

Report on Red River Valley Water Supply Project Needs and Options

Recreation Needs Assessment

Final Report



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INTRODUCTION

The purpose of this Recreation Needs Assessment is to identify the recreational water needs of the Red River Valley in North Dakota. This report is part of a needs assessment for the Red River Valley Water Supply Project. The purpose of the Red River Project is to meet the comprehensive water quality and quantity needs of the Red River Valley. The project's authorizing legislation (the Dakota Water Resources Act of 2000) identifies those needs as municipal, rural, and industrial water; water quality; aquatic needs; recreation; and water conservation measures. The Act directs the Secretary of the Interior to complete a *Report on the Red River Valley Water Needs and Options* (Needs and Options Report) and to jointly prepare an Environmental Impact Statement for the project with the state of North Dakota.

The information provided in this report is divided into consumptive and nonconsumptive water use. Consumptive water use means water that it is not available for other uses. An example of a recreational consumptive water use is irrigation of a soccer field. The volume of water used for irrigation that is not returned to the system is not available for other uses. Nonconsumptive water use is defined as a use of water such that it is available for other purposes. An example of a recreation nonconsumptive use is canoeing. Water is needed to experience enjoyable canoeing, but once the canoeing is over, the amount of water in the river is unchanged and available for other uses.

The delineation of consumptive and nonconsumptive water use is an important component of estimating future water needs identified in this report. Consumptive uses will be included in the Needs and Options Report analysis. Nonconsumptive recreation water use will be used in the Red River Project Environmental Impact Statement to evaluate the impacts on recreation by each of the alternative.

To quantify recreational water needs, this report identifies existing water-related recreation facilities and opportunities on the Sheyenne River and on the Red River of the North. Information on national and state participation levels, trends, and recreation demand is discussed. Recreation demands are based on a variety of factors including, but not limited to, age, race and ethnicity, migration, water quality, and water quantity. Based on local and state planning documents and a literature review of other reports and studies, recommendations are presented regarding management actions that may be needed in the future to meet public demand. Where possible, identification of future recreation activities and opportunities are discussed in terms of future water needs that may be required to sustain or enhance such activities and opportunities.

METHODS

The recreation information in this report discusses water-based and water-dependent recreation facilities and opportunities on or immediately adjacent to the Sheyenne and Red Rivers. Water-dependent activities are those in which water is essential to the activity. These include fishing, boating, swimming, rafting, canoeing, and most waterfowl hunting. Water-based activities are those for which water is not required, but for which water greatly contributes to the quality of the recreation experience. These activities include, but are not limited to, camping, hiking, viewing scenery, studying nature, and watching wildlife. Many of the recreation facilities and opportunities discussed would probably not exist without riparian river corridors created by these rivers. Water-related recreation facilities such as golf courses, ball fields, and urban parks use water to sustain vegetation and are included.

The recreation-related information used in this assessment was obtained from existing studies and reports that address recreation activities on rivers and streams in North Dakota in addition to reports and studies dealing with water-related recreation in the United States. Because the Red River forms a boundary between North Dakota and Minnesota, information from Minnesota on use of that river was also included. No studies have been initiated to supplement existing information.

Quantifying water needs for the different activities discussed in this report is difficult because information on a local and national level is limited or nonexistent. It is common for consumptive uses of water for agricultural, industrial, or municipal purposes to be quantified and well documented, whereas nonconsumptive uses of water for recreation and for fish and wildlife purposes are not quantified or well documented. In addition, no information is available that quantifies water needs for fishing and hunting. Usually, the recreation user only gets to use and enjoy water as it flows through the drainage system before it is used downstream for other purposes. The legal and institutional aspects of water rights and instream flows for specific purposes are not covered in this report.

RECREATION SETTING OF THE RED RIVER VALLEY

Sheyenne River

The Sheyenne River is a major tributary that drains into the Red River. The Sheyenne River originates in Sheridan County in central North Dakota and winds its way through the south-central part of the state, ultimately emptying into the Red River north of Fargo. During its course, the Sheyenne River traverses a variety of terrains, including flat plains, rolling sandhills, wide bottomland, tall grass prairie, and



Harvey Lake day-use area.

hardwood forests (U. S. Geologic Survey [USGS] 2003). As the Sheyenne River meanders in a southeasterly direction for approximately 542 miles, it passes through private, state, and federal lands. Cities such as Harvey, Sheyenne, Cooperstown, Sibley, Valley City, Fort Ransom, Lisbon, Kindred, West Fargo, and Fargo are adjacent to the river. Public access tends to be limited along several reaches because of private ownership of the lands adjacent to the river. Public access is provided along numerous state and federal highways; several county and secondary roads; state and federal recreation sites and by access points provided by the cities adjacent to the river (Figure 1).

The Sheyenne River flows within North Dakota State Planning Regions 3, 5, and 6, as described in the 2003-2008 State Comprehensive Outdoor Recreation Plan (SCORP). These planning regions include parts of the counties of Sheridan, Wells, Bensen, Eddy, Nelson, Griggs, Barnes, Ransom, Cass, and Richland (Figure 1, Recreation Setting). The area offers a variety of recreational opportunities.

