout the draws found in the undeveloped portions.

Facilities include picnic sites, a group picnic area, a primitive campground, handicap accessible fishing pier, a playground, a comfort station with shower, potable water, a fish-cleaning table, a fixed dock for pedestrian visitors, and a one-lane boat ramp with a courtesy dock.

A jetty is located between the boat ramp and a drainage area immediately downstream from the ramp. This jetty prevents sediments from an intermittent stream from being deposited on the boat ramp. A handicap accessible fishing pier was built on the jetty in 2001. It provides excellent shore

fishing access. The boat ramp is positioned on the west side of the jetty; therefore, strong currents in the tailwaters can cause difficulty when launching and loading boats. Portions of a steep bluff located about 300 feet downstream from the boat ramp periodically slump off, which can be dangerous to area users; however, this area has been signed to warn boaters and shoreline fishermen of potential hazards.

This area has not been evaluated for cultural resource sites. However, two known sites located in the Right Tailrace Recreation Area are believed to have been destroyed. Prior to any additional development in this area, a survey should be conducted to determine whether any cultural resources would be affected and whether any mitigation measures would be necessary.

Visitor Use. Visitors to the Right Tailrace Recreation Area originate from all over the United States. During times of heavy use, this area acts as an overflow camping area for the Left Tailrace Recreation Area. The Left and Right Tailrace combined account for nearly 25 percent of the visitation to the Big Bend project. The Right Tailrace Recreation Area affords year-round use. The main uses of the area include both water-oriented and land-based recreation activities -- boating, fishing, camping, picnicking, hiking, and wildlife viewing.

Fishermen most heavily use this area in the spring, but because the tailrace does not freeze over in the winter, this area also receives good winter use. Shoreline fishing is also popular, with many visitors casting from the shoreline below the parking area or from the right abutment of the powerhouse.

The campground is located in an open area that is not near the shoreline or comfort station. Because of this, many campers have been known to use the parking lot or the picnic sites and shelters as a campsite. The parking lot can become congested when a number of vehicles with trailers, boats, and campers utilize it at the same time.

During the fall, hunters use the recreation area as a place to set up base camp. They hunt in the surrounding "breaks" area along the river during the day but return to the recreation area at the end of the day.

Resource Objectives.

- Recognize the significance of both water-oriented and land-based resources;
- Provide opportunities for day use and camping;
- Provide the opportunity for handicap fishing; and

- Provide facilities to promote non-consumptive use of the area's natural resources through activities such as hiking, photography, and sightseeing.

Development Needs.

- Provide additional and update existing playground equipment;
- Redesign the recreation picnic area to provide a clearly designated picnic site and camping sites and include tables, shade shelters, fire rings, electric hookups, and potable water in both areas; and
- Establish additional tree cover in campground and day use areas.

Rationale. The Right Tailrace Recreation Area is classified as Recreation because of the type of facilities offered here, the area's location, and the amount of visitor use. Visitors to this recreation area come from all over the United States. This recreation area acts as an overflow area for the Left Tailrace Recreation Area and, as such, development of additional day use facilities, construction of designated camping areas, and interpretation of natural resources are among the top needs identified. Establishing vegetation in the campground and day use areas will not only provides the needed shade and shelter for visitors but will also provide benefits to the resident wildlife.

A land use classification of recreation is appropriate for the Right Tailrace Recreation Area because of its outstanding scenery, relatively high visitation rate, variety of facilities, and the close proximity to Big Bend Dam. The organized development of additional facilities would lessen the potential negative impact on area wildlife.

6.52. FORT HALE BOTTOM AREA - AREA TRANSFERRED TO LBST UNDER PROVISIONS OF TITLE VI.

6.53. WALKING CLIFF AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The Walking Cliff Area is located on the left bank 9 miles downstream from Big Bend Dam. Although this area is part of Lake Francis Case and the Fort Randall project, it is administered and managed by the Big Bend Project Office. This area, located in Buffalo County, lies within the boundaries of the Crow Creek Reservation.

Description. This area covers about 228 acres of land and is characterized by rough breaks sloping steeply to the river with extensive erosion along the shoreline. Cedar trees may be found along the draws while the remainder of the area is shortgrass prairie.

One cultural resource site is located in the Walking Cliff Area. Because it was inundated during the filling of Lake Francis Case, this site has not been evaluated for listing on the NRHP.

Area Use. The area is used heavily for hunting. It is adjacent to some state-owned hunting areas located on the south boundary that allow access to this area.

Resource Objective. The site-specific RO for this area is to upgrade the quality of habitat for upland and big game species.

Development Needs.

- Plant trees and shrubs to increase woody vegetation and to improve cover; and
- Establish food plots to supplement existing food sources.

Rationale. The land use classification of Multiple Resource Management: Wildlife Management - General is assigned to the Walking Cliff Area to maintain the natural condition of the area and for future habitat improvement.

6.54. CROW CREEK AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The Crow Creek Area is located on Lake Francis Case approximately 9 miles southeast of Fort Thompson at the mouth of Crow Creek in Buffalo County. Access is from State Highway 50. Although this area is part of Lake Francis Case and the Fort Randall project, it is administered and managed by the Big Bend Project Office. This area lies within the boundary of the Crow Creek Reservation.

Description. This area covers 186 acres of land of which only 1 acre is developed. The terrain is gently sloping to steep. Shortgrass prairie predominates; however, there is some agricultural encroachment in portions of the area. Woody vegetation found in the draws consists primarily of green ash, boxelder, elm, and burr oak. The riparian habitat along the shoreline includes isolated stands of cottonwood and peach-leaved willow with indigo bush as the predominant understory vegetation.

Lake Bedashosha, approximately 320 acres, is formed by the Crow Creek Dam, which was built by the Civilian Conservation Corps in the 1930s. The BIA is now responsible for the lake and dam. Because of safety concerns, the dam was breached in 1991 and most of the water drained out. The lake only has an average depth of 3 to 4 feet because of the amount of silt that has been deposited in the lake by runoff from the surrounding lands. The lake still supports a limited fishery, and, at times, birds such as cormorants, pelicans, and eagles have been observed along the shoreline. A variety of waterfowl also use the remaining portion of Lake Bedashosha.

A one-lane gravel boat ramp just to the east of State Highway 50 and a parking area are located in this area. Because of the inundated forest between the boat ramp and main channel of the lake, extreme care must be taken to get a boat into Lake Francis Case.

Two cultural resource sites are located in the Crow Creek Recreation Area. One site, Crow Creek Village, is eligible for listing on the NRHP. The other site has not been evaluated and was inundated when Lake Francis Case was filled.

Area Use. Use of this area is limited because the water channel from the boat ramp to the lake is shallow and can support only shallow draft boats. There is a minor amount of shoreline fishing at Lake Bedashosha. The primary use of the area is for waterfowl hunting.

Resource Objectives.

- Preserve and protect the cultural resource site in the area; and
- Upgrade the quality of wildlife habitat.

Development Needs.

- Plant trees to improve cover for wildlife;
- Control grazing and agricultural use to improve the habitat for wildlife; and
- Develop a plan for interpretation at the Crow Creek Village site.

Rationale. A land use classification of Multiple Resource Management: Wildlife Management - General is assigned to the Crow Creek Recreation Area because of its location, character, and resources.

6.55. CAMPBELL CREEK AREA

Classification. Multiple Resource Management: Wildlife Management - General

Management Agency. Corps of Engineers

Location. The Campbell Creek Area is located on the left bank downstream from Big Bend Dam. Although this area is part of Lake Francis Case and the Fort Randall project, it is administered and managed by the Big Bend Project Office. This area lies within the boundary of the Crow Creek Reservation.

Description. This area covers approximately 1,730 acres of land with topography that varies from nearly level in the southeast to rolling hills in the northwest. Dense cottonwood and willow riparian habitat is found along Wolf and Campbell Creeks. The remaining shoreline area contains remnants of floodplain forests with green ash, box elder, and burr oak trees.

The bald eagle, a federally listed threatened species, has been known to use the large cottonwoods and dead snags in the river for winter roosts. Food plots and trees have been planted in those areas with suitable soils to improve existing wildlife habitat.

The eroding banks along Wolf Creek have encroached on adjacent private lands. These banks have been stabilized now and native grasses have been reestablished. The bank stabilization has also improved the habitat for fisheries in the area.

Well over 20 cultural resource sites are located in the Campbell Creek Area. One site is eligible for listing on the NRHP. Many of the remaining sites were either impacted by the filling of Lake Francis Case, by erosion, or by vandalism.

Area Use. The main use of the area is hunting, although some grazing, fishing, and trapping do occur. Food plots of milo, millet, and corn have been established in portions of this area as a supplemental food source for various wildlife species.

Resource Objectives.

- Upgrade the quality of wildlife habitat; and
- Protect and preserve the remaining cultural resource sites in the area.

Development Needs.

- Plant trees, food plots, and native grasses for wildlife cover and supplemental food supply; and
- Stabilize the eroding bankline.

Rationale. A land use classification of Multiple Resource Management: Wildlife Management - General is assigned to the Campbell Creek Area because location, character, and resources for emphasis on wildlife management suit the area.

6.56. OLD FORT THOMPSON RECREATION AREA

Classification. Recreation

Management Agency. Corps of Engineers

Location. The Old Fort Thompson Recreation Area is located on the left bank of the spillway and 1 mile south of the town of Fort Thompson in Buffalo County. Access is from State Highway 47. A housing development is located to the north and a rodeo/powwow grounds area is located to the northwest of the recreation area.

Description. This area covers approximately 170 acres of land, 100 acres of which are developed. The topography ranges from flat to gently sloping, with relatively stable clayey soils. Soldier Creek runs between the camping loop and the large wooded day use area and empties into Lake Francis Case. Several shelterbelts and other tree plantings throughout the Old Fort Thompson Recreation Area provide shade and esthetic appeal. Wildlife food plots have been established as well.

Facilities in the area include parking areas, picnic shelters, tables, playground equipment, a comfort station, potable water, a campground, a one-lane boat ramp with courtesy dock, security light, vault toilets, and an interpretive trail. At one time, there was also a dump station, a second

campground loop, and a comfort station. Circulation roads have been redesigned to improve access and security within the area. The day use area contains numerous mature cottonwood trees and scattered grass ground cover. The picnic area is a popular spot for both small groups and family reunions.

The boat ramp, located on the eastern end of the day use area, was constructed in 1988 and is used to access Lake Francis Case. During the winter, this ramp receives considerable use by ice fishermen wishing to access the spillway outflow. An old access road from the town of Fort Thompson has been opened to allow direct access to the boat ramp without driving through the entire recreation area.

The Old Fort Thompson campground area is located immediately adjacent to South Dakota Highway 47. The campground area receives minimal use because of the distance to the water. Today, the campground area primarily serves as an overflow area for people from the Left Tailrace Recreation Area and other recreation areas in the immediate vicinity of the dam.

Winds from the south and southeast can cause considerable erosion to the unprotected shoreline of this area. The banks along the recreation area have been graded and stabilization has been provided. Downstream from the boat ramp, banks are one to three feet high and some are being undercut.

Five cultural resource sites are located in the Old Fort Thompson Recreation Area. One site has been evaluated and determined as not eligible for listing on the NRHP. The town of Fort Thompson, one of the remaining four sites, was occupied from 1863 until the 1950s. That site and the other three sites have not been evaluated for listing. Prior to any additional development, an evaluation should be made to determine whether these sites will be impacted by the development and whether any mitigation measures would be necessary.

Visitor Use. The Old Fort Thompson Recreation Area supports a wide variety of activities. Day use activities, camping, picnicking, boat access, and fishing are all activities that visitors enjoy in this area.

Visitation in the Old Fort Thompson Recreation Area is moderate and visitation is essentially day use. Visitors to this area are primarily local groups from Fort Thompson as well as nearby areas, although some camping does take place. Because the campground at Old Fort Thompson is located so far from the water and because there is limited shade available, most visitors are interested in camping use of the facilities at the Left Tailrace Recreation Area.

Visitation to the Old Fort Thompson Recreation Area has increased as a result of some changes within the area. After the construction of the boat ramp in 1988, some project visitors opted to use this ramp to launch their boats in order to avoid the crowded conditions that sometimes exist at the

Left Tailrace boat ramp. Also in 1988, an old access road from the town of Fort Thompson was reopened. This provides quick direct access to the boat ramp without requiring a drive through the entire recreation area and has increased the visitation from Fort Thompson.

Shoreline fishing also takes place along this recreation area and the area immediately downstream from the spillway outflow structure is used often. Walleyes can be taken year-round in the tailwaters downstream from Big Bend Dam. Fishing success in this particular area starts in early April and continues through early July.

Resource Objectives.

- Provide recreation opportunities for day use and camping;
- Provide access to Lake Francis Case for boating and fishing;
- Provide interpretation of the natural and historic resources in the area;
- Improve existing facilities and circulation roads; and
- Preserve and protect the cultural resource sites in the area.

Development Needs.

- Develop a comprehensive site plan for the area;
- Install security lighting throughout the area;
- Consolidate playground equipment to a central location;
- Pursue partnership opportunities for archeological excavation and development of the original Fort Thompson;
- Construct a fish-cleaning table with water and grinder;
- Provide vault toilets near the spillway outflow structure; and
- Riprap areas to control shoreline erosion.

Rationale. The Old Fort Thompson Recreation Area is a major recreation area because of its proximity to Big Bend Dam, State Highway 47, and the town of Fort Thompson. The area also serves as an overflow camping area for other recreation areas in proximity of the Big Bend Dam. The easily accessible shoreline in this area makes it attractive for water-oriented activities. The

quality of the resources of the surrounding area contributes to the wide variety of available land-based recreational activities, including picnicking, hiking, photography, and sightseeing. The mature cottonwood stand in the day use area contributes greatly to the area's aesthetic qualities and provides shade and shelter for visitors and incidental wildlife as well.

The project structures such as the dam, powerhouse, and spillway; the powerhouse visitor center; and the lake access to Lake Francis Case, as well as Lake Sharpe, contribute to the diversity and quality of the area. Because of the above factors, a land classification of Recreation is appropriate for this area.

7. CONCLUSIONS

Big Bend Dam was constructed between 1959 and 1963 and takes its name from the unique bend in the Missouri River 7 miles upstream from the dam. At this point in its course, the Missouri River makes almost a complete loop, traveling nearly 25 miles before returning to the "neck" where the land is 1 ½ miles wide.

Lake Sharpe, the reservoir impounded by Big Bend Dam, stretches over 50 river miles from Fort Thompson to Pierre, South Dakota. Much of the project lies within the Crow Creek Sioux Reservation on the east side and the Lower Brule Sioux Reservation on the west side. The reservations have had a significant impact on the development and use of the project lands and waters.

Recreation sites are distributed around the lake. However, because of the distance from major highways and heavily populated areas, visitation is relatively low. Most of the visitors to the Big Bend project are visitors from the southeastern South Dakota, Iowa and Nebraska. Visitation is concentrated in the areas near Pierre and the dam. The highest priority recreation facility needs for the project are upgraded day use facilities and campgrounds. This Master Plan designates areas where each of these needs should be met.

This Master Plan reflects changes to property ownership and management around Lake Sharpe due to Title VI. This plan presents an overall plan for the management and development of the resources under COE control at the Big Bend Dam/Lake Sharpe project. It also provides guidance on public use, natural areas, and cultural resources within the Big Bend project boundaries. Preparation of this plan required (1) an appraisal of the natural and cultural resource conditions of the project and the surrounding region and (2) an examination of environmental and administrative constraints and influences.

Sound stewardship of public lands requires development and management of project resources for the public benefit, consistent with resource capabilities. An important element of this approach is the establishment of viable resource objectives. This Master Plan recommends a broad range of resource objectives and management and development concepts covering the overall project, as well as specific areas within it. These recommendations are summarized below.

7.1. PROJECT OPERATIONS LANDS

- Continue to ensure that all project purposes (flood control, navigation, hydropower, fish and wildlife, recreation, municipal and industrial water supply, and irrigation) are carried out.

7.2. RECREATION LANDS

- Maintain existing recreation facilities administered by the Corps and provide safe, enjoyable recreational opportunities;
- Develop interpretive displays to identify and explain the natural, cultural, and historical significance of areas around the project; and
- Lease identified project lands to qualified non-federal sponsors for facilities development (and provide technical, advisory, and administrative support as needed).

7.3. MULTIPLE RESOURCE MANAGEMENT LANDS

- Develop, maintain, and/or upgrade facilities at low-density use areas to provide safe and enjoyable recreational experiences;
- Preserve and maintain existing riparian vegetation wherever possible; and
- Continue a vegetative planting program to improve visual quality, wildlife habitat, and stabilize shoreline.

7.4. ENVIRONMENTALLY SENSITIVE AREAS

- Preserve and protect unique and important ecological, cultural, and aesthetic resources.
- An Operational Management Plan (OMP) is a critical element in achieving the resource objectives and associated management and development concepts specified in the Master Plan. An OMP is being prepared for the Big Bend project.
- Extensive federal, state, tribal, and local agency coordination and citizen involvement was incorporated in all aspects of this Master Plan. Planning for the development, preservation, or enhancement of project resources will continue to be coordinated through other governmental agencies and special interest groups to ensure the efficient and timely implementation of the resources objectives.

8. RECOMMENDATIONS

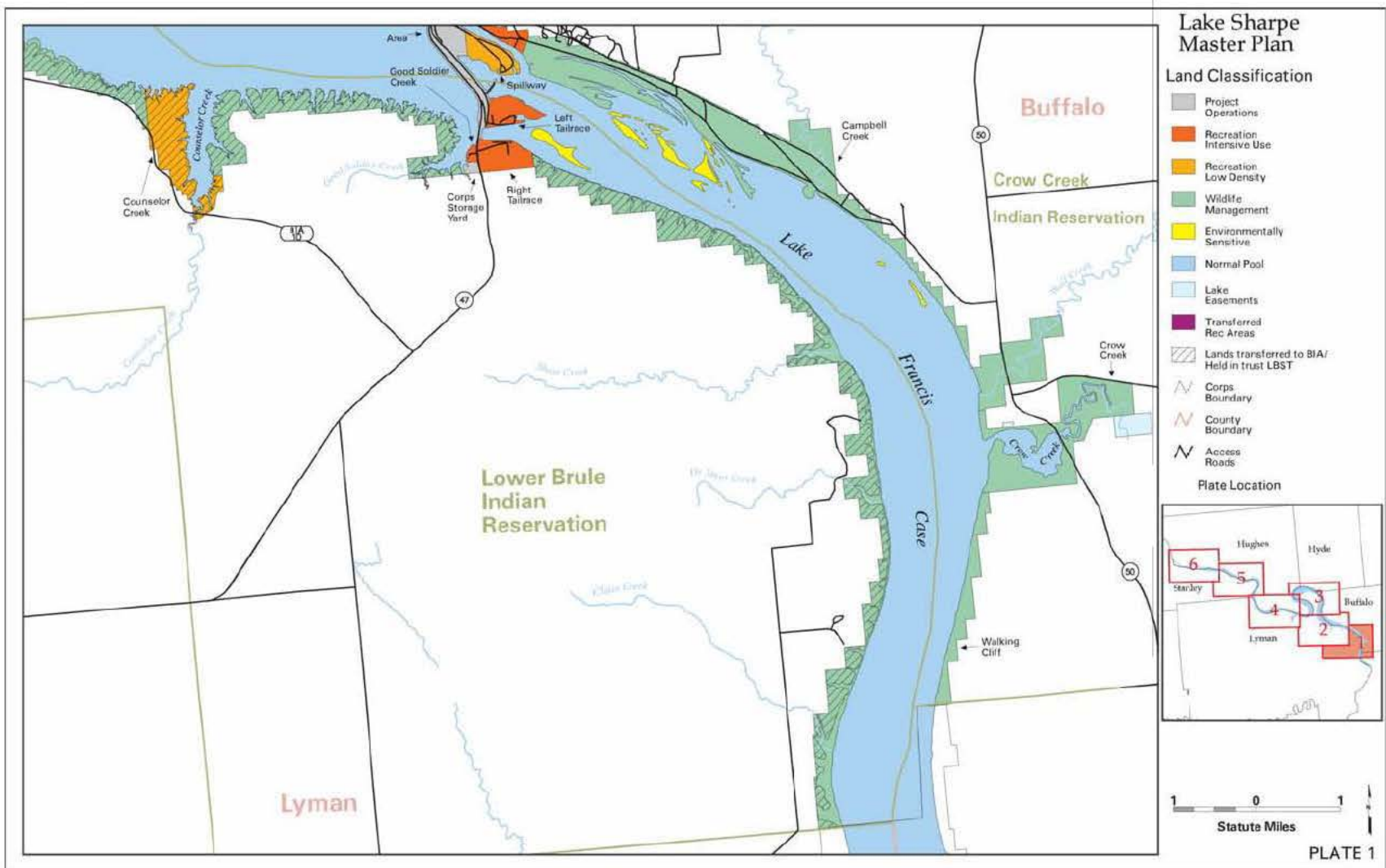
It is recommended that this updated Master Plan guidance be closely followed in managing the land and water resources at the Big Bend Dam/Lake Sharpe project. The plans and policies within this Master Plan are consistent with authorized project purposes and resource capabilities and accommodate federal, state, and local needs. They represent wise stewardship of resources and will result in increased opportunities for enjoyment of outdoor-recreation activities as well as providing wildlife habitat; improving visual quality; and protecting unique and important ecological, cultural, and aesthetic resources.