Red River Of The North

The recreation setting involves the Red River as it flows north from Wahpeton, North Dakota, to the United States and Canadian international border just north of Pembina, North Dakota. The Red River is the state boundary between North Dakota and Minnesota. As the river flows north to the international border for approximately 394 miles, it passes through private, state, and county lands and through or adjacent to several cities including Wahpeton, Fargo, Grand Forks, Drayton, and Pembina, North Dakota; and Breckenridge, Moorhead, Halstad, and East Grand Forks, Minnesota. General access to the river is provided by numerous North Dakota roadways off Interstate 29 and several Minnesota state highways, and numerous county and secondary roads. Access points can be found in cities and towns along the river. However, like the Sheyenne River, direct access to the Red River is limited because most of the lands adjacent to the river are privately owned.

The Red River is within North Dakota State Planning Regions 4 and 5, as described in the 2003-2008 SCORP. The planning regions include the counties of Steele, Traill, Cass, Richland, Pembina, Walsh, and Grand Forks. The Red River is also within the Minnesota counties of Wilkin, Clay, Norman, Polk, Marshall, and Kittson



Red River at Cass County Road 34, ND.

(Figure 1, Recreation Setting, for city, county, and road locations). The Minnesota counties are within the recreation areas of Fergus Falls, Moorhead, Ada, Crookston, Thief River Falls, and Hallock, as described in the State of Minnesota's Public Recreation Information Map. The Public Recreation Information Maps provide a comprehensive overview of the recreational facilities and opportunities in the state.

Red River Valley Water Needs and Options



The Red River offers residents and nonresidents a wide variety of outdoor recreational opportunities. In addition, the region offers many points of interest, including Icelandic and Turtle River State Parks and many wildlife management areas and historic sites in North Dakota and the Detroit Lakes recreation areas, state wildlife areas, historic sites, and state parks in Minnesota.

EXISTING RECREATION ENVIRONMENT

Information pertaining to the types of existing recreation facilities and opportunities in North Dakota and Minnesota, and recreation participation levels for both states and on a national level, can establish a baseline for assessing future needs. Factors and attributes that influence recreation such as water quality and streamflows are important aspects of the existing and future recreation environment. Recreation trends and the principal recreation providers (i.e., federal, state, local, and private) can be used to describe the existing recreation environment.

National Recreation Environment

The following information is intended to complement existing state and local data. By documenting the current national recreation environment and comparing it with the predicted future recreation conditions (which are based on future trends, user preferences, and other factors), resource managers can focus their efforts on establishing the appropriate types and quantities of recreation facilities and opportunities. These facilities and opportunities could be offered in concert with an appropriate water supply to provide the public with a variety of quality recreation experiences within the Red River Valley. However, recreation planners realize national trends may not reflect trends on a state or local level, and state and local trends may not be well established due to lack of data. The available state and local data are generally used to plan future recreation needs and opportunities.

National Trends Influencing Water-Related Recreation Activities

Recreation-related trends may influence future demand for creation of new or different types of public outdoor recreation opportunities. This discussion of national trends dealing with specific activities focuses on participation levels projected through the year 2050. Several key national trends related to future water recreation management and participation levels pertinent to this study are discussed in this section.



Treefoil Park, Fargo, North Dakota.

As society becomes more urbanized, travel patterns (including length of stay, repeated visitation, and distance traveled) will be increasingly dependent on the quality of the recreation opportunities and the recreation settings provided (Tarrant, Michael A. et al., 1999, as cited in USDA 2003). Urban residents typically have fewer outdoor recreation opportunities than rural residents, which results in increased demand for outdoor recreation opportunities and activities closer to urban areas.

Activities occurring on trails, streets, and roads continue to be popular. Walking, hiking, running, jogging, and bicycling can be done in a rural setting, but are most often done in an urban environment.

Projections for many water-dependent activities such as visiting beaches or water areas, canoeing, motorboating, nonpool swimming, and rafting show increases over projected population growth through the year 2050 (Bowker, J.M. et al., as cited in USDA 2003).

Nationally, hunting is expected to decline in popularity from 19 million to 16.5 million participants over the next 50 years. The National Survey of Fishing, Hunting, and Wildlife Associated Recreation reported a 4 percent decline in anglers nationwide from 1991 to 2001 (a 3 percent decline from 1996 to 2001). This reflects a trend, but not a significant one¹. It should be noted, however, that there were increases in fishing in the West North Central Region, which includes the states of North Dakota and Minnesota. Hunting nationwide declined by 7 percent from 1991 to 2001. Conversely, the West North Central Region showed no decline from 1991 to 2001 (U.S. Fish and Wildlife Service [Service 2001]).



City Park, Valley City, North Dakota.

Nonconsumptive wildlife activities such as birdwatching, photography, and other types of wildlife viewing are projected to increase more than the population growth through the year 2050. The largest factor contributing to the increase in nonconsumptive wildlife recreation seems to be the increasing age of the general population. Residential (close to home) wildlife watching rebounded slightly from its 1991 to 1996 declines. From 1996 to 2001, wildlife watching in the West North Central Region increased 21 percent (Service 2001).

Developed land activities such as camping, family gatherings, visiting historic places, sightseeing, and walking are expected to increase at a rate greater than population

¹ Statistical comparisons are made at the 5-percent level. This means that for 95 percent of all possible samples, the estimate for 1991 cannot be shown to be different from the estimate of 2001.

growth through 2050 for all regions of the United States. In the northern states, participation levels for biking and picnicking are also expected to increase, but at a slower rate.

Recreation research shows that demographic factors such as age, race or ethnicity, gender, wealth or income, education, and previous experience influence recreation behavior. The largest change expected in factors influencing recreation behavior relates to increases in population and real income. Population, age, and gender ratio are expected to change relatively little, whereas the percentage of whites in the population should decline as other racial groups grow at faster rates (Hof et al. 1983; Walsh et al. 1992 as cited by USDA 2003).

Of the outdoor recreation activities reviewed, those projected to grow fastest through 2050 measured by participation levels are visiting historic places, wildlife viewing, sightseeing, and biking. The slowest growing activities are projected to be rafting, hunting, and fishing. Hunting is the only activity projected to decline substantially below projected population increases. Demographic factors will continue to influence how water-based recreation is managed. Future vacationers are expected to stay longer at their destinations and participate in a variety of recreational pursuits rather than in one primary activity.

National Participation Levels

Identifying recreation participation levels is important for effective management of the natural environment for recreation purposes. It can help land and water management agencies forecast changes that may be required to meet demand. Table 1 shows recreation activities and corresponding participation levels in the United States. The percentages do not total 100 percent because recreationists often participate in more than one activity on a particular visit/trip.

Table 1. – Participation in Outdoor Water Recreational Activities by Percentage of the Total Population of the United States

Activity	Percent	Activity	Percent
Swimming	39.0	Floating, rafting	7.6
Boating (any)	30.0	Canoeing	6.6
Fishing (any)	29.1	Sailing	4.8
Studying nature near water	27.6	Personal watercraft	4.7
Camping (any)	26.8	Rowing	4.2
Freshwater fishing	24.4	Migratory bird hunting	2.1
Motorboating	23.4	Windsurfing	1.1
Saltwater fishing	9.50	Kayaking	0.7
Water skiing	8.90		

Source: U.S. Department of the Interior and U.S. Department of Commerce, 1996.

A more recent national survey in 1999 also identified swimming, fishing, and boating as the three most popular water-dependent activities, with swimming and fishing among the top five most popular outdoor recreation activities overall (Recreation Roundtable 2000, as cited in USDA 2003). Table 2 shows the results of a 1994-95 national survey that identified the seven most popular outdoor recreation activities and their participation levels.

Table 2. – Participation Levels for the Seven Top Outdoor Recreation Activities by Percentage of the Total Population of the United States

Type of outdoor activity	Percent of population	Number in millions
Camping (all overnight)	26.3	52.8
Hunting	9.3	18.6
Fishing	28.9	57.9
Boating/floating	29.0	58.1
Swimming	54.2	108.6
Outdoor adventure activities	36.8	73.6
Social activities	67.8	135.9

Source: 1994-95 National Survey on Recreation and the Environment, USDA Forest Service and the University of Georgia, Athens, Georgia, as cited in USDA, 2003.

The National Survey of Fishing, Hunting, and Wildlife Associated Recreation (Service 2001) states that 39 percent (82 million) of United States residents 16 years and older enjoyed some activity related to fish and wildlife (e.g., hunting, fishing, and watching wildlife). The region with the highest participation rates among its residents for hunting, fishing, and wildlife watching was the West North Central part of the United States. This region includes the states of Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. The participation rates in this region were 12 percent of the population for hunting, 27 percent for fishing, and 41 percent for wildlife watching.

Setting Attributes

Recreation setting attributes² are usually specific to a type of recreation area. Public satisfaction with certain attributes associated with a particular recreation setting is a factor that can aid in identifying future recreational needs. If users are not happy with a particular attribute, they are likely to seek alternative sites or substitute activities. Setting attributes that may contribute to user satisfaction of a site include fees, carrying capacity, site information, access, streamflows, water quality, health and safety, and general facility availability and conditions.

By identifying user satisfaction of selected attributes within a recreation setting, managers can concentrate their time and funding resources on enhancing those

² For the purposes of this document, an attribute is defined as a site condition users consider important for a quality recreation experience and will result in return visits to the site (e.g., solitude, scenery, adequate riverflow or reservoir elevation, shower, restroom, and boat ramp).

attributes that have low visitor satisfaction. In addition, as the population of the United States becomes more ethnically, socially, and economically diverse, recreation managers may have to modify attributes of outdoor settings to accommodate new demands.