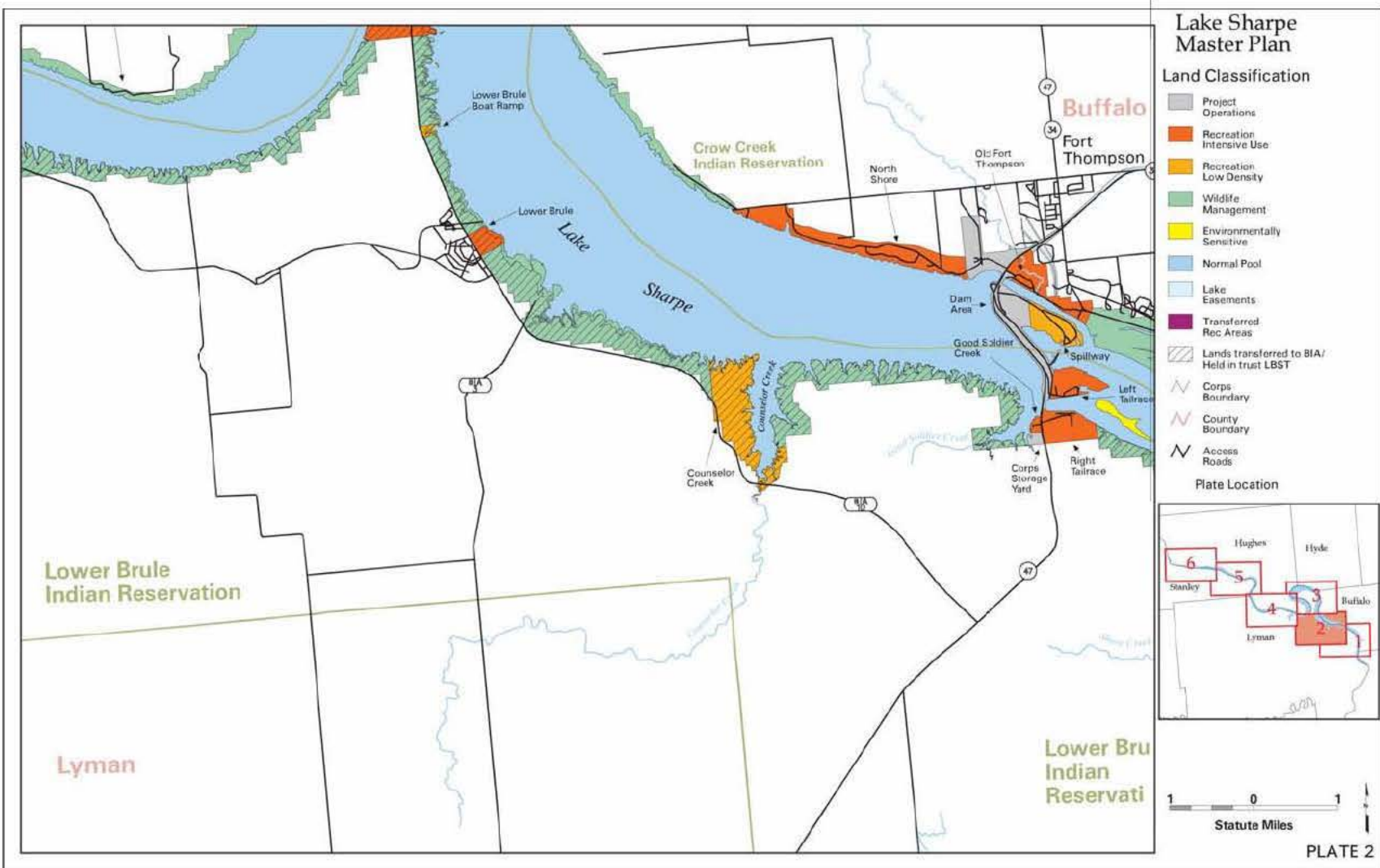
The continued cooperation with state and local interests to preserve and improve the natural and manmade resources at the Big Bend Dam/Lake Sharpe project will provide improved outdoor-recreation opportunities in South Dakota for future generations of both residents and nonresidents.

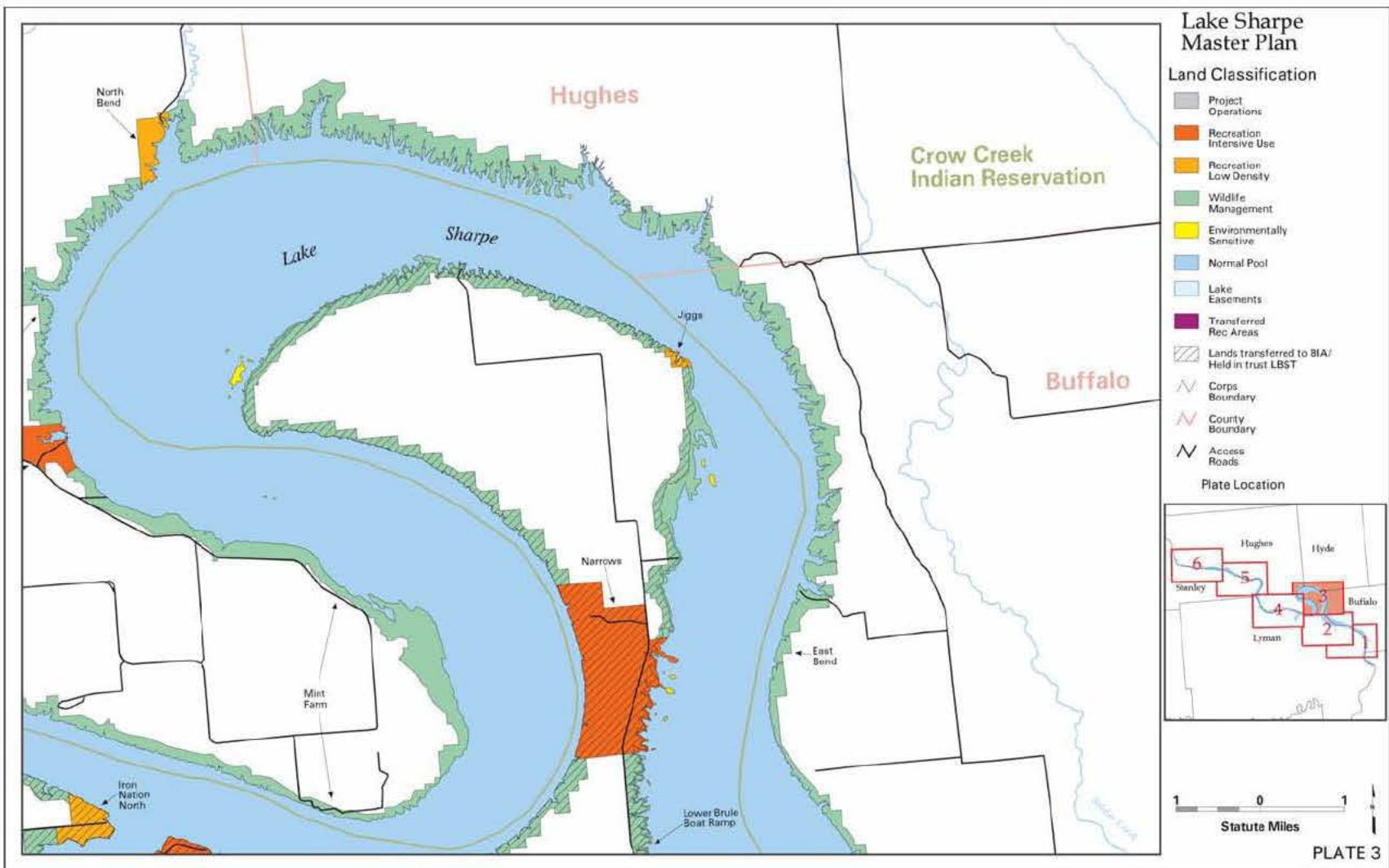
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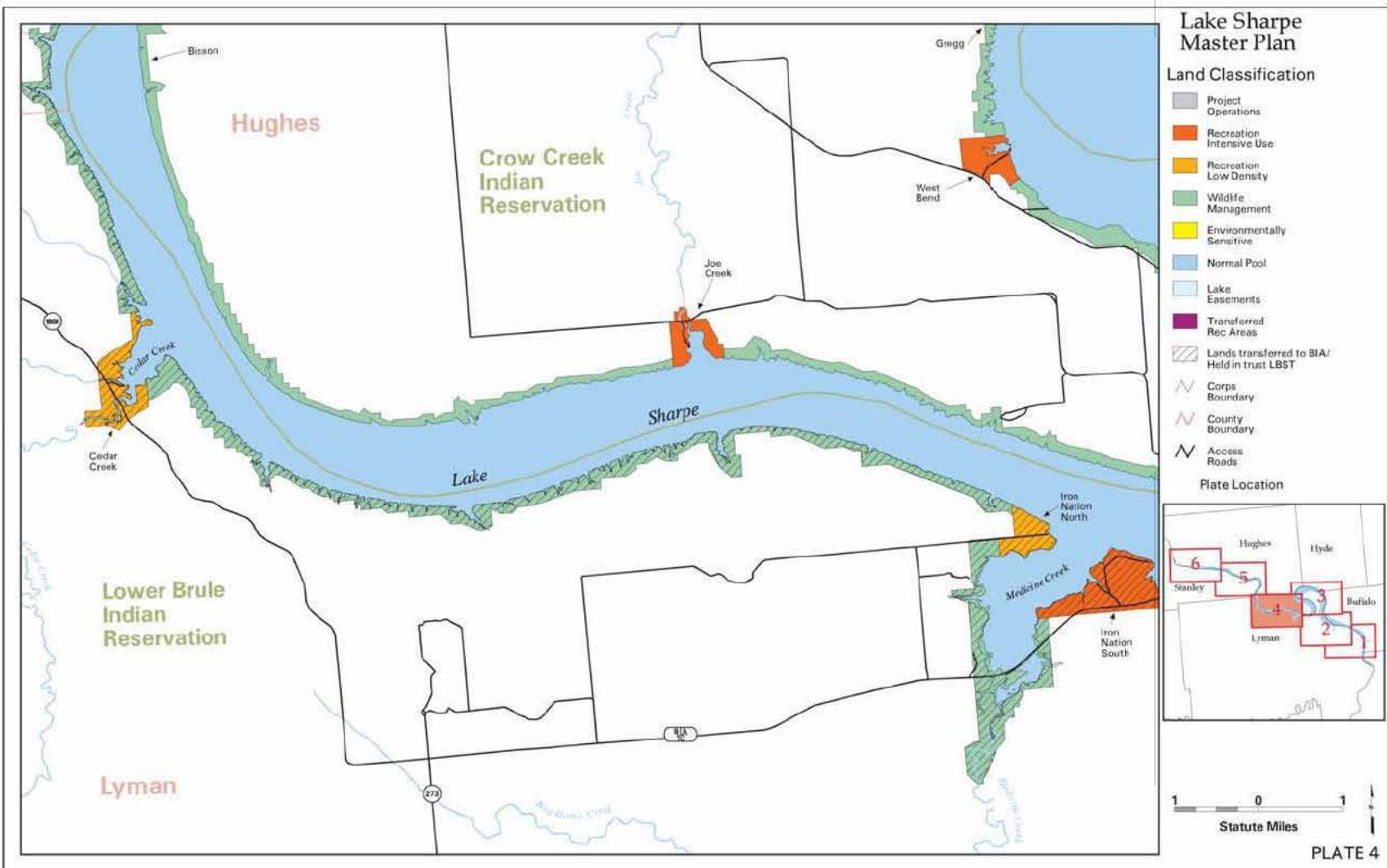
APPENDIX A: LAND CLASSIFICATION PLATES

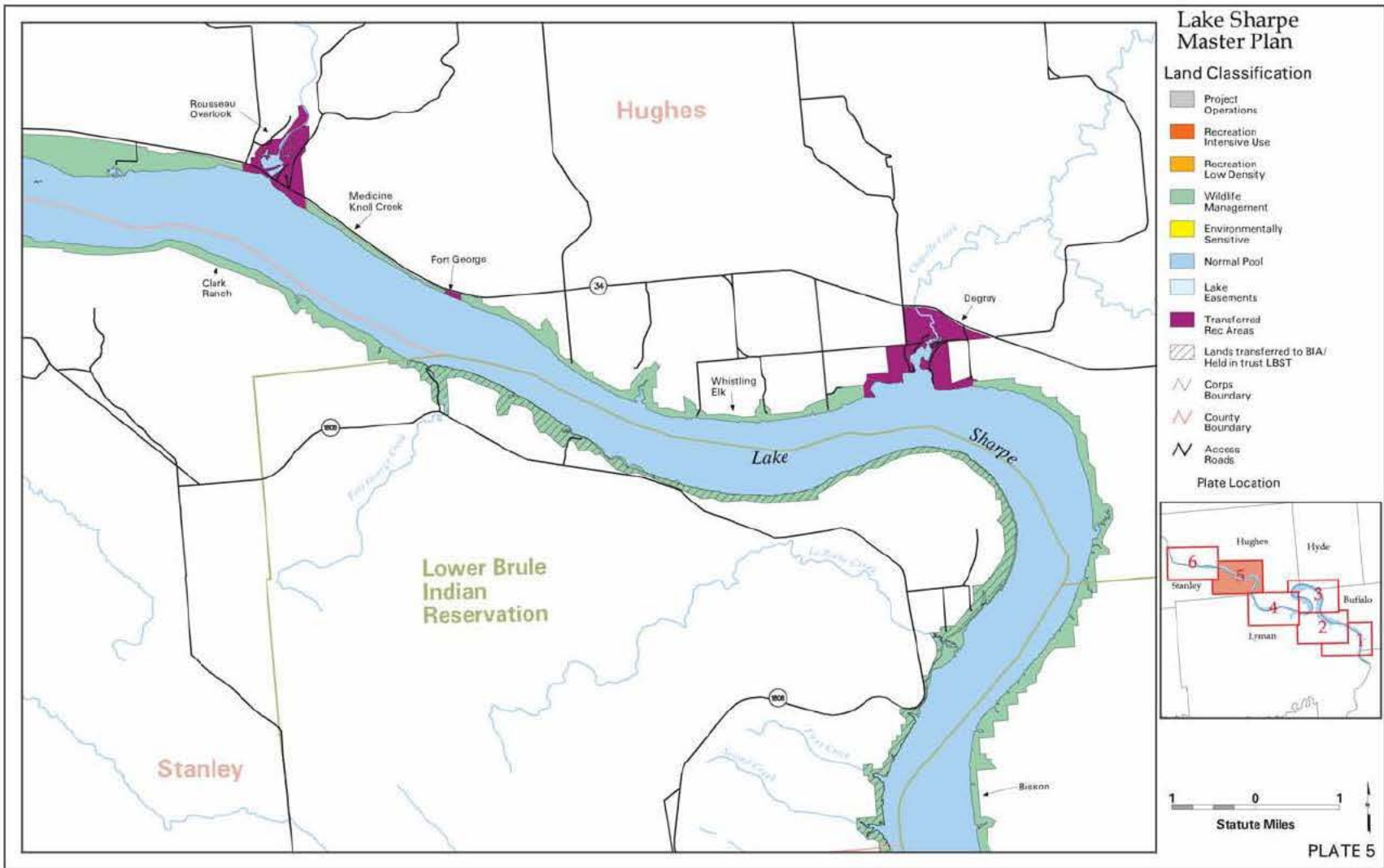
BIG BEND PROJECT

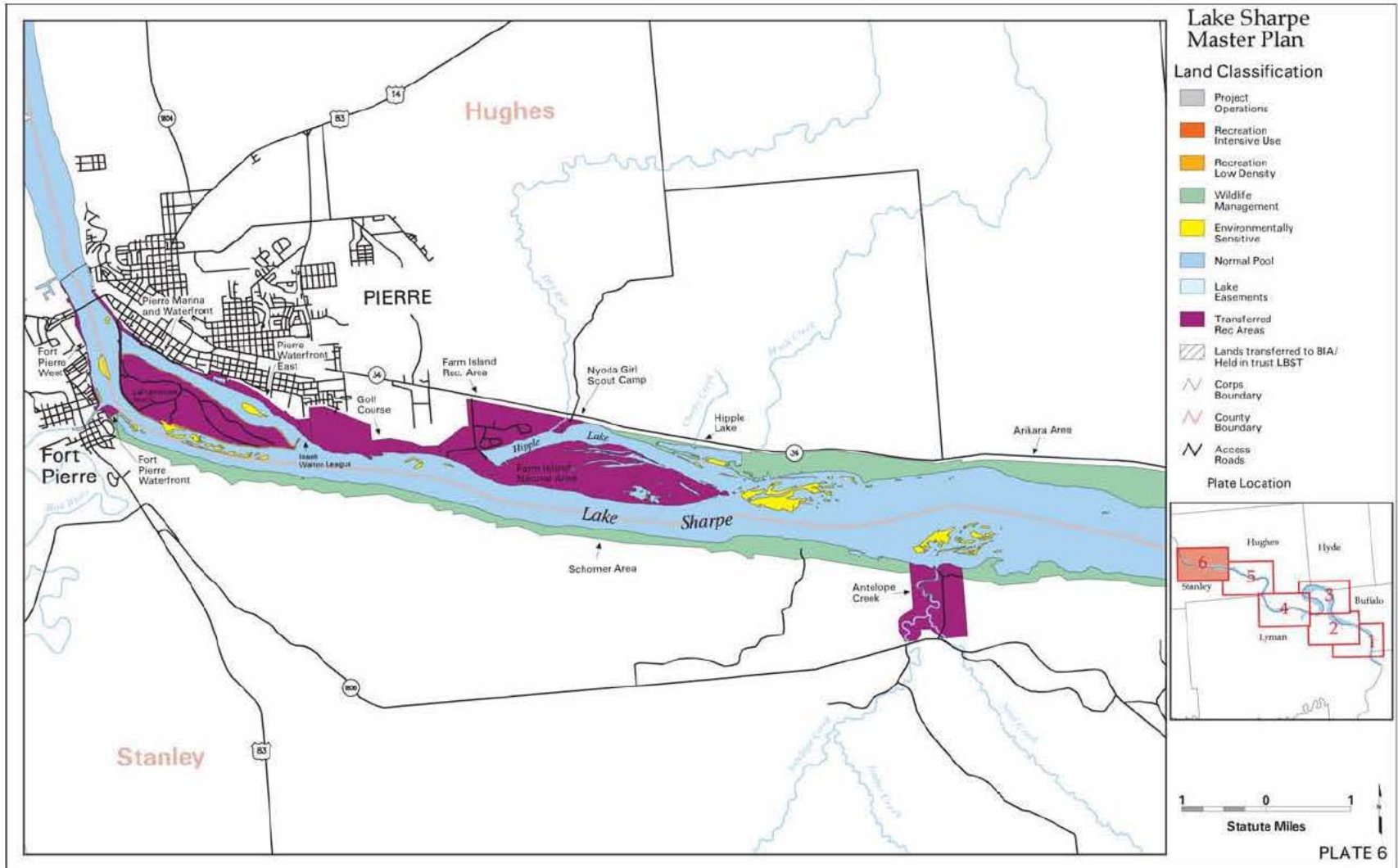












APPENDIX B: ENVIRONMENTAL ASSESSMENT

BIG BEND PROJECT

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**FINDING OF NO SIGNIFICANT IMPACT
MISSOURI RIVER, SOUTH DAKOTA
BIG BEND DAM/LAKE SHARPE MASTER PLAN UPDATE
BUFFALO, HUGHES, HYDE, LYMAN, AND STANLEY COUNTIES, SOUTH DAKOTA**

November 2004

In accordance with the National Environmental Policy Act and implementing regulations, a programmatic Environmental Assessment (EA), incorporated by reference herein, has been prepared for the 2004 update of the 1995 Big Bend Dam/Lake Sharpe Master Plan. The Master Plan update and EA became necessary when Public Law (P.L.) 105-53, Water Resources Development Act of 1999, amended by P.L. 106-541, Water Resources Development Act of 2000 (Title VI) transferred ownership of certain lands to the State of South Dakota and two Indian tribes. The updated Master Plan will provide guidance for stewardship of natural resources and management for long-term public access to, and use of, the natural resources of Lake Sharpe. The Master Plan update provides a comprehensive description of the project; a discussion of factors influencing resource management and development; an identification and discussion of special problems; a synopsis of public involvement and input to the planning process; and descriptions of past, present, and proposed development. The Master Plan update only concerns areas still under the ownership of the Corps of Engineers and only reflects changes in land classification and jurisdiction that occurred as a result of Title VI. It does not address or relate to any other Corps management policies that govern Lake Sharpe levels or flows from the dam.

Under the No Action alternative, the 1995 Master Plan would not be updated. The No Action alternative was eliminated from further consideration because the 1995 Master Plan is out of date due to significant changes in land ownership, management, and land use classification of many areas of the project; changes in pertinent laws and policies; and changes in development proposed to meet the needs of visitors, fish, and wildlife. If the 1995 Master Plan was not updated, future development proposals or resource management policies would require approval on a case-by-case basis without the benefit of evaluation in the context of an overall plan that is consistent with current needs and statutory authorities.

The EA and comments received from other agencies have been used to determine whether the proposed action requires the preparation of an Environmental Impact Statement (EIS). All environmental, social, and economic factors that are relevant to the proposal were considered in this assessment. These include, but are not necessarily limited to, prime farmland, water quality, air quality, noise, wetlands, fish and wildlife, threatened and endangered species, and cultural resources. The primary benefit of the proposed project would be the update of the 1995 Master Plan to reflect important changes in project land use, land management, and land ownership as a result of the Title VI Land Transfer. No adverse impacts to threatened or endangered species or cultural resources are expected to occur as a result of development and management activities proposed under the updated Master Plan. The proposed actions would be in compliance with applicable environmental statutes.

It is my finding, based on the environmental assessment, that the proposed Federal activity will not have any significant adverse impacts on the environment and will not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

Date: 4 Dec 04


Jeffrey A. Redey
Colonel, Corps of Engineers
District Engineer



US Army Corps of Engineers
Omaha District

**FINAL
ENVIRONMENTAL ASSESSMENT
WITH
FINDING OF NO SIGNIFICANT IMPACT**

**UPDATE OF DESIGN MEMORANDUM MB-90
BIG BEND DAM/LAKE SHARPE MASTER PLAN
Missouri River, South Dakota**

NOVEMBER 2004

**Prepared By:
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1 THE PROPOSED PROJECT

1.1 Location

At maximum normal operating pool level, which is 1422 feet mean sea level (m.s.l.), Lake Sharpe covers approximately 60,000 acres and has over 200 miles of shoreline. Lake Sharpe extends roughly 80 river miles (river mile 985 to river mile 1066) from Big Bend Dam, 1 mile southwest of Fort Thompson, South Dakota, to 11 miles downstream from Pierre and Fort Pierre, South Dakota. Big Bend Dam is 60 road miles from Pierre and 25 road miles from Chamberlain, South Dakota. Additional U.S. Army Corps of Engineers (Corps) fee-owned lands surround the reservoir and contain such facilities as the dam embankment, powerhouse, maintenance facilities, recreation facilities, and wildlife habitat. The Big Bend project covers parts of five South Dakota counties – Buffalo, Hughes, Hyde, Lyman, and Stanley counties.

1.2 Purpose and Need for the Master Plan

The Big Bend Dam/Lake Sharpe project was authorized under the Flood Control Act approved December 22, 1944 as amended, Public Law 78-534. The reservoir behind Big Bend Dam was officially named Lake Sharpe, for former South Dakota Governor Merrill Q. Sharpe. The first Master Plan for Lake Sharpe, DM MB-16B, was approved in June 1964 for the purpose of providing flood control, irrigation, municipal and industrial water supply, navigation, hydropower, recreation, fish and wildlife, and other purposes. The 1964 Master Plan is of limited use in guiding project development and resource use because of the many changes in recreational demand and use patterns. As a result, several supplements have been made to the 1964 document. Appendices to the 1964 Master Plan were submitted in 1977 and were approved in 1977 and 1978. In July 1993, the Corps submitted an updated Master Plan (Design Memorandum MB-90). After additional coordination with, and participation by, local and regional governments and interested parties, the updated Master Plan was re-submitted in March 1995. In 2002, another change in land allocation and jurisdiction occurred (Title VI Land Transfer), resulting in the initiation of another updated master plan. Prior to the land transfers, the Big Bend project contained 18,220 acres of land above the exclusive flood control pool (1423 feet m.s.l.). Of these, 4,709 acres of land were transferred to the State of South Dakota January 26, 2002, and 7,546 acres were transferred to the Bureau of Indian Affairs (BIA) in trust for the Lower Brule Sioux Tribe (LBST) June 25, 2002. Of the 5,965 acres of land above the exclusive flood control pool remaining under Corps ownership, approximately 4,700 acres would be transferred to the State of South Dakota within one year of full capitalization of the South Dakota Terrestrial Wildlife Habitat Restoration Trust Fund, in 2008 or 2009 (USACE 2001a). The changes made as a result of the Title VI Land Transfer were described in an environmental impact statement (EIS), which concluded that no significant cumulative impacts would be expected as a result of

the land transfers (USACE 2001a). In addition, an environmental assessment (EA) for the lease of 22 recreation areas within the project area to South Dakota was also prepared in 2000 and resulted in a finding of no significant impact (USACE 2000). An EA for the 1995 Master Plan was prepared in March 1993, and a Finding Of No Significant Impact was signed April 8, 1993. This EA is intended to address the changes that will be made to land allocation and management as a result of the update of the 1995 Master Plan, but does not address the Title VI Land Transfers already assessed in the EIS or the land leases assessed in the EA.

The update of the 1995 Master Plan will provide guidance for stewardship of natural resources, and management for long-term public access to, and use of, the natural resources of Lake Sharpe. The Master Plan update provides a comprehensive description of the project, a discussion of factors influencing resource management and development, an identification and discussion of special problems, a synopsis of public involvement and input to the planning process, and descriptions of past, present, and proposed development.

Since the adoption of the 1995 Master Plan, there have been many changes in ownership and management responsibilities, many Corps policies have been revised, visitation and resource conditions have changed, and several laws and regulations that apply to the area have been passed. These changes have been incorporated into the Master Plan update. Several issues of joint concern to the LBST and Crow Creek Sioux Tribe (CCST) have also been addressed.

2 ALTERNATIVES

2.1 Alternative 1: No Action

Under this alternative, an updated plan would not be approved for the project in the foreseeable future and the previous 1995 Master Plan would continue to provide the only source of comprehensive management guidance and philosophy. Information provided in the aforementioned document is out of date because of significant changes in land ownership and management responsibilities, project use conditions, pertinent laws and policies, visitor use and public demand, among others.

Under the 1995 Master Plan, development and management of the project area will likely take the same general direction outlined in the proposed updated Master Plan. However, future major developments or resource management policies would require approval on a case-by-case basis without the benefit of evaluation in the context of an overall plan.

For this environmental assessment, the “No Action” alternative is assumed to not achieve the potential of effective resource management of the Lake Sharpe project as proposed.

The result of the “No Action” alternative is discussed in Section 4, Consequences of the No Action Alternative.

2.2 Alternative 2: Proposed Updated Master Plan

2.2.1 Scope of the Updated Master Plan

This alternative would result from the approval of the proposed updated Master Plan. Management of the project would be accomplished in accordance with the resource objectives outlined in the updated Master Plan. The updated Master Plan establishes appropriate resource objectives for the project, prescribes land allocations and classifications, identifies development and management needs, provides management guidelines, and establishes the locations and suitable levels of recreation development. The updated Master Plan also provides a framework for the Operational Management Plan and provides a basis for reviewing out grant and recreation development proposals. The updated Master Plan is expected to be in effect for approximately twenty years. Supplements will be prepared as appropriate and justified.

Water management policies and procedures for the Missouri River are established by the Corps’ Northwestern Division and are currently under review. Fishery management and game hunting are predominantly under the authority of the South Dakota Department of Game, Fish and Parks (SDGFP) and the Tribes. The U.S. Fish and Wildlife Service (USFWS) manages migratory bird species. Therefore, water management, fishery management, migratory bird management and hunting, and game hunting are not addressed in the updated Master Plan. The updated Master Plan focuses primarily on recreation management and the management and stewardship of natural and historic resources.

2.2.2 Objectives of the Proposed Action

Certain objectives, known as “Project-Wide Resource Objectives,” have been pursued in the development of this document. These Resource Objectives include the following:

- To develop and manage lands and waters in full cooperation and coordination with other public management agencies and appropriate private sectors
- To develop and manage project lands and waters to support types and levels of recreation activities indicated by visitor demand and to be consistent with carrying capacities and esthetic, cultural, and ecological values
- To provide public education about the history of the area, Big Bend project resources, and the Corps' role in developing and managing these resources

- To develop and manage the project lands and waters to support a diversity of fish and wildlife
- To preserve and protect threatened and endangered species and unique and important ecological and esthetic resources
- To maintain and manage project lands and waters to support regional management programs
- To protect and interpret significant cultural resource sites
- To maintain a reservoir water supply of high quality for irrigation, water supply, recreation, fish, and wildlife use
- To manage resources in response to sedimentation trends

2.2.3 Land Allocation, Land Classifications, and Resource Objectives

All Big Bend project lands have an allocation of Operations because they were acquired to provide safe, efficient operation of the project for its authorized purposes. These project purposes include flood control, hydropower, navigation, irrigation, municipal and industrial water supply, fish and wildlife, and recreation. Separate lands were not acquired for purposes of recreation, fish and wildlife, or mitigation. Within the Operations allocation, land is divided into land classifications. All lands acquired for project purposes are classified in a manner that provides for development and resource management consistent with authorized project purposes and other Federal laws. The classification process refines this land allocation to fully utilize project lands and also considers public desires, legislative authority, regional and project-specific resource requirements, and suitability.

Land classifications and their extent at the Big Bend project when the 1995 Master Plan was prepared were: Project Operations, 404 acres; Recreation, 2,435 acres; Mitigation, 14,235 acres; Environmentally Sensitive Areas, 1,406 acres; Multiple Resource Management: Recreation-Low Density, 2,170 acres; Multiple Resource Management: Wildlife Management General, 1,412 acres; and Easement Lands, 373 acres. Corps-owned lands therefore totaled 22,062 acres, of which 18,220 acres were above the exclusive flood control pool and 3,842 acres were below the top of the exclusive flood control pool.

The updated Master Plan provides guidance on public use, water quality, natural areas, and historic properties within Corps' boundaries. It affirms land classifications and management practices similar to those already in effect and describes new allocations and the resource objectives of those allocations. These are further described in the paragraphs

below. A complete list of existing land use areas and associated resource objectives are included in the Master Plan update.

Project Operations Lands. Project Operations lands would consist of about 404 acres acquired to provide safe, efficient operation of the project for its authorized purposes. This classification includes lands required for the dam embankment, powerhouse, administration building, maintenance and storage yards, sewage lagoons, and other areas that are used solely for project operations.

Recreation Lands. These lands are designated for intensive or low density levels of recreational use to accommodate and support the recreational needs and desires of project visitors. Recreation lands would comprise approximately 1,056 acres of land. Resource objectives for management of these areas include, but are not limited to, providing for day and overnight use, opportunities for several activities in the same general vicinity, boat access, and use by handicapped and elderly persons.

Mitigation Lands. This classification includes those lands specifically designated to offset habitat losses associated with the development of the Big Bend project. Because the Title VI Land Transfer constituted the Corps' mitigation responsibilities, no areas are classified as Mitigation lands in the updated Master Plan. Areas remaining under Corps ownership that had land classifications of Mitigation in the 1995 Master Plan have land classifications of Multiple Resource Management: Wildlife Management General in the updated Master Plan. However, these areas have the same resource objectives and development needs in the updated Master Plan as they had in the 1995 Master Plan. These resource objectives include: upgrade the quality of habitat for upland, big game species, waterfowl, and/or wetland species; maintain and protect cultural resource sites; and stabilize the shoreline (by planting cattails, bulrushes, and/or marsh grasses). Management activities at the former Mitigation areas owned by the Corps largely consist of vegetative plantings and would be the same under either Master Plan, and no developments for recreation access are proposed.

Environmentally Sensitive Areas. This classification consists of areas where scientific, ecological, cultural, or esthetic features have been identified. Development of public use on lands within this classification is normally limited or prohibited to ensure that the sensitive areas are not adversely impacted. Agricultural or grazing uses are not permitted on lands with this classification. Approximately 245 acres of Big Bend project land would be classified as environmentally sensitive. Resource objectives for management include protecting and preserving any scientific, ecological, cultural, or aesthetic resource sites and protecting the environment for waterfowl and wildlife habitat.

Multiple Resource Management Lands. These lands are managed for one or more of the activities described here. Resource objectives for these lands include providing trails for interpretive hiking, accommodating and supporting non-consumptive resources such as hiking and photography, employing good stewardship practices by increasing the use of soil

conservation measures, ensuring successful natural propagation of diverse fish and wildlife species, and providing sites for future development that are adjacent to existing recreation area and within the project boundary that meet anticipated outdoor recreation demands. Consumptive uses of wildlife, including hunting, fishing, and trapping, are allowed when compatible with the wildlife objectives for a given area and with Federal and State fish and wildlife management regulations. These areas may be designated for one or more of the following uses:

- **Recreation-Low Density.** These lands would comprise approximately 276 acres and are designated for low-impact recreation use. Development of facilities on these lands is limited. Emphasis is on providing opportunities for non-motorized activities such as walking, fishing, hunting, or nature study.
- **Wildlife Management General.** These lands would comprise approximately 7,826 acres and are designated for wildlife management, although all project lands are managed for fish and wildlife habitat in conjunction with other land uses. These lands contain valuable wildlife habitat components that are maintained to yield habitat suitable for a designated wildlife species or group of species.
- **Vegetative Management.** Management activities in these areas focus on the protection and development of forest resources and vegetative cover. Neither the updated Master Plan nor the 1995 Master Plan classifies any lands for vegetative management. However, all project lands are managed to protect and develop vegetative cover in conjunction with other land uses.
- **Inactive and/or Future Recreation Areas.** This sub classification consists of lands for which recreation areas are planned for the future or that contain existing recreation areas that have been temporarily closed. Neither the updated Master Plan nor the 1995 Master Plan classifies any lands as inactive or future recreation areas.

Easement Lands. This classification consists of 173.69 acres of lands for which the Corps did not acquire fee title but did acquire (1) the right to enter onto the property in connection with the operation of the Big Bend project and (2) the right to occasionally flood the property. Planned use and management of easement lands will be in strict accordance with the terms and conditions of the easement estate acquired for the project.

Of the 22,062 acres in the 1995 Master Plan, 7,546 acres were transferred to the BIA/LBST and 4,709 acres were transferred to the State of South Dakota (USACE 2001a). The 2003 Master Plan includes a total of 9,807 acres above multipurpose pool of 1420 feet m.s.l.

2.2.4 Proposed Development

The updated Master Plan proposes several actions for the combined purposes of improving recreation and protecting and enhancing the natural resources found in the project area. The following is a summary of the general types and purposes of the proposed actions.

Constructing Facilities. Development proposed for the Big Bend project includes roads, camping and picnicking facilities, marina facilities, a designated swim beach, hiking trails, interpretive signage, playground equipment, fish cleaning tables, security lighting, toilets, potable water, a dump station, and a Native American Cultural Learning Center. In general, construction is focused into recreation areas or is designed to concentrate human access onto identified roads and pathways to prevent random access. At sites where many measures are proposed, the updated plan recommends that a site plan be prepared prior to expansion of recreation facilities.

Planting Trees and Shrubs. Trees and shrubs would be planted to increase winter cover, woody vegetation, food sources for wildlife, and dense nesting cover for upland game. Vegetation buffers would be created to separate overnight camping from day use areas. Plantings in campgrounds and day use areas will provide shade and shelter for people and wildlife.

Establishing Food Plots. Food plots will be established to supplement native food sources for waterfowl, migrant bird species, big game, and upland game species. Existing food plots range between 3 and 20 acres and typically consist of a monotypic stand of row crops, such as oats, wheat, tall cane, or sunflowers. Food plots are planted on previously farmed lands acquired by the Corps.

Controlling Erosion. Bank stabilization techniques will be implemented along the lake shoreline for erosion control, including constructing breakwaters; installing riprap; anchoring logs, snags, and hay bales; grading bank slopes where possible; and planting cattails, bulrushes, trees, and other shoreline vegetation.