Carrying Capacity

Social carrying capacity differs among users and depends on the type of experience being sought and the tolerance of the individuals or groups using the resource. Flows in the river system may affect the social carrying capacity of a river. If the usable surface acres of a river increase, the ability of recreationists to tolerate the presence of another user also increases. Likewise, if usable surface acres are small, the river system will not socially accommodate as many recreation users. If use increases over time, and the river acres remain constant, the river will eventually reach its social capacity limit (i.e., recreationists will reach a limit where they will not tolerate the sights and sounds of other users).

Physical carrying capacity of a river system can be increased or decreased by regulating flows that pass through the system (i.e., the usable acres available to a recreation user to participate in a specific activity can be increased or decreased by regulating the volume of water released into the system). Currently, however, the ability to regulate flows in the Sheyenne and Red Rivers is limited.

Environmental carrying capacity limits can be affected by river volume and timing of releases. High flows, or in some instances low flows, may negatively affect fish habitat and waterfowl nesting areas. High flows or excessive bank fishing over extended periods may cause unnecessary bank erosion. In addition, recreation activities may affect fish and wildlife in a variety of ways such as disruption of waterfowl nesting and feeding areas, alteration of waterfowl flight patterns, destruction of aquatic vegetation, and increased pollution from boat motors and human litter and waste.

Facility carrying capacity can be affected by increasing riverflows (i.e., if riverflows were optimized to enhance canoeing activities over extended periods of time, existing use of limited launch sites and support facilities may increase). This may cause overuse and deterioration of existing facilities.

Recreation Providers

Primarily four providers make outdoor recreation in the United States available: federal, state, and local governments, and the private sector. Recreation occurs in rural settings such as parks, forest, lakes and streams, and in urban settings such as urban parks and sports complexes that meet the immediate needs of urban recreationists. Following is a brief discussion of the four main providers of recreation opportunities in the United States.

Federal - The Federal Government is the largest provider of public outdoor recreation, providing approximately 650 million acres (about 28 percent of the total land area of the lower 48 contiguous states). Most federal land management agencies offer recreation that is primarily land based rather than water based. However, those land management agencies, the Bureau of Land Management, U.S. Forest Service, and Fish and Wildlife Service, also manage recreation facilities and opportunities near streams, rivers, and lakes. Water management agencies, Reclamation, Corps of Engineers (COE), and Tennessee Valley Authority, primarily focus on managing water-based and water-dependent recreation activities. The National Park Service manages not only land-based recreation facilities and opportunities but also activities that focus on water resources at national rivers, national seashores, and national lakeshores. National recreation areas and national Wild and Scenic Rivers are managed by a variety of agencies.

State - State acres available for recreation include state park lands (11.8 million acres), state forest lands (50.28 million acres), state wilderness lands (1.67 million acres), and state fish and wildlife lands (11.6 million acres).³ Recreation facilities and opportunities provided by states typically are offered at larger state park areas and smaller historic sites. Areas provided in the state park system are typically smaller than the federally-managed parks and somewhat larger than the more intensely developed local parks. State governments also play a significant role in conserving and managing the states' wildlife populations. State fish and wildlife lands tend to support opportunities that are more primitive and more dispersed settings than those found in state park systems. State forests offer outdoor recreation opportunities that are typically more primitive and dispersed. However, the recreation aspects of state forests are less known because management of state forests usually focuses on timber production and other timber-related activities. Like state forest and fish and wildlife lands, state wilderness areas offer more primitive and dispersed recreation opportunities than state park systems.

Local - The number of recreation acres supported by local entities is unknown. Because the recreation areas provided by local and municipal entities are small compared with state managed areas, the acreage for recreation provided by local and municipal entities is probably significantly less than that provided by state governments. Nevertheless, the President's Commission on America Outdoors estimated in 1987 that 60 percent of the nation's recreation areas were supported by local government, most of which were highly developed and managed for intensive use (Betz, Carter J. et al. 1999, as cited in USDA 2003).

³ The 11.6 million acres estimated for State fish and wildlife lands is an average of two reports, each reporting different estimates. A 1995 Bureau of Land Management report estimated 9.3 million acres, and a 1989 Recreation and Park Association assessment estimated 14 million acres, as documented by USDA, 1999.

Private - Nearly 60 percent of the land in the United States is privately owned (Teasly, Jeff R. et al. 1999, as cited in USDA 2003). Private lands support a large variety of recreation activities. Much of the nation's private land is open to recreation without restrictions. Other private land is available to the recreating public through leasing or by obtaining permission. The 181 million acres of private land available for recreation includes 130.48 million acres open to the general public and 50.57 million acres leased to individuals and groups. Access to private rural lands is important because public lands cannot meet the existing and future recreation demand. Without private lands, the natural resources of existing rural and urban public parks may become overused and degraded.

Red River Basin Recreation Environment

The types of recreation activities that are popular on a national scale are also the types that occur on or adjacent to the Sheyenne and Red Rivers. For the purposes of this report, it was assumed that the portions of Minnesota included in the project area have a recreation environment similar to that of North Dakota regarding activities, participation levels, trends etc.