Other Actions. Several other actions are proposed, including improvement of wildlife habitat by prescribed burning, planting native grasses, and controlling grazing and agricultural use; planting marsh grasses for fish habitat and food supply; and other site-specific improvements.

3 AFFECTED ENVIRONMENT

3.1 Hydrology

West of the Missouri River, the drainage pattern is generally well defined. The west-bank tributary streams have comparatively narrow valleys and are entrenched 100 to 150 feet below the surrounding uplands. The slopes of the tributary streams average between 5 and 8 feet per mile and tend to flatten toward the mouth. The Bad River, which enters the Missouri River at Fort Pierre, comprises over 50 percent of the 5,840 square mile Lake Sharpe drainage area. Due to relatively low rainfall in its drainage basin, the Bad River contributes only about 0.5 percent of the 26,000 cfs average daily water inflow into Lake Sharpe. The Bad River transports much sediment from the easily eroded soils in its drainage basin, however, and sedimentation has resulted in a relatively flat reservoir bottom. Other west-bank tributaries include Antelope Creek, Cedar Creek, Counselor Creek, and Medicine Creek.

East of the Missouri River, there are numerous depressions that store runoff, and some areas do not contribute directly to stream flow unless runoff is substantial. Slopes of the east-bank tributaries are substantially flatter than those of the west bank and have a lower quantity of runoff. The major east-bank tributary is Medicine Knoll Creek, and other east-bank tributaries include Chapelle Creek and Joe Creek.

Small quantities of shallow ground water exist in alluvium in river valleys. Shallow aquifers, less than 100 feet deep, are found east of Lake Sharpe along the stream courses. The locations of deep aquifers, up to 300 feet below the surface, are unknown.

Channel aggradations due mainly to sediment carried by the Bad River, and high water releases from Oahe Dam, have resulted in higher river stages at Pierre and Fort Pierre. When this is coupled with thick river ice formation under severe winter conditions, winter flooding can occur along the shoreline in the Pierre and Fort Pierre areas, especially if winds are strong. When winter floods threaten, releases from Oahe Dam are reduced.

3.2 Sedimentation and Shoreline Erosion

Nearly all the sediment entering Lake Oahe is trapped by Oahe Dam. Therefore, most sediment in Lake Sharpe originates from the Bad River, other tributaries, and from the banks surrounding the reservoir. Eroded soil runs off into tributary streams, which carry this sediment to the reservoir. The great reduction in flow velocity at the tributary inlets has resulted in deposition of much sediment, forming deltas at these inlets or embayments. In the upstream reaches of Lake Sharpe, delta formation has resulted in a rising ground water table that is causing marsh areas to form at the embayments of the Bad River and other tributaries. At Lake Sharpe, most of the recreational embayments

are relatively wide but shallow. Sediment is limiting boat access at many areas by deposition on boat ramps and accumulation in the bay, making launching and boat maneuvering more difficult. Littoral drift is also resulting in formation of bars or shoals across and within embayments and sediment deposition on boat ramps sited on Lake Sharpe as well as in embayments.

Shoreline erosion occurs at many locations around the 200-mile shoreline of Lake Sharpe. Because most of the banks are composed primarily of clay, the eroded material is transported into deeper areas of the lake, precluding the formation of a protective beach that breaks wave energy. The constant pool levels allow year-round attack by the forces of wind, wave, and ice at the same bank elevations. Where the shoreline is not protected, erosion continues unabated and sometimes encroaches on private land or results in adverse effects on cultural resources and/or recreational development.

3.3 Surface Water Quality

Lake Sharpe serves as a water supply for the municipalities of Fort Thompson and Lower Brule. The Mni Wiconi Water Project in Lower Brule provides rural water to the local area. In addition, a number of individuals whose homes are situated close to Lake Sharpe have obtained easements to withdraw water for domestic consumption. The City of Pierre provides secondary wastewater treatment, and discharge is made directly into Lake Sharpe. Both Fort Pierre and Lower Brule have sewage stabilization lagoons that discharge into Lake Sharpe when the effluent meets State standards.

The Corps monitors water quality six times per year at four locations: the outflow of Oahe Dam, which is considered inflow to Lake Sharpe; the outflow of Big Bend Dam; at Big Bend Dam; and upstream of Big Bend Dam (USACE 2001b). The United States Geological Survey (USGS) collects and analyzes samples six times per year on the Missouri River near Pierre, South Dakota. Designated swimming beaches are sampled by their respective management entities for bacterial analysis in accordance with state regulations. Any exceedance of state standards requires beach closing and retesting until the results meet regulatory standards.

Periodic algal blooms occur in Lake Sharpe when sufficient nutrients are coupled with ideal weather conditions. Wind disperses an algal bloom within the lake, but the blooms can continue in protected embayments. Water quality standards have been exceeded in Lake Sharpe by sulfate, arsenic, pH, dissolved oxygen, and iron. These exceedances are thought to be due to natural, rather than man-made, sources. Lake Sharpe was on the State of South Dakota's 303(d) List of Impaired Water Bodies in 1998 due to accumulated sediment but was off the list by 2002.

3.4 Accessibility

Big Bend Dam is located 25 miles north of Chamberlain, through which passes Interstate 90, the only east-west interstate crossing South Dakota. The east side of Lake Sharpe can be reached from Chamberlain and Pierre/Fort Pierre by South Dakota Highways 50 and 34, respectively. The west side of Lake Sharpe can be reached from I-90 by South Dakota Highway 47 and from county and BIA paved and improved roads. Areas at the north end of Lake Sharpe can be reached from Pierre and Fort Pierre by U.S. Highways 14 and 83. Access to project lands other than designated recreation areas can be difficult in some locations.

No commercial water traffic exists on Lake Sharpe, but private recreational boats can navigate from Fort Thompson and the Big Bend Dam area upstream to Pierre and Oahe Dam. Fuel and harbor accommodations are available at Pierre.

3.5 Topography and Soils

Lake Sharpe lies on the boundary between glaciated and unglaciated regions of the Great Plains Physiographic Province. East of the Missouri River, water from melting glaciers formed lakes and carved new river valleys, and drainage systems are not well developed. The ice sheets built up morainal ridges, created plains by leveling off high points and filling in low places, and left behind glacial debris—boulders, gravel, and fine sand. Because the area west of the Missouri River was not glaciated, the topography is rolling and thoroughly dissected by streams.

Twelve different soil associations are found at the Big Bend project. The soils vary in texture, parent materials, and suitability for road construction and recreation facility development. All the soil associations are well drained. Most of the soils are deep, but Sansarc, Opal, and Chantier soils are shallow, clayey soils that formed over shale on uplands, and on steep slopes these soils are highly erodible. Soils with variable characteristics formed on parent material deposited from elsewhere: alluvium, alluvial fans, low terraces, glacial outwash plains, glacial till, and glacial drift. Most soil associations have adequate fertility for native grasses, and the three soil associations that include Lowry silty soils are fertile enough for cultivation of wildlife food plots (USDA 1975, 1980, 1985, 1987, 1998).

3.6 Vegetation

Mixed prairie vegetation dominates the Big Bend project lands. On the clayey soils that comprise most areas around Lake Sharpe, western wheatgrass and green needle grass, both mid-height species, are usually dominant. Overgrazing or other disturbance usually results in their replacement with short grasses, such as blue grama and buffalo grass. Draws or low alluvial terraces have a lot of moisture and so can support warm-season,

tall grass prairie vegetation in which big bluestem, Indian grass, and switch grass predominate.

Bottomland woodlands, considered an extension of the eastern deciduous forest, are found along the banks of the Missouri River from Pierre and Fort Pierre downstream to Lake Sharpe. Cottonwoods dominate, but green ash, box elder, peach leaf willow, eastern red cedar, and Russian olive are also present. The under story includes dogwood and chokecherry. Bottomland woodlands found along most tributaries flowing into Lake Sharpe are shorter, less diverse, and less valuable for wildlife habitat than Missouri River bottomland forests. Cottonwoods are largely absent; bur oak, green ash, and box elder dominate; and a shrubby under story includes wild plum and chokecherry. Woodlands in upland draws and on north-facing and east-facing slopes typically contain either a sparse over story of green ash and a dense under story, or an over story of mostly red cedar with some juniper and an under story of low density due to heavy shading by the cedars. Red cedar is invading areas of grasses and shrubs in the draws and adjacent prairies. Extensive tree plantings were conducted on uplands near the dam or near recreation areas for shade and wind protection, wildlife habitat, and aesthetics.

Shrub lands on silty soils usually contain low shrubby species such as leadplant, snowberry, and wild rose, while the silver or dwarf sagebrush (*Artemisia cana*) community is associated with clay soils on lower slopes and bottomlands. Lack of periodic fire or other disturbances that would spur vigorous growth and reproduction, and over browsing by deer or cattle, would likely result in some deterioration in quality of stands of shrubs in the future. Along gently sloping shorelines of Lake Sharpe, small areas of scrub-shrub wetlands have developed, with Russian olive and sandbar willow predominant.

Aquatic vegetation is most extensive near the Bad River delta, and is also found in delta areas in the embayments of other tributaries. Established woody species include cottonwood, willows, and indigo bush; herbaceous species include cattail, river bulrush, softstem bulrush, American bulrush, giant reed, and reed canary grass. Barren beaches fringe most of Lake Sharpe, but emergent wetland vegetation has become established in areas where it is protected from waves by snags, boulders, and riprap. As barrier beaches formed across embayments, many small ponds developed that are fringed by emergent herbaceous or woody wetland vegetation and usually also contain submerged aquatic plants. Submerged aquatic plants are also found in embayments, in depths up to 7 feet. Species include water milfoil, river pondweed, and sago pondweed. Submerged aquatic plants have been increasing due to nutrients from agricultural runoff entering embayments and increased penetration of sunlight due to reduced turbidity during recent drought conditions. An epiphytic algal community is also present in shallow, clear water and may be attached to aquatic plants, rocks, or logs.

3.7 Fish

Lake Sharpe has a cool- to warm-water fishery. The walleye fishery is among the best in the United States. Average annual harvest ranged between 100,000 and 200,000 walleyes from 1994 through 2002; with generally high catch rates of fish averaging 1.5 to 3 pounds. Walleye abundance, growth rates, and reproduction are high due to an adequate forage fish base, comprised primarily of gizzard shad, emerald shiner, and yellow perch. The stability of the forage species base, especially gizzard shad, is a concern because of its susceptibility to winterkill. Smallmouth bass and channel catfish are the other major Lake Sharpe sport fish; populations of white bass, white crappie, freshwater drum, goldeye, and carp are also high. Two cold-water fish, rainbow smelt and Chinook salmon, which were introduced into Lake Sakakawea and Lake Oahe respectively, are occasionally found in Lake Sharpe.

The Oahe tail waters is a growing stream fishery for Chinook salmon, sauger, smallmouth bass, and trout. However, buffalo fish, northern pike, shovelnose sturgeon, creek chub, blue suckers, and other fish dependent on riverine habitat or vegetated slack water habitat still have low populations. Since impoundment in the 1960s, intermittent stocking of species such as rainbow trout, brown trout, and smallmouth bass has improved the cold- to-cool-riverine fishery downstream from Oahe Dam. Muddy inflows from the Bad River result in reduced fishing success in the upper end of Lake Sharpe, but these warm-water, nutrient-rich inflows enhance overall productivity in the lake. SDGFP releases bluegills, largemouth bass, white crappie, and tiger muskies into Hipple Lake to improve the warm- and cool-water fishery in slack water areas.

Hipple Lake and the numerous embayments represent important nursery and adult habitat for most of the warm- and cool-water fishes. These areas of high productivity are becoming shallower because of sedimentation, and the marsh wetlands that are developing provide more cover for forage fish and spawning habitat for Northern pike, chubs, perch, and panfish. The sedimentation of embayments does not appear to affect the walleye, which spawns over gravel. Bar formation at mouths of embayments is reducing shore erosion and turbidity in the embayments. The resulting increased light penetration aids sight-feeding predator fish and fosters growth of aquatic plants. In shallow embayments, including the West Bend Recreation Area on Corps owned lands managed by SDGFP, the non-native Eurasian water milfoil (*Myriophyllum spicatum*) is spreading (Lott 2004), but growth has not become dense enough to reduce boating activities.

3.8 Wildlife

3.8.1 Birds

The Central Flyway passes through Lake Sharpe, and waterfowl migrate through the area in spring and in fall and early winter. Increases in crop acreages, especially corn, have coincided with increased numbers of migratory waterfowl, and food plots growing near Lake Sharpe are thought to be a major attractant. Four state-designated waterfowl refuges, where no hunting is allowed, are located within the Crow Creek Reservation.

Large water birds found at Lake Sharpe include the double-crested cormorant, great blue heron, white pelican, and American bittern. Large numbers of sand hill cranes also migrate through the area in spring and fall. Smaller birds that frequent open water, marshes, and shorelines include gulls, herons, rails, bitterns, sandpipers, terns, blackbirds, marsh wrens, and common yellowthroats. Swallows and belted kingfishers live in banks along the shoreline. At least 85 species of passerine birds have been found at Farm Island (Backlund 2004).

Birds of prey include the bald eagle, golden eagle, turkey vulture, osprey, and numerous nesting species of hawks, falcons, and owls. Many songbirds use the Big Bend project's grasslands and woodlands (especially woody draws and shelterbelts) as nesting habitat, a food source, or winter cover. Upland game birds include the ring-necked pheasant, prairie chicken, sharp-tailed grouse, mourning dove, and Hungarian partridge. Wild turkeys have benefited from tree plantings in draws as well as from food plots. Birds nesting in native prairie grasslands at the Big Bend project include the upland sandpiper, western meadowlark, lark bunting, horned lark, chestnut-collared longspur, burrowing owl, bobolink, grasshopper sparrow, lark sparrow, Savannah sparrow, and field sparrow.

3.8.2 Mammals

Populations of white-tailed deer and mule deer have increased since impoundment. Large islands, weedy croplands, marshlands, shelterbelts, and tributary bottomland woodlands preferred by white-tailed deer have increased. Mule deer have increased due not only to increases in irrigated croplands and woodlands in draws, in which they browse, but also to the more restricted harvesting on Tribal reservations. Pronghorn populations on both the east and west sides of the Big Bend project have always been low due to the lack of shrub-grassland habitat. Elk and bison became rare in the area in the 1880's, but the LBST and CCST reintroduced them into game ranges in the Lake Sharpe area.

Small game populations include the white-tailed jackrabbit, which inhabits croplands and grasslands, and the eastern cottontail and fox squirrel, which live in brushy and wooded areas. Other furbearers include the coyote, bobcat, red fox, badger, spotted and striped

skunks, raccoon, beaver, mink, weasel, and muskrat. A few porcupines are found in tributary bottom woodlands. Few prairie dogs live on project lands but are more common on adjacent rangelands, where towns range from a few holes (0.5 acre) to several hundred holes (over 320 acres). Other common rodents include the Richardson ground squirrel, thirteen-lined ground squirrel, pocket gopher, prairie vole, prairie deer mouse, and western harvest mouse.

3.8.3 Reptiles and Amphibians

The dominant amphibians are the tiger salamander, northern leopard frog, chorus frog, plains spadefoot toad, woodhouse toad, and Great Plains toad. Common reptiles include the snapping turtle, western painted turtle, bull snake, prairie rattlesnake, red-sided garter snake, and plains garter snake. Less common are the Midland soft-shell turtle (*Apalone mutica mutica*), false map turtle (*Graptemys pseudogeographica*, a State-considered threatened species), western hog-nosed snake, and eastern yellow-bellied racer.

3.9 Rare and Endangered Species and Communities

Five federally listed endangered or threatened species may reside and/or nest in the project area (USFWS 2003, 2004). These five species are found in table 1 and are discussed below. The federally listed endangered black-footed ferret is also discussed because although it was extirpated from the Big Bend project area, its reintroduction is being evaluated. The federally listed endangered Topeka shiner (*Notropis topeka*), Eskimo curlew (*Numenius borealis*), whooping crane (*Grus americana*), and scaleshell mussel (*Leptodea leptodon*); the federally listed threatened western prairie fringed orchid (*Platanthera praeclara*); and the Dakota skipper (*Hesperia dacotae*), a candidate for listing, are not expected to occur in the project area.

Table 1. Federally listed species that may occur in the Big Bend/Lake Sharpe area.

Common Name	Scientific Name	Expected Occurrence	ESA Listing
Bald eagle	<i>Haliaeetus leucocephalus</i>	Migrant, winter resident, nesting	Threatened
Interior least tern	<i>Sterna antillarum</i>	Migrant, nesting	Endangered
Piping plover	<i>Charadrius melodus</i>	Migrant, designated critical habitat, nesting	Threatened
Pallid sturgeon	<i>Scaphirhynchus albus</i>	Missouri River, upper end of Lake Sharpe	Endangered
American burying beetle	<i>Nicrophorus americanus</i>	Tall grass prairie and wet meadows	Endangered
Black-footed ferret	<i>Mustela nigripes</i>	Prairie grasslands	Endangered

3.9.1 Bald Eagle, *Haliaeetus leucocephalus* (Federally Listed Threatened)

The bald eagle was listed as an endangered species February 14, 1978 following a dramatic drop in population that began at the turn of the century (43 FR 6233). Its status was reclassified to threatened July 12, 1995 (60 FR 36000), effective August 11, 1995. It was petitioned for delisting on July 6, 1999 (64 FR 36454). Bald eagles are found throughout the continental United States and Canada. In the Midwest, breeding primarily occurs in Minnesota, Wisconsin, and Michigan (USFWS 2000), but nesting along the Missouri River is increasing as eagle populations expand. Bald eagles prefer to nest in trees near water, well separated from disturbed areas, and sturdy enough to support a nest that averages 5 feet wide and 3 feet deep (USFWS 2000). Eagle diets consists mainly of fish, but may include waterfowl, carrion, or small prairie mammals.

Bald eagles have nested in Lyman and Hughes counties and are also known to occur in Buffalo, Hyde, and Stanley counties (USFWS 2004). In 2002 and 2003, a pair of eagles nested in cottonwoods on the east bank of the Missouri River about 5 miles downstream from Big Bend Dam, but no chicks fledged. A pair of bald eagles nested in the dead cottonwood trees at the DeGrey Recreation Area in 2004 (Backlund 2004). In the Main Stem Missouri River region, bottomland cottonwood habitats favored by bald eagles have been reduced in the project area by reservoir inundation (USFWS 2000). Eagles migrating through the Big Bend project area use the remaining cottonwood forest habitats that are also near good foraging areas, in particular near the tailraces of the Oahe and Big Bend dams, which are not ice-covered in the winter and attract fish and waterfowl. In 1995, up to 200 eagles spent the late fall and winter communally roosting in mature cottonwoods along the Missouri River (USACE 1995), mainly in the Oahe Downstream area. Eagles also roost at DeGrey when geese are abundant, and some day roosting occurs on Farm Island and LaFramboise Island (Backlund 2004). Up to 12 eagles roost in isolated cottonwoods close to the water, just upstream and downstream from Big Bend Dam, where the nearest roads receive only light traffic during late fall and winter.