Approximately 89 percent of North Dakota is in private ownership, 8 percent is public ownership, and 2 percent is tribal trust lands. Of the 8 percent in public ownership, 5.2 percent is owned in fee title by the federal government (including water acres such as Lake Ashtabula) and 2.3 percent is in state ownership (North Dakota Game and Fish Department 1999).

In 1996, fishing, sightseeing, walking/jogging, camping, boating/water skiing, picnicking, hunting, and bicycle riding were the most popular river-related recreation activities for residents of North Dakota (ND Parks and Recreation Department 1997). Fishing continues to be the number one water recreation activity for the state. Of the total population of North Dakota, approximately 179,000 people (28 percent) participated in fishing activities, 139,000 people (22 percent) participated in hunting activities, and 190,000 people (30 percent) participated in wildlife watching activities. Approximately 1,624,000 Minnesotans (33 percent) participated in fishing, 597,000 (12 percent) participated in hunting, and 2.5 million (51 percent) participated in wildlife watching (Service 2001).

North Dakota river recreation participants reported taking part in recreation activities most often during summer months (June, July, and August). About 34 to 39 percent of the statewide river recreation users participated in May and September. Statewide, March had the lowest recreation use. Most users participated in recreation activities during June (69.9 percent), July (75 percent), and August (58.8 percent) (ND Parks and Recreation Department 1997). Except for fishing and some other activities, most of the recreation activities were land activities that are water based. The optimum time for river-dependent activities like canoeing and rafting is earlier in the year (April and May), when flows are historically higher. Other river-dependent

activities such as fishing, swimming, and tubing occur primarily in June, July, and August, when the weather is typically better and flows allow easy access to the river and associated beach and fishing areas (Reclamation 1999).

Sheyenne River Recreation Environment

River-based and associated water-dependent recreation activities on the Sheyenne River are important to North Dakotans. The Sheyenne River is ranked fourth in recreation use in the state, behind the Missouri, Red, and Little Missouri Rivers. The Sheyenne River offers a wide variety of urban and rural public recreation facilities and opportunities. The river attracts visitors who participate in water-dependent recreation activities such as canoeing, rafting, and fishing and water-based activities such as hunting, camping, wildlife and scenic viewing, and hiking (Figure 2, Sheyenne River Recreation Map).

According to the 1997 North Dakota State Parks study, Sheyenne River recreation activities include walking/jogging (20.1 percent), fishing (13 percent), sight-seeing (10.5 percent), hunting (10.4 percent), hiking (8.3 percent), photography (8.3 percent), and picnicking (6.3 percent).

Public Recreation Areas

Visitors to the Sheyenne River have access to a wide variety of public lands such as the Lake Ashtabula/Baldhill Dam, Lonetree Wildlife Management Area, Fort Ransom State Park, H.R. Morgan State Nature Preserve, and the Sheyenne National Grasslands, among others.

Lake Ashtabula/Baldhill Dam - Lake Ashtabula is a popular area for water-related recreation along the Sheyenne River system. The reservoir was created by the construction of Baldhill Dam in 1950 and is located 12 miles northwest of Valley City, North Dakota. Baldhill Dam is managed by the COE to serve primarily as a water supply structure, but also provides flood control. Overall, the Lake Ashtabula/Baldhill Dam site has 2,582 acres of public land and approximately 5,250 acres of water, which provide a variety of recreational opportunities. Recreation activities include boating, camping, fishing, hunting, picnicking, swimming, and snowmobiling (COE 2003). The results of a creel survey at Lake Ashtabula are described in the fishing section.

The COE operates seven recreation areas at Lake Ashtabula that offer a variety of facilities and services. Facilities consist of four campgrounds, three designated swimming areas, seven boat ramps, picnic facilities, and playgrounds. All sites have access to drinking water and restrooms. The COE also manages 13 separate wildlife areas at Lake Ashtabula that offer quality habitat and are open to public hunting (COE 2003).

Lonetree Wildlife Management Area - Located at the headwaters of the Sheyenne River in Sheridan County North Dakota, Lonetree Wildlife Management Area

(WMA) is the largest wildlife area in North Dakota. Its 33,163 acres offer a variety of recreational opportunities such as hunting, trapping, hiking, sightseeing, bird watching, and photography. Within Lonetree WMA lies the Sheyenne Lake National Wildlife Refuge. The refuge includes parts of Sheyenne and Coal Mine Lakes and 334 acres of upland around Sheyenne Lake. This area is closed to hunting and trapping. The management goal for Lonetree WMA is to provide abundant and diverse wildlife for public consumptive and appreciative use year around. Consumptive uses include hunting, trapping, fishing and berry picking. Appreciative uses include bird watching, photography, and walking or driving to observe nature. Based on general observations, it is estimated that approximately 250 people use Lonetree WMA annually for appreciative use purposes.