3.9.2 Interior Least Tern, *Sterna antillarum* (Federally Listed Endangered)

The interior least tern was listed as endangered May 28, 1985 (50 FR 21792), effective June 27, 1985. It is a migratory bird with an historic breeding range extending from eastern Colorado to southern Indiana and from Texas to Montana. The least tern still breeds in most of its historical breeding range, but populations are fragmented and generally found in less-altered river segments (USFWS 1990). Precise locations of wintering areas remain unknown. Least terns arrive at breeding areas from late April to early June and spend 4 to 5 months there. They nest as lone pairs or in colonies that can contain over 100 pairs on open areas of sand or gravel beaches within a river channel or reservoir shoreline (USFWS 2000). Nests are usually located in well-drained areas at a distance from the water line, with sparse or no vegetative cover (Schulenberg and Placek 1984). Foraging habitats include side channels, sloughs, tributaries, and shallow-water habitats adjacent to islands and the main channel. Nesting and foraging habitat has

declined due to irrigation diversion and river damming and channelization (USFWS 2000). Least terns typically feed on small fish in shallow areas of streams and lakes less than 400 yards from the nest site (USFWS 1990). The nests are constructed of small stones, twigs, and debris in shallow depressions in an open sandy area, gravel patch, or other exposed substrate. Both sexes participate in incubation of two to three eggs, usually lasting 20 to 25 days. Chicks fledge after 20 days and begin foraging for themselves at 35 days, but do not learn to fish until after migrating from breeding grounds in the fall. Life spans are reported to range from 5 to 15 years (USFWS 2000).

Interior least terns have nested in Hughes and Stanley counties (USFWS 2004) at Lake Oahe. They have also nested on the islands in the Missouri River downstream from Oahe Dam, but not on a regular basis (USACE 1995). Missouri River bed aggradation due to high sediment inflow from the Bad River has resulted in higher stages and a higher water table for given discharges from Oahe Dam, and the islands have consequently become vegetated by cattails, decreasing their suitability as nesting areas. The interior least tern is not known to occur in Hyde, Buffalo, and Lyman counties (USFWS 2004).

3.9.3 Piping Plover, *Charadrius melodus* (Federally Listed Threatened)

The piping plover was listed as threatened December 11, 1985 (50 FR 50726), effective 30 days later, in January 1986. The northern Great Plains breeding population of the piping plover historically bred in the northern Great Plains/Prairie region from Alberta to Ontario and south to Nebraska (USFWS 1988). During the winter, piping plovers have been observed in the U.S. along the Gulf of Mexico and in eastern Mexico (Haig and Oring 1985). Piping plover habitat remains distributed across much of the species' historic range, although in a much reduced and fragmented condition (USFWS 2000). In the Great Plains, piping plovers nest on alkali wetlands, gravel shorelines, and river sandbars. Feeding plovers utilize open, wet, sandy areas, feeding primarily on exposed substrates by pecking for invertebrates at or just below the surface (Cairns 1977).

Nesting of piping plovers has been documented on the Missouri River main stem from Valley County, Montana, to Dixon County, Nebraska. In the Missouri River main stem reservoirs, plovers nest along the reservoir shorelines if suitable habitats are available. The USFWS has designated critical habitat for the northern Great Plains breeding population on Oahe project lands in Hughes and Stanley counties (67 FR 57637), where the piping plover is known to occur, but no critical habitat has been designated on Lake Sharpe. Possible habitat may occur in Buffalo and Lyman counties (USFWS 2004), in the Fort Randall project area. Use of the Big Bend project area by the piping plover has not been regular. Because the Lake Sharpe pool elevation has been stable, even during high Missouri River main stem flows in 1997, grasses and shrubs may grow to the edge of the lake; there are few unvegetated beach areas, and any shoreline areas of sand are narrow.

3.9.4 Pallid Sturgeon, *Scaphirhynchus albus* (Federally Listed Endangered)

The pallid sturgeon was listed as endangered on September 6, 1990 (55 FR 36641), effective October 9, 1990. Pallid sturgeon are found in the Missouri River and in the Mississippi River downstream of the Missouri River confluence (Gilbraith et al. 1988). Pallid sturgeon are adapted to the big river environment with dynamic flows, high velocities, and high turbidity. Adults are frequently found in deep pools or slow velocity areas with sandy substrate in or adjoining floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channels (USFWS 2000). Pallid sturgeon spawn in late April or early May in the lower Missouri River and in late May and early June in the upper Missouri River. Spawning is suspected to occur in swift water in the main channel when water temperatures are 56 to 66°F (Keenlyne and Jenkins 1993). Adhesive eggs are released into the water column in deep channels over firm substrate. Males reach sexual maturity at approximately 22 inches in length and females mature at age 7 to age 20 years, depending on environmental conditions. Fecundities greater than 100,000 eggs have been observed but vary with fish size and environmental conditions. Pallid sturgeon are long-lived, reaching ages over 50 years. Fish are the preferred food of adult pallid sturgeon, although aquatic insect larvae are also consumed in earlier life stages (USFWS 2000).

Pallid sturgeon populations or individuals are found in only a few selected areas within the Missouri River. Based on research data, 50 to 100 pallid sturgeon were estimated between Oahe Dam and Big Bend Dam (Eco-Tech, Inc. 2001). In this reach, 20 pallid sturgeon were captured from 1990 through 1993, most for purposes connected with the Pallid Sturgeon Recovery Plan, but only two were captured since then, in 1994 and 1995, and none since then (Krentz 2004). Most of these pallid sturgeon came from the upper end of Lake Sharpe (USFWS 1997). Telemetry studies conducted on Lake Sharpe pallid sturgeon from 1989 to 1991 indicated that pallid sturgeon over 11 pounds were most often found over mud substrates, while pallid sturgeon less than 11 pounds were most often found over gravel substrates (Erickson 1992). There is no evidence of pallid sturgeon reproduction at the Big Bend project. The Pallid Sturgeon Recovery Plan identified six recovery-priority management areas that still provide suitable habitat, but it does not include any areas within the Oahe or Big Bend projects (USFWS 1993).

3.9.5 American Burying Beetle, *Nicrophorus americanus* (Federally Listed Endangered)

The American burying beetle was listed as endangered July 13, 1989 (54 FR 29652). The American burying beetle is a large orange and black beetle, about 1.5 inches long. The beetle was historically distributed throughout eastern North America and was also found along some western tributaries of the Missouri River, including the Bad River, but has disappeared from most of its historic range. It buries small dead animals in the soil and lays its eggs in the carcass. The emerging larvae will then have a constant food supply and will not have to compete with fly larvae, since the carcass is buried. The

habitat of the American burying beetle includes pastures and other agricultural land with humus or loose topsoil suitable for burying carrion.

A comprehensive status survey is being conducted for the American burying beetle in South Dakota. Until status surveys are completed, the beetle could occur wherever there is significant humus or topsoil suitable for burying carrion. The beetle has been found in Gregory, Tripp, and Todd counties (USFWS 2004), mostly in southern Tripp County, and all other survey efforts in South Dakota, including surveys on Big Bend project lands, have been negative. Based on results of previous surveys and lack of suitable habitat, the beetle is unlikely to occur in the Big Bend project area (Backlund 2004).

3.9.6 Black-footed Ferret, *Mustela nigripes* (Federally Listed Endangered)

The black-footed ferret was listed as endangered on June 2, 1970 (35 FR 8495). The black-footed ferret spends its entire life associated with prairie dog towns and is dependent on prairie dogs for food and shelter. The historic range of the ferret corresponds closely with that of prairie dogs. Short grass and mid-grass prairie, semi-arid grasslands, and the mountain basins of North America are in this historic range, extending from Saskatchewan and Alberta to Texas, New Mexico, and Arizona. The black-footed ferret was probably never abundant, but its population is greatly reduced from earlier levels due to the eradication of prairie dogs by farmers and ranchers. The Federal Government conducted a status review of the black-tailed prairie dog, *Cynomys ludovicianus*, beginning in 1999 in response to a petition filed by the National Wildlife Federation (64 FR 14424). The status review has been completed, and the black-tailed prairie dog is no longer a candidate for listing as a threatened or endangered species (69 FR 51217, August 18, 2004). Prairie dogs are herbivores that graze on upland grasses, forbs, and shrubs. They dig complex burrow systems, with entrances marked by conspicuous mounds, to form colonies or towns in short- or mixed-grass prairie, notably wheatgrass and needle grass (USFWS 1978). The towns in the vicinity of Lake Sharpe range in size from a few holes covering 0.5 acre to several hundred holes covering over 320 acres (USACE 1995). Few black-tailed prairie dogs live on lands acquired for the Big Bend project, but their populations are expanding both on and off Big Bend project lands. A GIS-based survey within the external boundaries of the CCS Tribal Reservation in 2003 identified one black-tailed prairie dog town on Big Bend project lands and more extensive towns off project lands (Wolf 2004). A GIS-based survey in 2003 showed 3,000 acres of prairie dog towns on the LBS Tribal Reservation, mostly on lands that were not acquired for the Big Bend project, a 20 percent increase over the 2,500 acres found in 2002 (Janis 2004).

The black-footed ferret does not presently exist on Big Bend project lands (USFWS 2004). However, the increase in number and extent of prairie dog towns in the vicinity of the Big Bend project, discussed above, would add to the suitability of short grass and mid-grass prairie areas adjacent to project lands for reintroduction of the black-footed

ferret. The USFWS established minimum areas of prairie dog habitat (80 acres of black-tailed prairie dog towns or 200 acres of white-tailed prairie dog towns) needed to support a black-footed ferret (USFWS 1989). In 2004, the LBST began a 2-year-long, USFWS-funded study of the feasibility of reintroduction of the black-footed ferret and the swift fox on the LBS Tribal Reservation (Janis 2004).

3.9.7 State Species of Concern

The State of South Dakota has identified 15 species it considers threatened or endangered in the State (SDGFP 2004). Six of these species—the pallid sturgeon, bald eagle, Eskimo curlew, interior least tern, piping plover, and whooping crane—were addressed earlier. The osprey, *Pandion haliaetus*, State-considered threatened, is a transient that frequents areas downstream of the Big Bend powerhouse, where fish are readily available in the tailrace. Ospreys are found throughout the project area during migration. The peregrine falcon, *Falco peregrinus*, State-considered endangered, is also a transient, but no specific data on sightings within the project area are available.

The false map turtle, *Graptemys pseudogeographica*, State-considered threatened, is omnivorous, and its diet includes fish and mollusks. The false map turtle was last observed below Big Bend Dam in 1966 and near Farm Island in 1986 (USACE 1995). Turtle nesting habitat has been greatly reduced by rip-rapping of the shorelines of LaFramboise Island and the Missouri River banks, and no hatchling turtles have been seen in the project area in the last few years (Backlund 2004).

The river otter, *Lutra canadensis*, State-considered threatened, dens in beaver lodges and runways that provide protection from predators. The river otter was observed at the Big Bend project in 1979 near LaFramboise Island (USACE 1995). River otter were seen in 2004 just below Oahe Dam, and possible den sites were located (Backlund 2004). The swift fox, *Vulpes velox*, State-considered threatened, would not be expected on Big Bend project lands because of lack of open, level short grass prairie habitat (Backlund 2004). However, in 2004 the LBST began a 2-year-long, USFWS-funded study of the feasibility of reintroduction of the swift fox on the Lower Brule Tribal Reservation (Janis 2004).

The finescale dace (*Phoxinus neogaeus*) and the northern redbelly dace (*Phoxinus eos*), considered by the State to be endangered and threatened respectively, were not historically found in the Big Bend project area. The sturgeon chub (*Macrhybopsis gelida*) and sicklefin chub (*Macrhybopsis meeki*), which are State-considered threatened species, were present historically, but are not found currently, in waters in and near the Big Bend project (Backlund 2004). Construction of the Missouri River dams destroyed much of the habitat of the sturgeon chub and sicklefin chub, and the USFWS estimated that they occupied only 55 and 54 percent, respectively, of their historic ranges in the Missouri River (66 FR 19910).

3.10 Visual Qualities

The S-shaped dam embankment along with the rugged, scenic shoreline and open water of Lake Sharpe are attractive visual resources. The lake is surrounded by rugged bluffs and prairie grasslands, with some dense stands of trees in a few ravines. The pristine atmosphere in many areas along the lake attracts campers and other recreators. Visitors can view large numbers of waterfowl, wading birds, and shorebirds in the protected bays during migration. Many areas are of wilderness quality and provide habitat and food for large and small game. Timber resources are limited and are not commercially harvested. The only distractions to esthetics are the large power transmission lines and supporting stations, mostly near the dam embankment and powerhouse.

3.11 Cultural Resources

The Missouri River system has provided habitat for various peoples for more than ten thousand years. The Paleoindian and Archaic hunter-gatherer peoples were followed by those who led an increasingly sedentary existence, centered not only around the migrations of herd animals such as the bison, but also the cultivation of crops such as corn, beans, and squash. These peoples were ancestral to the present-day Mandan, Hidatsa, and Arikara tribes. During the historic era they were followed by those of Siouan and Ojibway tribes, themselves forced westward by the expansion of Euro-American settlers. The area in and around Lake Sharpe therefore contains abundant cultural resource sites of a wide variety, such as lithic scatters, campsites, tipi rings, earth lodge villages, wagon trails, military outposts, and historic homesteads.

Under the authority of National Historic Properties Act (NHPA) of 1966, as amended; the Archeological Resources Protection Act of 1979, as amended (ARPA); the Antiquities Act of 1906; the Native American Graves Protection and Repatriation Act of 1990, as amended (NAGPRA); the National Environmental Policy Act of 1969 (NEPA); and ER 1130-2-1; the Corps is mandated to protect and preserve eligible cultural resources which may be affected by the operation and management of its projects.

There are 223 recorded sites on Corps-owned property at the Big Bend project. Of these sites, 116 are listed on or eligible for the National Register of Historic Places, 33 are unevaluated, and 74 are not eligible for listing.

The normal operating pool at Lake Sharpe is 1420 feet m.s.l. The normal operation of the main stem reservoirs affects the status of these sites, primarily through erosion. The slumping of cut bank soils destroys site integrity and exposes artifactual remains to the elements and depredation. This erosion may be caused by fluctuating pool levels or wind and wave action. The Corps has attempted to mitigate this damage at a number of locations through bank stabilization procedures, such as the placement of riprap and vegetative plantings.

The other major cause of damage to cultural resource sites is looting, through pot hunting, vandalism, or “beachcombing”. There are no hard data for the main stem reservoirs, but many of the known major sites have likely experienced some sort of depredation. Project rangers periodically check well-known sites for damage of any kind, and have posted signs warning against site vandalism of any sort at major lake access areas. Tribal members also regularly monitor sites.

3.12 Socioeconomic Characteristics

South Dakota’s population was 754,844 in 2000, an increase of 8.5 percent since 1990. Of the five counties adjacent to the Big Bend project, Hughes County, where Pierre is located, is the only predominantly urban county. In the non-urban counties, the population is low and decreasing, per capita income is low, and median age is rising. The population of South Dakota is primarily of northern European ancestry. Native Americans, most of whom are members of one of the State’s nine Sioux tribes, are numerically the only significant minority. In 2000, the 62,283 Native Americans living in South Dakota constituted 8.3 percent of the State’s population and represented an increase of 38.7 percent over the number of South Dakota residents identifying themselves as Native American in 1980. The CCS and LBS Tribal Reservations, which are adjacent to Lake Sharpe, had a population of 3,578 in 2000.

The population is expected to grow in the major urban areas and on Tribal reservations and decline in rural areas, for a small but steady net increase. Increased visitation to the Big Bend project could result from increases in visitors from outlying urban areas and from increased use by Native Americans living nearby. Increases in elderly visitors can be expected due to increases in the proportion of elderly in the general population, increased mobility, and increases in universally accessible recreation facilities.

Most visitors to the Big Bend project are from South Dakota. The number of visitors from Sioux Falls, the State’s largest city, is higher than that from many nearer but smaller cities. Although the South Dakota economy is highly dependent on agriculture, tourism is expanding, and sales of goods and services to tourists are increasing. The unemployment rate for the State of South Dakota was 3.0 percent in June 2003 (Labor Market Information Center 2003), but the unemployment rate on reservations is much higher. Per capita income within reservations is lower than in rural non-reservation counties, and per capita income is highest in urban counties.

3.13 Visitation and Recreation Activities

Visitation to areas acquired for the Big Bend project totaled over 5 million visitor hours in 2000 and increased to over 6 million visitor hours in 2003, after the Title VI land transfers. Many visitors are travelers en route to the Black Hills, Yellowstone, or other attractions. In 2000, the Big Bend project ranked last among the six Missouri River main stem reservoirs in terms of total visitor hours, but ranked second to the Gavins Point

project in terms of visitor hours per mile of shoreline. Visitation is not evenly distributed among the recreation areas. In 2000, over 32 percent of total visitor hours at designated recreation areas were spent at the Left Tailrace. Visitation projections indicate the need for improved and increased development at existing recreation areas rather than development of new recreation areas. Many recreation areas were transferred to the State of South Dakota and the BIA/LBST, which can develop new or expanded recreation facilities, as appropriate. Nine recreation areas have not been transferred: Left Tailrace, Spillway, North Shore, Good Soldier Creek, Right Tailrace, and Old Fort Thompson, managed by the Corps; and North Bend, West Bend, and Joe Creek, managed by SDGFP.

Approximately 40 percent of Lake Sharpe visitors engage in water-based recreation activities. Fishing is the major recreational activity, and Lake Sharpe is a major destination area for fishing parties from South Dakota and adjacent states. The lower reaches of Lake Sharpe are primarily fished from boats due to relatively limited shoreline access. Some boat ramps are currently silting in, and if they become nonfunctional, long reaches of the lake would be difficult to access from shore. A large number of tree snags, both exposed and submerged, is another problem for boaters and water skiers. The increasing number of larger boats with deep-draft hulls is creating a demand for expanded marina facilities. Because 50 to 70 percent of Lake Sharpe visitors originate outside the local area, the number of boat ramps is inadequate, and siltation at some boat ramps and embayments exacerbates the problem. Over 11 percent of Lake Sharpe visitors participate in swimming, both at designated and undesignated areas. Water quality is monitored regularly.

At recreation areas, campground facilities are separated from day use areas, and demand exists for more campsites and improved camping facilities that offer all amenities. The LBST and CCST maintain powwow grounds near the Big Bend project, and many people attending events there use the campgrounds at the Old Fort Thompson and Left Tailrace recreation areas. Most primitive camping is associated with hunting and fishing trips. According to a visitation survey in 1993, hunting accounted for about 10 percent of visitor use in designated recreational areas, but most hunters use other, more isolated areas. During the fall and winter, hunters may account for 50 percent of total visitors and harvest waterfowl (mainly Canada geese and mallard ducks), sharp tailed grouse, pheasants, Hungarian partridges, pronghorns, white-tailed deer, and mule deer on lands acquired for the Big Bend project; and elk and buffalo on the LBS Tribal Reservation.

Visitors can engage in many land-based day use activities. Picnicking facilities are available at most recreation areas. Additional picnic areas and additional shelters, playgrounds, toilet facilities, and potable water facilities at existing picnic areas are needed. Walking, jogging, hiking, and bicycling on trails, nature trail use, cross-country skiing, and snowmobiling are popular. No areas around Lake Sharpe are designated for off-road vehicle use. All visitors can enjoy the scenic views at the Big Bend project and

can also take advantage of cultural-related sightseeing with a self-guided driving tour through the CCS Tribal Reservation and LBS Tribal Reservation.

3.14 Environmentally Sensitive Areas

The Lake Sharpe Islands, totaling about 245 acres, are the only management unit with a land classification of environmentally sensitive. They do not include Farm Island and LaFramboise Island but include all the other islands between Big Bend Dam and Pierre, plus those islands immediately downstream from Big Bend Dam. The islands range from low, newly formed sandbars with little vegetation to islands with high banks and mature trees. The islands are popular for duck hunting, and deer are hunted with bows on some larger islands. Least terns, piping plovers, and bald eagles have been found nesting and/or roosting on the islands, so development has been limited. The islands have no known cultural resource sites. The Corps currently owns and manages the islands, but ownership and management of the islands above the exclusive flood control pool will transfer to the State of South Dakota or the LBST not later than 1 year after the South Dakota Terrestrial Wildlife Habitat Restoration Trust Fund and the LBST Terrestrial Wildlife Habitat Restoration Trust Fund are fully capitalized, in 2008 or 2009.

4 CONSEQUENCES OF THE NO ACTION ALTERNATIVE

Under the provisions of Title VI, the Government retains fee title to lands and structures necessary for continuation of the operation, maintenance, repair, replacement, rehabilitation, and structural integrity of the dam and related flood control and hydropower structures, including land below the top of the exclusive flood control pool. The Government will lease in perpetuity all or part of the Left Tailrace, Right Tailrace, and Good Soldier Creek recreation areas to the LBST upon request. With regard to other Big Bend project lands located within the external boundaries of the LBS Tribal Reservation, the Government transferred the remaining recreation areas and portions of the other areas above the top of the exclusive flood control pool to the BIA in trust for the LBST on June 25, 2002.

For the remaining lands acquired for the Pick-Sloan Missouri River Basin program, located outside the external boundaries of Tribal reservations, fee title of recreation areas was transferred to the State of South Dakota on January 26, 2002. Fee title of other lands that are above the top of the exclusive flood control pool are to be transferred to the State of South Dakota no later than 1 year after the South Dakota Terrestrial Wildlife Habitat Restoration Trust Fund is fully capitalized.

The No Action alternative, namely continuing to abide by the 1995 Master Plan, is not legally or technically feasible. Development and management proposals in the Master Plan must be in accordance with current laws and regulations. Because it predated Title VI legislation, the 1995 Master Plan does not take into account the effects of Title VI on current and future ownership and management of lands acquired by the Federal

Government for the Big Bend project. Therefore, continued use of the 1995 Master Plan would not be in compliance with existing Federal laws.

5 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

The proposed action, namely the 2003 Master Plan update, takes into account the provisions of Title VI legislation on ownership and management of all management areas that previously comprised the Big Bend Dam/Lake Sharpe project. The proposed Master Plan update is a Corps of Engineers document and, therefore, does not include resource plans for management units that have been transferred to the State of South Dakota or the LBST. However, references to resources, recreation facilities, and potential problems at areas that have been transferred under Title VI are included in the Master Plan update. There are several reasons for this inclusiveness. First, ecological boundaries do not coincide with boundaries of recreation areas or the exclusive flood control pool elevation. Secondly, Lake Sharpe itself, which forms a boundary for most management areas, is within the Corps' realm of responsibility. Third, the Corps has had limited funds to implement all the resource objectives for previously Corps-managed areas at Lake Sharpe. The additional ideas, management efforts, and funding sources provided by the State and the Tribes would be expected to have a positive impact on dealing with changes in visitation, recreational activities, and environmental characteristics at Lake Sharpe since the Title VI Land Transfer, and these non-Corps activities are included in the discussion of cumulative effects. The input these entities provided to the finalization of the 2003 Master Plan update, including the appended Cultural Resources Management Plan, symbolizes the spirit of cooperation needed in the future for managing resources and recreation opportunities within the lands acquired for the Big Bend project. Overall consequences of the proposed Master Plan update would be expected to be positive. Potential effects that cover activities on lands for which the Corps is responsible are detailed below.

5.1 Hydrology

Channel aggradation due mainly to sediment carried by the Bad River, and high water releases from Oahe Dam, have resulted in higher Missouri River stages at Pierre and Fort Pierre. When this is coupled with thick river ice formation under severe winter conditions, winter flooding can occur along the shoreline in the Pierre and Fort Pierre areas, especially if winds are strong. Under another program, in Pierre and Fort Pierre the Corps is continuing to flood proof homes or relocate residents who have been adversely affected by winter flooding. No measures included in the proposed Master Plan or the 1995 Master Plan would raise the water table further, nor would they have an effect on these ongoing programs.

5.2 Sedimentation and Shoreline Erosion

Sediment from the Bad River has been deposited in the upstream reaches of Lake Sharpe. The rising water table increasingly favors marsh vegetation, and these conditions must be considered when selecting species for planting or planning recreation facilities. Most areas between the Bad River and the upper end of Lake Sharpe were transferred to the State under Title VI and are managed by the SDGFP and the City of Pierre.

Sediment carried by tributaries continues to be deposited in the embayments and on boat ramps in the embayments, making boat launching and maneuvering more difficult. Littoral drift is continuing to form bars or shoals across and within embayments and sediment deposition on boat ramps sited on Lake Sharpe. Most of the embayments experiencing sedimentation problems are within recreation areas transferred under Title VI to the State or the BIA/LBST, and the SDGFP and LBST, respectively, are responsible for maintaining access at boat ramps. Under both the updated Master Plan and the 1995 Master Plan, the Corps would be responsible for maintaining boat access at Corps-managed areas; however, the Corps has not needed to remove sediment in several decades. At Corps-owned and SDGFP-managed recreation areas at embayments with ramps, sediment at Joe Creek is not affecting the ramp but is making the bay shallower; the West Bend ramp is functional, but in 2003 SDGFP removed sediment from the mouth of the bay with a 60-foot truck hoe; and at North Bend, silt is not accumulating on the ramp, but rather in the bottom of the bay and in bar deposits at the mouth, and only small boats can gain lake access (Thompson 2004).

The constant pool levels allow year-round attack by the forces of wind, wave, and ice at the same bank elevations. Most soils around the lake contain a lot of clay with particle sizes so small they are transported into deeper areas of the lake rather than forming a beach that breaks wave energy. Both the updated Master Plan and the 1995 Master Plan propose the same shoreline protection activities at the same Corps-owned areas. Corps activities under both Master Plans would likely have the same positive effect on reducing shoreline erosion. At the Mint Farm and Whistling Elk areas, logs, snags, hay bales, and wetland plantings were successful in trapping sediment to establish a beach that provided some protection against erosion. At some areas with a long fetch such as North Shore, vegetative plantings have been unsuccessful in controlling erosion, and riprap may be needed. The riprap could potentially result in a loss of vegetation along the shoreline, but not protecting the bank from erosion could result in the loss of an even greater amount of vegetation in the future. Riprap placement could also result in negative effects on any cultural resources present; a cultural resources investigation would first be conducted and Section 106 compliance would be completed prior to implementation of the project so that any adverse effects to a Historic Property could be mitigated prior to the placement of riprap. Both Master Plans indicate that when planning construction of new facilities, projections of bank line erosion should be made to avoid the need for relocating and/or protecting those facilities. If this is done, even though the development proposed for

North Shore in the 1995 Master Plan was more extensive than that proposed in the updated Master Plan, the amounts of shoreline protection needed under the two Master Plan should not differ significantly.

5.3 Surface Water Quality

Lake Sharpe serves as a water supply for Fort Thompson, Lower Brule, the Mni Wiconi rural water project in Lower Brule, and homes near the lake. Neither the updated Master Plan nor the 1995 Master Plan proposes any Corps activities on Corps-owned lands that would negatively affect the suitability of Lake Sharpe as a water supply source.

The Corps currently monitors water quality six times per year at four locations: the outflow of Oahe Dam; the outflow of Big Bend Dam; at Big Bend Dam; and upstream of Big Bend Dam (USACE 2001b). The Corps would perform additional monitoring under the 2003 Master Plan update: hourly year-round at the powerhouse (penstock); monthly from May through September, sampling from near the bottom in addition to the current near-surface sample in Lake Sharpe near the dam; and monthly year-round at the Big Bend Dam tail waters. These additional monitoring efforts would enable the Corps to understand and more effectively manage aquatic resources at Lake Sharpe and to evaluate the effectiveness of measures implemented to enhance surface water quality. Therefore, Corps water quality monitoring activities would likely result in greater positive effects on surface water quality under the updated Master Plan than the 1995 Master Plan.

Most designated swimming beaches at Lake Sharpe are currently managed by the SDGFP or LBST. Managing entities of all designated swimming beaches, including the Corps, collect water samples for bacterial analysis in accordance with State regulations. Any exceedance of State standards requires beach closing until the water quality meets State standards. No Corps activities proposed under the updated Master Plan or the 1995 Master Plan would be expected to adversely impact water quality at swimming beaches.

Periodic algal blooms occur in Lake Sharpe when sufficient nutrients (most of which are attached to sediment) are coupled with ideal weather conditions. Algal blooms can disperse within the lake but continue in protected embayments. The additional Corps water quality monitoring efforts could not provide data that would result in prevention of algal blooms. Therefore, Corps activities under either Master Plan would have no effect on algal blooms.

5.4 Accessibility

The east side of the Big Bend project has good highway access, but partly due to the more rugged topography, access by paved roads to many areas that are not designated recreation areas is limited. Non-Corps entities are responsible for road improvements

outside Corps-owned project lands. Therefore, Corps activities would not have any effect on road accessibility to Big Bend project lands under either Master Plan.

For private recreational boats, fuel and harbor accommodations are available at Pierre and some marina areas. Both the updated Master Plan and the 1995 Master Plan propose to add a marina at the Corps-owned North Shore Recreation Area, which would increase boat access. Therefore, both Master Plans would likely result in equivalent, positive effects on boat accessibility to Lake Sharpe.

5.5 Topography and Soils

Development proposed at Corps-owned areas in both Master Plans would affect local topography through cut-and-fill processes at construction sites. The only difference between the 1995 Master Plan and the updated Master Plan in proposed development at Corps-owned areas is at the North Shore Recreation Area. Both Master Plans propose additional camping, beach, and marina facilities, and a Cultural Learning Center. The updated Master Plan also proposes a playground and fish cleaning station. The additional facilities proposed in the 1995 Master Plan were much more extensive and included a motel, a restaurant, an indoor pool and recreation area, a rodeo/powwow grounds, an outdoor sports complex, and an exercise trail. Therefore, development proposed in the updated Master Plan would have less effect on topography at the Big Bend project than would development proposed in the 1995 Master Plan, but this effect would likely not be significant because the additional facilities constitute a very small percentage of Corps-owned lands at the Big Bend project.

Most of the soils along the shore of Lake Sharpe are clayey, are subject to erosion by lake waters, and may present problems for particular kinds or levels of development. Both the updated Master Plan and the 1995 Master Plan identify specific shoreline erosion control measures appropriate for the various management areas at Lake Sharpe. Both Master Plans also indicate that when planning development, the county soil survey should be used to site facilities on soils suitable for that type of development and to identify special construction techniques needed to overcome soil limitations. Therefore, Corps activities under both Master Plans would likely be similar in the degree to which they avoided potential negative effects of soil characteristics on shoreline erosion and facility silting.

5.6 Vegetation

For Big Bend project lands remaining in Corps ownership, almost all management areas have the same vegetative planting proposals under both the 1995 Master Plan and updated Master Plan. Vegetation buffers would be planted to separate day use areas from camping areas. Trees and shrubs would be planted to increase shade and winter cover, dense nesting cover, and food sources for wildlife. Food plots and native grasses would be planted for wildlife habitat and to supplement existing wildlife food sources. At the Crow Creek area, habitat would be improved by controlling grazing. At the Whistling

Elk area, Arikara area, and the Corps-owned portion of the Clark Ranch area, planting of wetland species would improve habitat for fish as well as waterfowl. Areas remaining under Corps ownership that had a land classification of Mitigation in the 1995 Master Plan have a land classification of Multiple Resource Management: Wildlife Management General in the updated Master Plan. However, these areas have the same resource objectives and development needs in both Master Plans. For areas owned by the Corps, therefore, Corps activities would have similar, positive effects on vegetation quality for wildlife habitat under both Master Plans.

Both Master Plans propose construction of recreation facilities, an access road, and placement of riprap that would reduce vegetative cover in some Corps-owned areas. The proposed construction is minor in nature, and is identical in both Master Plans, except at North Shore. As detailed above, the construction proposed for North Shore in the updated Master Plan appears much less extensive than that proposed in the 1995 Master Plan and, therefore, would likely have less of a negative impact on vegetative cover. This difference in impact on vegetative cover would not likely be significant because the reduction in vegetated acres constitutes only a small percentage of the total vegetated acres owned by the Corps at the Big Bend project.

5.7 Fish

The fisheries at Lake Sharpe are managed by the SDGFP. Tributary inflows continue to bring high amounts of sediment and nutrients to the embayments, shallowing them. Barrier bars continue to form across mouths of embayments, reducing long-fetch wave action and shoreline erosion within the embayment. Light penetration has increased due to the reductions in depth and turbidity, favoring macrophyte growth. This good fish cover has made the embayments important nursery areas. Both Master Plans propose wetland plantings to improve fish habitat at the Whistling Elk Area, which would likely have a small positive effect on the Lake Sharpe fishery. Both Master Plans propose provision of lake access at boat ramps on Corps-owned land. The boat ramps at Corps-managed areas have remained relatively free of sediment, and no sediment removal has been needed for several decades. The Corps-owned Joe Creek, West Bend, and North Bend recreation areas have boat ramps in embayments and are managed by SDGFP. Sediment at the Joe Creek area is not affecting the ramp but is making the bay shallower, and sediment removal may be needed in a number of years. The West Bend ramp is functional, but in 2003 SDGFP removed sediment from the mouth of the bay with a 60-foot truck hoe. At North Bend, silt is not accumulating on the ramp, but rather in the bottom of the bay and in bar deposits at the mouth, and only small boats can gain lake access (Thompson 2004). Removal of sediment entails removal of the aquatic plants, benthic invertebrates, and nutrients contained in the sediment. This would reduce productivity, fish cover and rearing habitat, and spawning areas for certain fish that spawn near macrophytes. These negative effects would likely not be significant, however, because the sediment would be removed from only a fraction of the embayment

area. Overall, actions to maintain lake access at ramps on Corps lands proposed in the Master Plans would not likely have a significant effect on Lake Sharpe fisheries.

5.8 Wildlife

The Central Flyway passes through Lake Sharpe, and waterfowl migrate through the area in spring and in fall and early winter. Increases in crop acreages have coincided with increased numbers of migratory waterfowl. Food plots growing near Lake Sharpe are a major attractant. Large numbers of sand hill cranes also migrate through the Big Bend project. Both the 1995 Master Plan and the updated Master Plan propose planting food plots for waterfowl and wildlife at the same areas. Therefore, under either Master Plan, food plots at Corps-owned areas likely would have the same positive effect on the number of migratory waterfowl landing at Lake Sharpe.

Many songbirds use grasslands and woodlands (especially woody draws and shelterbelts) as nesting habitat, a food source, or winter cover. Wild turkeys frequent trees planted in draws and also benefit from wildlife food plots. Upland game birds use grasslands and shrubs as dense nesting cover and a food source. A number of bird species use prairie grasslands for ground nests. For Corps-owned lands at the Big Bend project, both the 1995 Master Plan and the updated Master Plan propose the same type of plantings of trees, shrubs, grasses, and/or food plots for wildlife habitat, cover, dense nesting cover, and/or food at the same areas. Therefore, under either Master Plan, plantings at Corps-owned areas would likely have the same positive effect on the number of birds dwelling in trees and prairie grasslands at the Big Bend project.

White-tailed deer and mule deer populations have increased due to increases in weedy croplands and woodlands, including Corps-planted shelterbelts. Corps improvement of grassland and woodland habitat and planting of food plots has fostered increases in small game populations. Wetland conditions persisting near Lake Sharpe have benefited many water-oriented furbearers such as the raccoon, beaver, mink, and muskrat. Planting activities for each Corps-owned area are the same under both Master Plans. Therefore, Corps activities under both Master Plans would result in the same positive effect on mammal populations at the Big Bend project. Because Corps vegetative plantings, beach development through shoreline erosion protection measures, and wetland improvement measures are the same under both Master Plans, positive effects of Corps activities on reptiles and amphibians should be similar under either Master Plan.

5.9 Rare and Endangered Species and Communities

The threatened bald eagle, endangered interior least tern, threatened piping plover, endangered pallid sturgeon, and the black-tailed prairie dog, a candidate for listing, are known to currently reside or breed in the Big Bend project area (USFWS 2003, 2004). Pending completion of a status survey, the endangered American burying beetle could possibly, but not likely, be found on Big Bend project lands (USFWS 2004, Backlund

2004). The whooping crane migrates through the area. In addition, the endangered black-footed ferret may be reintroduced into the project area in the reasonably foreseeable future (Janis 2004).

In general, for any development on Corps lands, a site plan would be prepared and a site-specific NEPA analysis, including an assessment of potential impacts to threatened and endangered species, would be coordinated with Federal agencies, Tribes, and State of South Dakota entities. If a Section 404 individual permit or a new Section 404 regional general permit were required for any Corps action, coordination regarding compliance with the Endangered Species Act would be accomplished as part of the public review process for issuance of the Section 404 permit. If the nature of the Corps action requires only a Section 404 nationwide general permit, which does not involve an action-specific public review, State and/or Federal agency coordination has already determined that the proposed action falls within a specific category of actions that would not result in adverse effects on the environment, including effects on threatened and endangered species. Potential effects of Corps actions on Corps-owned areas on federally listed and candidate species are discussed below.

Whooping Crane. The federally listed endangered whooping crane, *Grus americana*, migrates through the Big Bend project area. The only sightings have been reported near the DeGrey area and at a marsh complex along the lake several miles north of Lower Brule. The whooping crane is not known or expected to occur in any of the five counties adjacent to the Big Bend project (USFWS 2004). Actions proposed on Corps lands by either the updated Master Plan or the 1995 Master Plan would have no effect on the whooping crane.

Bald Eagle. The federally listed threatened bald eagle, *Haliaeetus leucocephalus*, mainly roosts at the Big Bend project during the winter but has also nested. Up to 200 eagles spend the late fall and winter roosting in cottonwoods along the Missouri River downstream from Oahe Dam (USACE 1995), at DeGrey, on Farm Island, and on LaFramboise Island. A pair of eagles nested in the dead cottonwoods at DeGrey in 2004 (Backlund 2004). The area downstream from Oahe Dam is part of the Oahe project and was leased in perpetuity to the State of South Dakota under the provisions of Title VI. DeGrey, Farm Island, and LaFramboise Island were all transferred to the State under Title VI and are managed by SDGFP. Only plantings and shoreline erosion control measures are proposed at Corps-owned areas adjacent to any of these State-owned areas in the updated Master Plan or the 1995 Master Plan. The timing and location of Corps activities would be chosen to avoid effects on eagles or their nests to the extent possible.

Eagles also roost in the fall and winter and nest in the spring in Corps-owned areas. Up to 12 eagles roost in isolated cottonwood trees along the water just upstream and downstream from Big Bend Dam, in areas served by secondary roads that see little traffic during the late fall and winter. In the spring of 2002 and again in the spring of 2003, a

pair of bald eagles nested 5 miles downstream of Big Bend Dam on the east bank of the Missouri River but did not produce any fledgling chicks. For development actions on Corps-owned lands, plans and specifications would avoid, minimize, or mitigate the felling of mature cottonwoods; if the construction schedule overlaps nesting or roosting periods, the specifications would include the magnitudes of non-disturbance areas and the times and conditions under which they would be in effect. With these provisions and the site-specific EA and regulatory permit review provisions noted above, actions on Corps-owned lands proposed in either the updated Master Plan or the 1995 Master Plan would not affect the bald eagle.