The route for the National Scenic North Country Trail runs through Lonetree WMA. A 32-mile section of the trail has been developed as a simple path across Lonetree WMA and is within 1 mile of at least one camping area with potable water for convenience of overnight hikers (Reclamation 2001). When completed, the North Country Trail will become the longest continuous trail in the United States linking some of the most outstanding scenic, natural, recreational, historic and cultural areas in the northern tier states. The trail will run from Fort Henry, New York, to Lake Sakakawea, North Dakota. Approximately 2,000 miles of the proposed 4,200 miles of trail is currently open for public use. Of the proposed 475 miles of trail in North Dakota, approximately 85 miles are open along the Sheyenne River (Figure 2).

Fort Ransom State Park - Fort Ransom State park was established in 1979 to preserve the homesteading heritage of North Dakota. A farmstead within the park is the setting for annual Sodbuster Days celebrations with demonstrations and exhibits of early homesteading life. Fort Ransom State Park is located 34 miles south of Valley City, North Dakota, adjacent to the Sheyenne River. This 887-acre park has a visitor's center, camping, trails for hiking and biking, fishing, canoeing, kayaking, picnic areas, and playgrounds. The park is also located along the Sheyenne Valley National Scenic Byway/Backway, and a short segment of the National Scenic North Country Trail winds through the park (ND Parks and Recreation Department 2003c).

H.R. Morgan State Nature Preserve - This state owned and managed nature preserve is located approximately 24 miles east-northeast of the town of Lisbon along the Sheyenne River. Recreational opportunities at this preserve are limited but include bird watching, hiking, and wildflower viewing. There are developed trails for hiking and horseback riding and primitive camping is allowed except where posted (ND Parks and Recreation Department 2003a).

Sheyenne National Grasslands - The Sheyenne National Grasslands comprise approximately 70,180 acres of public land associated with 64,769 acres of privately owned lands located in Ransom and Richland Counties in southeastern North Dakota. Recreational opportunities include hunting, hiking, horseback riding, nature studies, primitive camping, canoeing, and fishing on the Sheyenne River. A 25-mile segment of the National Scenic North Country Trail, which crosses the National Grasslands, is an excellent area for hiking, mountain biking, and horseback riding (USDA Forest Service 2002).

Fishing

The North Dakota Game and Fish Department's website www.state.nd.us/gnf/fishing describes fishing opportunities as being along the entire length of the river, especially below dams at Lisbon, Fort Ransom, near Kathryn, Cooperstown, Mill Dam, and Baldhill Dam. Species include pike, perch, walleye, crappie, bullhead, smallmouth bass, white bass, rock bass, and catfish.

A creel survey was conducted at Lake Ashtabula by the North Dakota Game and Fish Department during the open water season in 1999. Table 3 shows species, estimated catch rate, and harvest rate for the open water period from May 1, 1999, through October 31, 1999. Overall, the survey estimated 90,066 hours of fishing from a boat and 19,952 hours of fishing from shore for a total of 110,018 angler hours. No comparative data are available that would show how fishing pressure might have changed since 1999.

Table 3. – Creel Survey Results for Lake Ashtabula, 1999.

Yellow Perch	92,751	0.800
Bullhead	8341	0.727
White Bass	11,119	0.277
Walleye	4162	0.072
Crappie	1969	0.029
Northern Pike	1534	0.019
Smallmouth Bass	132	0.008

Source: North Dakota Game and Fish Department, 1999

Canoeing

ND Parks and Recreation Department (2003b) only recommends three segments of the Sheyenne River for canoeing. Although the river extends through North Dakota for 280 miles, many hazards and low head dams disrupt canoeing. The following stretches are recommended for canoeing: a 22-mile stretch southeast of Cooperstown, a 14-mile stretch from the Baldhill Dam to Chautauqua Park in Valley City, and the river through Fort Ransom State Park. The scenic value and wildlife viewing are very good.

The first stretch, a section of the Sheyenne River southeast of Cooperstown, extends for 22 miles from the Cooperstown Bible Camp to the Thompson Bridge. The stretch of river takes approximately 6 to 9 hours to canoe. There are three excellent to good access points, and three fair to poor access points. Hazards along this stretch of river consist of extensive snags from fallen trees and require a few portages north of the Bible Camp. Canoeing is usually best in spring or after heavy rains. A minimum flow of 400 cfs will provide fair to good canoeing (ND Parks and Recreation Department 2003b).

The second stretch, canoeing from Baldhill Dam to Valley City National Fish Hatchery or Chautauqua Park, takes approximately 5 to 8 hours. Access to the river is considered good along three points. Hazards include two rock dams that must be portaged between Baldhill Dam and the fish hatchery. Both portages are treacherous. It is recommended that canoeists do not canoe through Valley City, because there are several dams that make the trip very hazardous. Water levels depend on runoff and releases from Baldhill Dam. A flow of at least 80 cfs is recommended (ND Parks and Recreation Department 2003b).