Interior Least Tern and Piping Plover. The federally listed endangered interior least tern, *Sterna antillarum*, formerly nested on the islands in the Missouri River downstream from Oahe Dam, but the islands have become vegetated by cattails due to the rising water table. Critical habitat for the federally listed threatened piping plover, *Charadrius melodus*, has been designated at Lake Oahe, but not at Lake Sharpe (67 FR 57637). The piping plover has not been known to nest at Lake Sharpe because grasses and shrubs may grow to the edge of the lake, there are few unvegetated beach areas, and any shoreline areas of sand are narrow.

Procedures for avoiding disturbance by visitors to nesting terns and plovers are already implemented at all Corps-owned areas. For development actions on Corps-owned lands with a construction schedule that may overlap tern or plover nesting periods, the plans and specifications would include the extent of the nondisturbance areas and the procedures to be followed by Corps and construction staff. Therefore, development actions on Corps-owned lands under either the updated Master Plan or the 1995 Master Plan would not affect the least tern or the piping plover.

Pallid Sturgeon. The federally listed endangered pallid sturgeon, *Scaphirhynchus albus*, is found mainly in the upstream end of Lake Sharpe. Based on research data, 50 to 100 pallid sturgeon were estimated between Oahe Dam and Big Bend Dam (Eco-Tech, Inc. 2001). There is no evidence of pallid sturgeon reproduction at the Big Bend project. Development at Corps-owned areas would require a site-specific Environmental Assessment that included identification and evaluation of potential impacts to threatened and endangered species, and that would be coordinated with Federal agencies, Tribes, and State of South Dakota entities. Other Corps activities in the waters or along the shoreline of Lake Sharpe at or below elevation 1422 feet m.s.l. would require a Section 404 permit if they involved placement of fill. The Section 404 regulatory process involves a determination that the action is in compliance with the Endangered Species Act, even if an action-specific public review is not required. The NEPA and regulatory processes would need to be completed prior to implementation of the activity of development. Therefore, activities in Corps-owned areas proposed in either the updated Master Plan or the 1995 Master Plan would not affect the pallid sturgeon.

American Burying Beetle. The federally listed endangered American burying beetle, *Nicrophorus americanus*, has not been found in any of the five counties that border Lake Sharpe. Its habitat includes land with humus or loose topsoil suitable for burying carrion. Surveys conducted on Big Bend project lands have not found any American burying beetles, and it is unlikely that they exist at the Big Bend project (Backlund 2004). The vicinity of any site proposed for development on Corps-owned lands would be surveyed for the American burying beetle as part of the site-specific Environmental Assessment, and no development would be implemented if it were determined to have adverse effects on the American burying beetle. Therefore, development in Corps-owned areas proposed in either the updated Master Plan or the 1995 Master Plan would not affect the American burying beetle.

Black-footed Ferret. The federally listed endangered black-footed ferret, *Mustela nigripes*, was extirpated from Big Bend project lands. The black-footed ferret requires prairie dog towns for food and shelter. Black-tailed prairie dog towns are found on both the east and west sides of Lake Sharpe. The USFWS estimated that 80 acres of black-tailed prairie dog towns or 200 acres of white-tailed prairie dog towns would be needed to support one black-footed ferret. The extent of prairie dog towns increased 20 percent, from 2,500 acres in 2002 to 3,000 acres in 2003, within the external boundaries of the LBS Tribal Reservation (Janis 2004). This indicates that the area around Lake Sharpe may have the carrying capacity for an introduced population of black-footed ferrets, and in 2004 the LBST began a study to determine the feasibility of introducing a black-footed ferret population on the LBS Tribal Reservation. The vicinity of any site proposed for development on Corps-owned lands would be surveyed for the black-tailed prairie dog as part of the site-specific NEPA compliance, and no development would be implemented if it were determined to have adverse effects on the black-tailed prairie dog. Therefore, development in Corps-owned areas proposed by either the updated Master Plan or the 1995 Master Plan would have no effect on the black-tailed prairie dog. Consequently, such development under either Master Plan would have no effect on potential future experimental populations of the black-footed ferret.

5.10 Visual Qualities

The S-shaped dam embankment along with the rugged, scenic shoreline and open water of Lake Sharpe are attractive visual resources. The updated Master Plan proposes no development that would interfere to any great extent with views of the dam embankment, the lake, and the rustic views of prairie, woody draws, and the wildlife they attract. The extensive number of buildings in the recreation development proposed for North Shore in the 1995 Master Plan could possibly block or clash with rustic views or views of the dam from certain lines-of-sight. Therefore, development at Corps-owned areas proposed in the updated Master Plan would be much less likely to have a negative effect on visual qualities at the Big Bend project than development proposed in the 1995 Master Plan would.

5.11 Cultural Resources

The Corps is responsible for any adverse impacts to cultural resources that result from the operation of the Big Bend Dam/Lake Sharpe project, including cultural resources on lands transferred to the State of South Dakota or to the BIA/LBST under the provisions of Title VI. Normal operation of the Big Bend project results in wind and wave action as well as low fluctuation in pool levels. These factors cause slumping of cut bank soils, which may destroy site integrity and expose artifactual remains to the elements and depredation. The Corps has attempted to mitigate this erosion damage at a number of sites through bank stabilization procedures, such as the placement of riprap and vegetative plantings. Vandalism and artifact looting have also damaged cultural resource sites. Corps rangers periodically check well-known sites for damage of any kind and have posted signs warning against site vandalism and looting at major lake access areas. Tribal members also regularly monitor sites.

In order to reduce the impacts to these sites, stabilization and protection measures will be continued, and the public will continue to be informed and educated. Periodic press releases will include the information that the looting of cultural sites is illegal, and that law enforcement officials do in fact prosecute offenders. The Lake Sharpe Cultural Resources Management Plan details the ongoing actions that the Corps' Omaha District and the Tribes will take to ensure that the operation and maintenance of this lake project has minimal impact on cultural resources. The updated Master Plan, with appended CRMP, would result in fewer negative impacts on cultural resources, and more positive effects than the 1995 Master Plan. It would increase the public's familiarity with provisions in the law regarding cultural resources protection. The action plan provides for resurvey of some areas for cultural resources, site and shoreline monitoring, increased priority for site evaluations and nomination of eligible sites to the National Register, a prioritization system for site protection, and enhancement of public education.

5.12 Socioeconomic Characteristics

Most visitors to the Big Bend project are from South Dakota. Many visitors come from some distance away and stop at the Big Bend project on their way to other destinations. The proximity of all the Corps-managed designated recreation areas to I-90 has resulted in high visitation levels. Additional recreation facility development to meet demonstrated visitor needs is proposed in both the updated Master Plan and the 1995 Master Plan. For all the Corps-owned recreation areas, the proposed facilities are identical in both Master Plans except for North Shore. The types of facilities proposed by the updated Master Plan are the same types of facilities found at other Corps-owned recreation areas; the proposed Cultural Learning Center would assume the cultural interpretation functions of the visitor center that was destroyed by a tornado in 1992. On the other hand, the 1995 Master Plan proposed a hotel/lodge complex, a restaurant, and an indoor pool/recreation area that would not be considered "outdoor recreation" facilities and could be constructed on non-project lands. The North Shore development

proposed in the updated Master Plan appears to have a greater effect on reducing unmet visitor needs for outdoor recreation facilities that take advantage of the Big Bend project's land and water resources than does that proposed in the 1995 Master Plan.

Increases in elderly visitors can be expected at the Big Bend project. For Corps-owned recreation areas, both Master Plans propose handicapped-accessible facilities and additional campground facilities with electrical hookups (which would be more likely to be used by elderly visitors than would tent camping areas). Therefore, Corps development activities in both Master Plans would likely have similar effects in reducing unmet outdoor recreation needs for the elderly and handicapped.

The unemployment rate is higher, and the median income lower, for the CCST and LBST than for non-Native Americans in the five counties adjacent to Lake Sharpe. Development proposed at Corps-owned areas in both Master Plans could provide seasonal employment for Native Americans. The development proposed for North Shore in the 1995 Master Plan would appear to have a greater effect in reducing seasonal unemployment of Native Americans not only during construction, but also during operation of the facilities afterward, than that proposed in the updated Master Plan. However, the reduction in unemployment for Native Americans would not likely be significant because only a small fraction of the seasonal labor involved would likely be performed by Native Americans; only seasonal unemployment, not year-round unemployment, would be reduced; and these reductions would likely be small compared to total unemployment among Native Americans in the Big Bend project area.

5.13 Visitation and Recreation Activities

Visitor hours increased by nearly 20 percent between 2000 and 2003. The relatively stable elevation of Lake Sharpe that enabled boat ramps to be functional during the recent drought may have been responsible for some of the recent increase in visitation. However, it is likely that the additional recreation facilities that were needed when the 1995 Master Plan was prepared, during a series of "wet" years, are still needed. Both Master Plans indicate that the additional development should occur at existing recreation areas rather than developing new recreation areas.

Both Master Plans propose the same facilities at each Corps-owned area except for North Shore. Fishing is the major recreational activity, and the lower reaches of Lake Sharpe are primarily fished from boats because of limited shoreline access. Both Master Plans propose marina development at the North Shore Recreation Area because it is the primary lake access for the southern end of Lake Sharpe. The two campgrounds did not have electrical hookups or showers and are closed or under-used. Visitor hours at North Shore in 2000 constituted only 6.5 percent of visitor hours at all designated recreation areas. North Shore visitation was below potential carrying capacity, and facilities needed to be redesigned to attract and accommodate more visitors. Because of the relatively low

visitation, however, the various activity areas could be redeveloped with relatively little inconvenience to visitors. Developing the two campground areas with additional campsites and full amenities, expanded beach, playground area, fish-cleaning station, and marina facilities would meet the needs of fishermen, other boaters, and campers (including the elderly) desiring more amenities. Both Master Plans also recommend development of a Native American Cultural Learning Center that would assume some functions of the visitor center that was destroyed by a tornado in 1992 and also take advantage of the proximity of the LBS and CCS Tribal Reservations and the Native American Loop tour.

The rodeo/powwow grounds and the exercise trail proposed in the 1995 Master Plan would also meet existing outdoor recreation needs. However, the hotel/lodge complex, restaurant, indoor pool, and indoor recreation center would not meet outdoor recreation needs and would occupy space at the North Shore area that could otherwise be used to meet outdoor recreation needs. Overall, recreation facility development at Corps-owned areas proposed in both Master Plans would reduce unmet needs for outdoor recreation facilities, but facilities proposed in the updated Master Plan would likely have a greater positive effect in reducing those needs than facilities proposed in the 1995 Master Plan would.

5.14 Environmentally Sensitive Areas

The Lake Sharpe Islands, totaling 245 acres, are the only management areas with a land classification of Environmentally Sensitive Areas. The Corps currently owns and manages the islands, but ownership above the exclusive flood control pool will transfer to the State of South Dakota or the BIA/LBST, and management to the SDGFP and LBST respectively, within one year after the two Terrestrial Wildlife Restoration Trust Funds are capitalized. The resource objective is to protect the environment for use by waterfowl, upland game, and big game species. There are no known cultural resource sites. No development need has been identified, and no development was suggested in either the updated Master Plan or the 1995 Master Plan. Therefore, neither Master Plan proposes any actions that could adversely affect the diversity of plant and animal species on the islands.

6 POTENTIAL CUMULATIVE EFFECTS

Cumulative effects, as defined by the Council on Environmental Quality for NEPA, are those impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of the agency of persons undertaking these actions.

Numerous cumulative effects from previous actions have occurred throughout the Lake Sharpe area. Construction of Big Bend Dam and filling of the Lake Sharpe reservoir, construction of the additional upstream dams on the Missouri River, management of the

Missouri River for navigation and water supply and dam operations, water diversions and uses by various private and public entities, and development of the Missouri River flood plain for agricultural and urban uses have caused dramatic changes to the Missouri River system. These anthropogenic changes have caused cumulative effects to resources, ecosystems and human communities. The Missouri River system is now primarily a passive, controlled system with dramatically reduced abundance and diversity of most natural communities and habitats, although a significant amount of restoration is occurring in the basin.

Implementation of proposals for Corps-owned areas in the updated Master Plan would incrementally reduce the cumulative effects that have occurred in the Big Bend project area and would also compensate for increased visitor use of the project area in the future. These include more stringent and comprehensive guidelines for development on project lands, recreation areas designed with high carrying capacities so intensive visitor use can be concentrated away from resource-oriented areas, greater environmental protection and improvement of wildlife habitat, and greater maintenance of sustainable resources.

These Corps actions would be combined with actions of those managing the areas transferred to the State of South Dakota and to the BIA in trust for the LBST to further incrementally reduce the cumulative impacts on the environment that have occurred in the Big Bend project area. The resources of the State and the LBST would be added to Corps dredging funds, equipment, and expertise to reduce cumulative impacts of sediment on lake access. Incremental to the shoreline erosion reduction activities provided for in the updated Master Plan at Corps-owned areas, the LBST constructed a breakwater in a shallow area at Grassrope, and water is expected to deposit suitable sand and gravel to reduce cumulative effects of the Big Bend project on tern and plover habitat and shoreline erosion.

7 PUBLIC, AGENCY, AND TRIBAL COORDINATION

A news release inviting comments from the public on the draft of the updated Big Bend Dam/Lake Sharpe Master Plan and EA was distributed by the Corps' Omaha District Public Affairs Office May 24, 2004, to 14 regional newspapers and news services (Appendix C). Draft copies of the Master Plan update and EA were made available to the public on the Internet and at the Corps' Big Bend Project Office, the Rawlins Municipal Library in Pierre, and the Cozad Memorial Library in Chamberlain for a 30-day comment period, which ended June 25, 2004. No comments were received from the general public.

On May 24, 2004, letters were mailed to South Dakota congressional representatives notifying them of the distribution of the draft of the updated Big Bend Dam/Lake Sharpe Master Plan and EA to the appropriate agencies and Tribes (Appendix C). No comments were received from congressional representatives.

A paper copy of the updated Master Plan and the EA, and a compact disk containing these two documents, were mailed May 24, 2004 for a 30-day review and comment period to the following Federal agencies, Tribes, and State offices: U.S. Fish and Wildlife Service, Bureau of Indian Affairs, National Park Service, Environmental Protection Agency, Natural Resources Conservation Service, Santee Sioux Tribe of Nebraska, Omaha Tribe of Nebraska, Winnebago Tribe of Nebraska, Ponca Tribe of Nebraska, Yankton Sioux Tribe, Crow Creek Sioux Tribe, Flandreau Santee Sioux Tribe, Rosebud Sioux Tribe, Lower Brule Sioux Tribe, Three Affiliated Tribes, Cheyenne River Sioux Tribe, Standing Rock Sioux Tribe, Oglala Sioux Tribe, Assiniboine and Sioux Tribes of Fort Peck, Sisseton-Wahpeton Sioux Tribe, Northern Cheyenne Sioux Tribe, South Dakota Department of Game, Fish, and Parks, and South Dakota State Historical Society (Appendix C).

Two comments were received from agencies during the comment period ending June 25, 2004. A telephone comment was received from the U.S. Fish and Wildlife Service June 18, 2004 on revising wording in the EA regarding the effects of development proposed in the Master Plan on six species (Appendix C). The suggested “no effect” wording for the black-footed ferret and black-tailed prairie dog was incorporated. However, the Corps determined that the proposed development would not affect the bald eagle, interior least tern, piping plover, and pallid sturgeon and so did not use the phrase “may affect, but not likely to adversely affect” suggested by the U.S. Fish and Wildlife Service for those species. In a letter dated June 22, 2004, the South Dakota Department of Game, Fish, and Parks stated the agency had no comments on the update to the Big Bend Dam/Lake Sharpe Master Plan but desired improved coordination and a longer review and comment period for future master plans (Appendix C).

On May 3, 2004, prior to the completion of the EA, a consultation on the draft of the updated Big Bend Dam/Lake Sharpe Master Plan was held with all interested Tribes at the Great Plains Tribal Association meeting in Aberdeen, South Dakota. The only Tribal comment was an oral request from the Crow Creek Sioux Tribe for an additional consultation to be held in the vicinity of the Crow Creek Sioux Tribal Reservation. On June 29, 2004, letters were sent to Bureau of Indian Affairs (BIA) officials at the Great Plains Regional Office and at the Crow Creek Agency indicating that a consultation meeting would be held in the near future to discuss the draft of the updated Big Bend Dam/Lake Sharpe Master Plan and EA and extending the comment period until July 16, 2004 (Appendix C). No Tribal comments were received. Representatives of the BIA and the Crow Creek Sioux Tribe attended a consultation meeting with the Corps’ Big Bend Project Manager Konnie Olson and Park Manager Rod Vaughn on July 17, 2004. The BIA had no comments and stated that the Lower Brule Sioux Tribe had no comments. A letter from the Crow Creek Sioux Tribe, dated August 31, 2004, stated that the Tribe had no comments (Appendix C).

July 17, 2004. The BIA had no comments and stated that the Lower Brule Sioux Tribe had no comments. A letter from the Crow Creek Sioux Tribe, dated August 31, 2004, stated that the Tribe had no comments (Appendix C).

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8 REFERENCES

Backlund, Doug. 2004. Personal communication. Wildlife Biologist, Natural Heritage Program, South Dakota Department of Game, Fish, and Parks. Telephone conversation May 10, 2004 regarding the potential occurrence of threatened and endangered species at the Big Bend project.

Cairns, W.E. 1977. Breeding biology and behavior of the piping plover (*Charadrius melodus*) in southern Nova Scotia. M.S. Thesis. Dalhousie University.

Eco-Tech, Incorporated. 2001. Draft Biological Assessment for the Transfer of Federal Lands to the State of South Dakota. May 2001.

Ericson, J.D. 1992. Habitat selection and movement of pallid sturgeon in Lake Sharpe, South Dakota. Master's Thesis. South Dakota State University, Brookings.

Fritz, Mike. 1993. Western prairie fringed orchid. Nebraska Game and Parks Commission, Lincoln, Nebraska.

Gilbraith, D.M., M.J. Schwalbach, and C.R. Berry. 1988. Preliminary report on the status of the pallid sturgeon, *Scaphirhynchus albus*, a candidate endangered species. Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings. 76pp.

Haig, S.M., and L.W. Oring. 1985. The distribution and status of the piping plover throughout the annual cycle. *Journal of Field Ornithology* 56:334-345.

Janis, Ben. 2004. Personal communication. Fish and Wildlife Coordinator for the Lower Brule Sioux Tribe. Telephone conversation May 12, 2004 regarding the extent of prairie dog towns and the feasibility study for reintroduction of the black-footed ferret and swift fox on the Lower Brule Tribal Reservation.

Keenlyne, K.D., and L.G. Jenkins. 1993. Age at sexual maturity of the pallid sturgeon. *Transactions of the American Fisheries Society* 122:393-396.

Krentz, Steven. 2004. Personal communication. Supervisory Fishery Biologist, U.S. Fish and Wildlife Service, Bismarck, ND. Telephone conversation May 25, 2004 regarding pallid sturgeon captured in the 1990's in the Lake Sharpe vicinity.