The third stretch, the Fort Ransom State Park Canoe Trail, takes approximately 1.5 to 7 hours, depending on the starting point. Fort Ransom State Park provides canoe access. Many day-trippers will put in at the park, canoe upstream and float back down. For a fee, park personnel will provide transportation to one of six drop-off points and canoeists can float back to the park. Two of these access points are publicly accessible allowing the independent canoeist to provide their own drop off and pick up. The trip from Little Yellowstone to Fort Ransom takes approximately 6 to 7 hours. Hazards include occasional snags and deadfalls. Canoeing is usually best in the spring and early summer. Based on the Parks and Recreation Department's recommendations, the USGS estimates that a flow of 94 cfs at the Lisbon gaging station would be adequate for canoeing in the Fort Ransom area (ND Parks and Recreation Department 2003b and USGS 2003).

Water Quality

As required by Section 303(d) of the Clean Water Act, each state is required to identify water bodies (i.e., lakes, reservoirs, rivers, streams, and wetlands) that are considered water quality limited. A water body is considered water quality limited when it is known that its water quality does not meet applicable state standards. North Dakota's Department of Health, Division of Water Quality (2003), has identified two areas along the Sheyenne River that do not support recreation because of poor water quality, and one area that fully supports recreation but is threatened. Lake Ashtabula has been identified as not supporting recreation due to excessive

nutrient/eutrophication⁴. The Sheyenne River, from its confluence with the Maple River downstream 18.51 miles to its confluence with the Red River, is impaired due to high levels of fecal coliform. The Sheyenne River near Lisbon downstream 11.37 miles to its confluence with Dead Colt Creek has been identified as fully supporting recreation but threatened due to the presence of fecal coliform. The Department of Health has also identified certain tributaries that flow into the Sheyenne River as not fully supporting recreation, or as fully supporting recreation but threatened.

Red River Recreation Environment

The Red River is important to both Minnesota and North Dakota. The river is dominated by urban types of recreation facilities and opportunities provided primarily by the cities of Wahpeton, Fargo, Grand Forks, and Pembina, North Dakota; and Moorhead, Breckenridge, and East Grand Forks, Minnesota. Dispersed recreation opportunities are also available, and several developed and undeveloped boat launch sites are located along the river (Figure 3, Red River of the North Recreation Map).

Recreation activities on the Red River include sightseeing (21.8 percent), walking/jogging (20 percent), bicycling (13.3 percent), fishing (10.7 percent), snowmobiling (8.5 percent), and picnicking (5.0 percent) (ND Parks and Recreation Department 1997).

The Red River is ranked second to the Missouri River in recreation use in the State of North Dakota. Rural lands adjacent to the Red River in both states are mainly privately owned so access is limited to urban areas. Unlike the Sheyenne River, the Red River lacks large tracts of public land other than areas encompassed by cities and towns. Recreational areas along the river are highly dependent on urban park settings for access and facilities. It is important to note that sister cities on both sides of the Red River are working together to promote recreational opportunities and to provide better access.

Public Recreation Areas

New recreation developments are being proposed because of the severe 210-year flood event of 1997. Since the 1997 flood, many communities, including Grand Forks and Wahpeton, North Dakota, and East Grand Forks, Minnesota, have initiated planning efforts to enhance the river corridor primarily for flood control. These corridors serve a dual purpose in that they create recreational areas along the flood prone river. Communities are working cooperatively with the COE in these planning efforts. The Greenway Plan for the cities of Grand Forks and East Grand Forks and the Red River State Recreation Area Management Plan are examples of completed

⁴ Eutrophication is described as the process in which more organic matter is produced than existing biological, oxidization processes can consume. The increase in the nutrient levels of a lake or other body of water usually causes an increase in the growth of aquatic animal and plant life.

planning documents that will guide local communities in enhancing recreational opportunities along the river.

The Greenway and the Red River State Recreation Area - One of the most significant projects along the Red River has been the development of the Greenway on the Red. After the flood event of 1997, a new plan to protect cities along the Red River was developed to provide an open space along the river that is free of infrastructure vulnerable to another flood event and to enhance recreational activities for the residents in the cities along the river. The Greenway consists of approximately 2,200 acres of space between the river and flood protection levees in Grand Forks, North Dakota, and East Grand Forks, Minnesota. Recreational facilities include boat ramps, hiking and biking trails, campsites, picnic areas and playgrounds. Many recreational events are scheduled to take place in the Greenway throughout the year.

A major component of the Greenway is the Red River State Recreation Area. It is one of the newest state recreation areas being developed in Minnesota. After the flood of 1997, 500 properties were acquired in East Grand Forks, Minnesota, leaving 1,230 acres of green space in the flood plain next to the river. Land was donated to the state to use as parkland. The park is currently under construction with hopes of having a campground that can accommodate 300 campers. Along with the campground, the site will include biking and hiking trails, fishing access, habitat improvement, pedestrian bridges over the river, historic sites, and a visitor center featuring flood plain history and interpretive programs (MNDNR 2002). The Red River State Recreation Area Management Plan includes detailed information about recreation opportunities within a 60-mile radius of the state recreation area.

Urban Recreation Areas - There are numerous recreation areas such as parks, ball fields, public swimming pools, and golf courses throughout the Red River Valley that are categorized as consumptive water users. These recreational facilities depend on individual surface and municipal water resources for maintenance and esthetics. Parks, ball fields, and golf courses are not generally water dependent in that they could be used without irrigation. These recreation facilities would be considered as water based because their value as a resource increases with consumptive use of water for landscape enhancement. A swimming pool is water dependent because the supply of water is integral to the function of the facility.