Labor Market Information Center. 2003. Labor Force Statistics. Website: <http://www.state.sd.us/applications/ld54lmcinfo/labor/LFLISTPUBM.ASP>. Accessed July 25, 2003.

Lott, John. 2004. Personal communication. Fisheries Biologist, South Dakota Department of Game, Fish, and Parks. Telephone conversation May 10, 2004 regarding productivity in embayments and macrophyte infestations at Lake Sharpe.

Perkins, Keith, and Douglas C. Backlund. 2000. Freshwater Mussels of the Missouri National Recreational River below Gavins Point Dam, South Dakota and Nebraska. SDGFP Report 2000-1. Available at website: <http://www.usace.army.mil/html/pd-e/RecRiver/>, link "MNRRCclamreport.pdf".

Rombough, Kyrik. 2004. Personal communication. Natural Resources Engineering Specialist, Air Quality Program, South Dakota Department of Environment and Natural Resources. Telephone conversation May 17, 2004 regarding air quality in the five counties adjacent to the Big Bend project.

Schulenberg, J.H. and M.B. Placek. 1984. Status of the interior least tern in Kansas. American Birds 38:975-981.

Simpson, John. 2004. Personal communication. Grant and loan writer, South Dakota Department of Game, Fish, and Parks. Telephone conversation May 12, 2004 regarding outdoor recreation development at the Big Bend project using Land and Water Conservation Fund Act funding.

South Dakota Department of Game, Fish, and Parks (SDGFP). 2004. Threatened, Endangered, and Candidate Species of South Dakota. Updated March 15, 2004. Website: <http://www.sdgifp.info/wildlife/diversity/tes.htm>. Last accessed August 30, 2004.

Thompson, Pat. 2004. Personal communication. Regional Manager, Parks Division, South Dakota Department of Game, Fish, and Parks. Telephone conversation May 24, 2004 regarding sedimentation in the recreation area embayments managed by SDGFP.

U.S. Army Corps of Engineers (USACE). 1995. Design Memorandum MB-90, Master Plan, Big Bend Dam/Lake Sharpe, Missouri River, South Dakota. USACE, Omaha District. Updated March 1995.

USACE. 2000. Final Environmental Assessment for the Lease of 22 Recreation Areas at Lake Oahe, Lake Francis Case, and Lewis and Clark Lake to the State of South Dakota. USACE, Omaha District. December 2000.

USACE. 2001a. Final Environmental Impact Statement, Title VI Land Transfer to the State of South Dakota. Prepared for USACE, Omaha District by Mangi Environmental Group, Inc. 2 Volumes. November 2001.

USACE. 2001b. Revised Draft Environmental Impact Statement, Missouri River Master Water Control Manual. USACE, Northwestern Division. August 2001.

U.S. Department of Agriculture (USDA), Natural Resources Conservation Service, in cooperation with U.S. Department of the Interior (USDI), Bureau of Indian Affairs and South Dakota Agricultural Experiment Station. 1998. Soil Survey of Hyde County, South Dakota. USDA, Washington, DC.

USDA, Soil Conservation Service, in cooperation with USDI, Bureau of Indian Affairs and South Dakota Agricultural Experiment Station. 1975. Soil Survey of Hughes County, South Dakota. USDA, Washington, DC. January 1975.

USDA, Soil Conservation Service, in cooperation with USDI, Bureau of Indian Affairs and South Dakota Agricultural Experiment Station. 1985. Soil Survey of Brule and Buffalo Counties, South Dakota. USDA, Washington, DC. December 1985.

USDA, Soil Conservation Service and Forest Service, in cooperation with USDI, Bureau of Indian Affairs and South Dakota Agricultural Experiment Station. 1980. Soil Survey of Stanley County, South Dakota. USDA, Washington, DC. September 1980.

USDA, Soil Conservation Service and Forest Service, in cooperation with USDI, Bureau of Indian Affairs and South Dakota Agricultural Experiment Station. 1987. Soil Survey of Lyman County, South Dakota. USDA, Washington, DC. May 1987.

U.S. Fish and Wildlife Service (USFWS). 1978. Rehabilitation of Western Wildlife Habitat: A Review. FWS/OBS-78/86. USFWS, Fort Collins, Colorado. December 1978. 238 pp.

USFWS. 1988. Great Lakes and northern Great Plains piping plover recovery plan. USFWS, Twin Cities, Minnesota.

USFWS. 1989. Black-footed Ferret Survey Guidelines for Compliance with the Endangered Species Act. USFWS, Denver, Colorado, and Albuquerque, New Mexico.

USFWS. 1990. Interior population of the least tern (*Sterna antillarum*), Recovery Plan. USFWS, Region 3, Fort Snelling, Minnesota. 90 pp.

USFWS. 1993. Recovery plan for the pallid sturgeon (*Scaphirhynchus albus*). USFWS, Bismarck, North Dakota. 55 pp.

USFWS. 1997. Ongoing pallid sturgeon nationwide database. USFWS, Bismarck, North Dakota.

USFWS. 2000. Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System. USFWS, Region 6, Denver, Colorado, and Region 3, Fort Snelling, Minnesota.

USFWS. 2004a. Endangered Species by County List: South Dakota. Updated January 7, 2004. Website: <http://www.southdakotafieldoffice.fws.gov/Endspbycounty.htm>. Last accessed August 30, 2004. USFWS, Mountain-Prairie Region, South Dakota Ecological Services Field Office.

USFWS. 2004b. Candidate Species by County List: South Dakota. Updated August 16, 2004. Website: http://www.southdakotafieldoffice.fws.gov/cty_cand.htm. Accessed August 30, 2004. USFWS, Mountain-Prairie Region, South Dakota Ecological Services Field Office.

Wolf, Kristy. 2004. Personal communication. Wildlife Biologist, Crow Creek Sioux Tribe. Telephone conversation May 18, 2004 regarding wildlife habitat and threatened and endangered species on the Crow Creek Tribal Reservation.

EXHIBIT A:

**COMPLIANCE WITH
ENVIRONMENTAL STATUTES**

COMPLIANCE WITH ENVIRONMENTAL STATUTES
Environmental Assessment
October 2003 Update of Design Memorandum MB-90
Big Bend Dam/Lake Sharpe Master Plan
Missouri River, South Dakota

American Indian Religious Freedom Act (AIRFA) of 1978, 42 U.S.C. 1996.

In compliance. AIRFA protects the rights of Native Americans to exercise their traditional religions by ensuring access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. No proposals in the updated Big Bend Master Plan would adversely affect the protections offered by this Act. Access to sacred sites by Tribal members would not be affected.

Archaeological Resources Protection Act (ARPA) of 1979, 16 U.S.C. Sec. 470aa-11.

In compliance. This act protects archeological resources and sites that are on public lands and Indian lands, and fosters increased cooperation and exchange of information between governmental authorities, the professional archeological community, and private individuals. It also establishes requirements for issuance of permits by the Federal land managers to excavate or remove any archeological resource located on public lands or Indian lands. All persons proposing to engage in archeological excavation on Big Bend project lands are required to apply for and obtain an ARPA permit.

Bald Eagle Protection Act, 16 U.S.C. Sec. 668, 668 note, 668a-668d.

In compliance. The Endangered Species Act (ESA) contains requirements on Corps projects concerning bald eagles. See Endangered Species Section of the EA.

CEQ Memorandum, August 10, 1980, Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory.

Not applicable. This memorandum states that each Federal agency shall take care to avoid or mitigate adverse effects on rivers identified in the Nationwide Inventory (FR 1980). No portion of the Big Bend project is listed on the Nationwide Rivers Inventory.

Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.

In compliance. The purpose of this Act is to protect public health and welfare by the control of air pollution at its source, and to set forth primary and secondary National Ambient Air Quality Standards (NAAQS) to establish criteria for States to attain, or maintain. The South Dakota Department of Environment and Natural Resources stated that Buffalo, Hughes, Hyde, Lyman, and Stanley counties are in attainment of all NAAQS (Rombough 2004). Some temporary emission releases may occur during construction activities proposed in the updated Master Plan; however, air quality would not likely be impacted to any measurable degree.

Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.

In compliance. The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters (33 U.S.C. 1251). The Corps regulates discharges of dredge or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act. The selection of disposal sites for dredged or fill material is done in accordance with the Section 404(b)(1) guidelines, which were developed by the U.S. Environmental Protection Agency (see 40 CFR Part 230). The permit decision is generally based on the outcome of a public interest balancing process where the benefits of the project are balanced against the detriments. A permit will be granted unless the proposal is found to be contrary to the public interest. Section 401 of the Clean Water Act allows states to grant or deny water quality certification for any activity that results in a discharge to, or placement of fill material into, waters of the United States and requires a Federal permit or license. Certification requires a finding by the State that the activities permitted will comply with all water quality standards individually or cumulatively over the term of the

permit. Any action involving placement of fill in waters of the U.S. at or below 1422 feet m.s.l. at the Big Bend project by the Corps, a non-Corps entity, or any individual would require a Section 404 authorization and Section 401 water quality certification.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

In compliance. Typically CERCLA is triggered by (1) the release or substantial threat of a release of a hazardous substance into the environment; or (2) the release or substantial threat of a release of any pollutant or contaminant into the environment which presents an imminent threat to the public health and welfare. To the extent such knowledge is available, 40 CFR Part 373 requires notification of CERCLA hazardous substances in a land transfer. Compliance with this act is required on a case-by-case basis for real estate activities such as easements, grants, etc.

Endangered Species Act, as amended. 16 U.S.C. 1531, et seq.

In compliance. Section 7 (16 U.S.C. 1536) states that all Federal departments and agencies shall, in consultation with and with the assistance of the Secretary of the Interior, insure that any actions authorized, funded, or carried out by them do not jeopardize the continued existence of any threatened or endangered (T&E) species, or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary to be critical. Corps management and construction activities proposed by the updated Master Plan would have no effects on Federally listed or candidate T&E species known to exist in Big Bend project areas for which the Corps is responsible. Corps activities would avoid disturbing nesting sites of piping plovers, interior least terns, and bald eagles; would avoid disturbing winter roosting sites of bald eagles; and would avoid impacts to the pallid sturgeon, American burying beetle, black-tailed prairie dog, and any reintroduced black-footed ferrets, as detailed in the EA for the updated Master Plan. The Corps determined that no T&E species would be affected by activities proposed in the updated Master Plan. The USFWS concurred in these determinations except for the bald eagle, interior least tern, piping plover, and pallid sturgeon, which USFWS considered would be affected, but would not likely be adversely affected.

Environmental Justice (E.O. 12898).

In compliance. Federal agencies shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. The updated Master Plan does not disproportionately impact minority or low-income populations. It proposes construction of a Cultural Learning Center highlighting culture and history of Native American Tribes; disseminates information about a driving tour through Tribal Reservations adjacent to the Missouri River mainstem reservoirs, which could increase tourist spending on the Reservations; provides protection for cultural resource sites and Tribe-identified Traditional Cultural Properties; and proposes construction projects on Corps-owned lands that could provide temporary employment for some Native Americans.

Farmland Protection Policy Act, 7 U.S.C. 4201, et seq. (Subtitle I of Title XV of the Agriculture and Food Act of 1981), effective August 6, 1984.

In compliance. This Act instructs the Department of Agriculture, in cooperation with other departments, agencies, independent commissions and other units of the Federal government, to develop criteria for identifying the effects of Federal programs on the conversion of farmland to nonagricultural uses. The updated Master Plan proposes planting food plots for wildlife on Corps-owned lands that were previously cultivated and does not propose taking any prime or unique farmland out of agricultural production.

Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq.

In compliance. The Act establishes the policy that consideration be given to the opportunities for outdoor recreation and fish and wildlife enhancement in the investigating and planning of any Federal navigation, flood control, reclamation, hydroelectric or multi-purpose water resource project, whenever any such project can reasonably serve either or both purposes consistently. Big Bend project purposes include recreation and fish and wildlife enhancement, and the updated Master Plan includes project-wide goals and site-specific resource objectives and development needs that relate to recreation and to fish and wildlife.

Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.

Not applicable. The FWCA requires governmental agencies, including the Corps, to coordinate activities so that adverse effects on fish and wildlife will be minimized when the waters of any stream or other body of water are proposed for modification. The updated Master Plan does not propose any Corps actions that involve modifications to Lake Sharpe or its tributary streams.

Floodplain Management (E.O. 11988).

In compliance. Section 1 requires each agency to provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Any development proposed in the updated Master Plan must be in compliance with Northwestern Division (NWD) Regulation 1110-2-5, Land Development Guidance at Corps Reservoir Projects, dated April 30, 2004. This regulation establishes NWD guidance for evaluating land development proposals within Corps reservoir projects with authorized flood storage allocations. The Corps has responsibility to assure that the authorized project purposes are not compromised, that the public is not endangered, and that natural and cultural resources associated with project lands are not harmed, in accordance with applicable Federal and State regulations. The criteria and procedures for evaluation of development proposals in this regulation are to assist in meeting these responsibilities and complying with applicable laws and directives. Existing structures are exempted from this policy. However, significant modifications and/or replacement of existing structures are subject to this policy.

Indian Sacred Sites (E.O. 13007).

In compliance. This Executive Order requires that agencies avoid damage to Indian sacred sites on Federal land, and avoid blocking access to such sites for traditional religious practitioners. The Federal Government gives Tribes notice when an impact to a sacred site occurs. All ground-disturbing activities proposed on Big Bend project lands will continue to be coordinated in advance with the Tribes.

Land and Water Conservation Fund Act (LWCF), as amended, 16 U.S.C. 4601-4601-11, et seq.

In compliance. Planning for recreation development at Corps projects is coordinated with the appropriate states so that the plans are consistent with public needs as identified in the State Comprehensive Outdoor Recreation Plan (SCORP). The Corps must coordinate with the National Park Service (NPS) to insure that no property acquired or developed with assistance from this Act will be converted to other than outdoor recreation uses. If conversion is necessary, approval of NPS is required, and plans are developed to relocate or re-create affected recreational opportunities. The South Dakota Department of Game, Fish, and Parks (SDGFP) used LWCF funds to develop some recreation facilities at the West Bend Recreation Area, which was not transferred under Title VI legislation, but the SDGFP is continuing to manage the area for outdoor recreation (Simpson 2004).

Migratory Bird Treaty Act of 1918 as amended, 16 U.S.C. 703-711, et seq.

In compliance. The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that affirms, or implements, the United States' commitment to four international conventions with Canada, Japan, Mexico and Russia for the protection of shared migratory bird resources. The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent over-utilization. Executive Order 13186 (2001) directs executive agencies to take certain actions to implement the act. When development is scheduled to occur, compliance with the MBTA would be considered along with environmental compliance for the specific activities.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq.

In compliance. This environmental assessment (EA) and finding of no significant impact (FONSI) have been prepared for the proposed action. An environmental impact statement is not required.

National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.

In compliance. Federal agencies having direct or indirect jurisdiction over a proposed Federal or Federally assisted undertaking shall take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. All ground-disturbing activities proposed on Big Bend project lands are coordinated in advance with the State Historic Preservation Officer, Advisory Council for Historic Preservation, Tribes and any other interested parties under Section 106 of the Act.

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, as amended, 25 U.S.C. Sec. 3001 to 3013.

In compliance. This Act provides for the protection of Native American and Native Hawaiian cultural items. It establishes a process for the authorized removal of human remains, funerary, sacred, and other objects of cultural patrimony from sites located on land owned or controlled by the Federal Government. NAGPRA requires Federal agencies and Federally assisted museums to return specified Native American cultural items to the Federally recognized Indian tribes or Native Hawaiian groups with which they are associated. Notification of all inadvertent discoveries of such items covered by the Act are reported to the appropriate affiliated descendant or Tribe in order of precedence as set by the Act. Any claims to such items are reviewed and the procedures to repatriate within the Act are followed.

Noise Control Act of 1972, 42 U.S.C. Sec. 4901 to 4918.

In compliance. This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Federal agencies are required to limit noise emissions to within compliance levels. Noise emission levels at sites where development was proposed in the updated Master Plan would increase above current levels temporarily during periods of construction; however, appropriate measures will be taken to keep the noise level within the compliance levels.

North American Wetlands Conservation Act, 16 U.S.C. Sec. 4401 et seq.

In compliance. This Act establishes the North American Wetlands Conservation Council (16 U.S.C.4403) to recommend wetlands conservation projects to the Migratory Bird Conservation Commission. Section 9 of the Act (16 U.S.C. 4408) addresses the restoration, management, and protection of wetlands and habitat for migratory birds on Federal lands. Federal agencies acquiring, managing, or disposing of Federal lands and waters are to cooperate with the Fish and Wildlife Service to restore, protect, and enhance wetland ecosystems and other habitats for migratory birds, fish and wildlife on their lands, to the extent consistent with their missions and statutory authorities. The updated Master Plan proposes no activities that involve filling in or draining wetlands; proposes shoreline erosion protection activities that involve creation of littoral and epilittoral wetlands along the shoreline at Lake Sharpe; and proposes the planting of cattails, bulrushes, and marsh grasses for improvement of fish and migratory waterfowl habitat.

Protection of Wetlands (E.O. 11990).

In compliance. Federal agencies shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies' responsibilities. Each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands, which may result from such use. In making this finding the head of the agency may take into account economic, environmental and other pertinent factors. Each agency shall also provide opportunity for early public review of any plans or proposals for new construction in wetlands. Prior to construction of any facilities proposed in the updated Master Plan, a site-specific NEPA analysis, including an assessment of potential impacts to wetlands, would be coordinated with Federal and State agencies and Tribes. If a Section 404 permit is required, coordination regarding compliance with EO 11990 would be accomplished prior to permit issuance.

Reservoir Salvage Act, as amended, 16 U.S.C. Sec. 469.

In compliance. This Act provides for (1) the preservation of historical and archeological data that might otherwise be lost or destroyed as the result of flooding or any alteration of the terrain caused as a result of any Federal reservoir construction projects; (2) coordination with the Secretary of the Interior whenever activities may cause loss of scientific, prehistorical, historical, or archeological data; and (3) expenditure of funds for recovery, protection, and data preservation. Any construction proposed at the Big Bend Project connected to operation and maintenance of the facility is reviewed in advance by the Corps' Omaha District cultural resources staff. In all cases avoidance of historic properties is the preferred alternative. When such disturbance is unavoidable, suitable protection or data recovery will be implemented as required by the Act.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

In compliance. This law prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers. The law specifically exempts Corps of Engineers' activities from regulation under Section 10. However, activities by non-Corps entities in waters of the U.S. at the Big Bend project are regulated under Section 10. Work such as a boat dock installation or water intake line requires a Section 10 permit application; for work that includes placing fill, a joint Section 404/10 permit application can be made.

Watershed Protection and Flood Prevention Act, 16 U.S.C. 1101, et seq.

Not applicable. This Act authorizes the Secretary of Agriculture to cooperate with states and other public agencies in works for flood prevention and soil conservation, as well as the conservation, development, utilization, and disposal of water. This act imposes no requirements on Corps Civil Works projects.

Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.

Not applicable. This act establishes that certain rivers of the Nation, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values; shall be preserved in free-flowing condition; and shall be protected for the benefit and enjoyment of present and future generations. The Missouri River reach where the Big Bend project is located is not designated as a wild or scenic river, nor is it, or any nearby tributaries, on the National Inventory of Rivers potentially eligible for inclusion in the wild and scenic rivers system.