Fishing

The Red River is internationally known for its trophy-size channel catfish. The river segment from Fargo, North Dakota/Moorhead, Minnesota, north to Lake Winnipeg is prime catfish territory (MNDNR and North Dakota Game and Fish 1996). Events such as the Frosty Bobber and Cats Incredible are two annual

fishing contests held in January and August of each year in East Grand Forks, Minnesota.

Comprehensive access-based creel surveys for the Red River were conducted by the MNDNR in 1994 and again in 2001. Data were collected from anglers who accessed the river from Minnesota or North Dakota. The estimated angling pressure was 159,723 angler-hours in 1994 and 108,182 hours in 2001. More than 70 percent of fishing was by bank anglers. In 1994, conditions were listed as good 81 percent of the time as compared to 65 percent in 2001. The angling pressure declined approximately 32 percent between 1994 and 2001. The reason for this decline in fishing pressure is difficult to ascertain. Possible factors include higher than normal spring precipitation in 2001 resulting in higher than normal water levels. High water levels contributed to muddy banks, limited access to sites, and generally poor conditions for fishing.

Canoeing

Except in extremely dry years, the Red River generally experiences adequate flow to support canoeing throughout the summer. Streamflow and stage data are available for canoeists to reference and determine the best flows for their enjoyment. Because the Red River is open to canoeists throughout the summer, there are no streamflow or stage canoeing recommendations (USGS 2003b).

Red River of the North Canoe and Boating Route Master Plan - The Red River of the North Canoe and Boating Route Master Plan (2002) is the most comprehensive report on water-based and water-dependent recreational opportunities and needs along the entire Red River. The Master Plan was written by River Keepers, a Fargo-Moorhead based organization dedicated to encouraging sustainable uses of the Red River. The vision statement of the plan is “increased canoeing and boating uses of the Red River of the North with emphasis on safety; interpretive, historical, and environmental awareness; and economic development.” The plan outlines specific goals that need to be met to improve and encourage use of the Red River. This plan contains inventories of recreational use infrastructure (e.g., access sites, 8 dams, 21 tributaries, 32 road crossings) and gives examples of ways to improve and to enhance opportunities. Improvements include repairing boat ramps, developing portages around dams, developing canoeing rest stops and overnight campsites, increasing public knowledge through information and education efforts, and identifying an entity to implement the plan. According to the plan, canoeing accounts for approximately 10,000 hours of activity annually on the Red River.

Water Quality

The State of North Dakota (2003) has identified five sections of the Red River that are water quality limited according to Section 303(d) of the Clean Water Act. Two of these sections do not fully support recreation due to high levels of fecal coliform.

These are the Red River from its confluence with the Ottertail River downstream for 26.81 miles to the confluence with Whiskey Creek, and the river from the 12th Avenue Bridge in Fargo for 20.09 miles downstream to the confluence with the Sheyenne River.

Three of five sections of the Red River fully support recreation but are threatened due to high levels of fecal coliform. These stretches are the Red River from its confluence with Whiskey Creek downstream 51.64 miles to its confluence with the Wild Rice River, the Red River from the confluence of Wild Rice River 21 miles downstream to the 12th Avenue bridge in Fargo, and the Red River from the confluence with the Sheyenne River 10.45 miles downstream to the confluence with the Buffalo River. There are also several tributaries to the Red River identified as having impaired or threatened water quality for recreation.

In addition to the sites listed by the State of North Dakota, the State of Minnesota has identified a section of the Red River as water quality limited and not supporting recreation due to the presence of fecal coliform (Minnesota Pollution Control Agency 2003). This section is from the confluence of the Red with the Buffalo River downstream for about 15 miles to where the Elm River empties into the Red River.

RECREATION NEEDS

Water is often rated by recreationists as the most important attribute of their chosen setting, and the amount of land/water edge and surface water are positively related to increased scenic value of the area (USDA 2002). Not only is water essential to many water-based recreational opportunities, studies indicate that symbolic aspects of water such as its calming and relaxing effect on individuals is also important to the quality of outdoor recreation activities. However, obtaining accurate recreation use data are difficult, particularly for dispersed recreational activities (USDA 2002).

Water needs related to recreation are vastly different from impacts to recreation from a given project. Needs reflect the minimum amount of water necessary to conduct a recreational activity and do not necessarily reflect an optimum, ideal, or desirable amount of water for a specific activity. Using available data, recreation needs have been identified along the Sheyenne and Red Rivers in this report. Water quantity required for recreation is difficult to analyze because the outdoor recreation season mainly occurs when there is open water and warm weather (April 1 to September 30), the subjective nature of a users' experience related to flow, and the transient behavior of users of recreational resources. Recreational activity tends to peak in July mainly because of warm weather rather than in response to river flows. The peak recreation season correlates with the highest water demand for municipal, rural, and industrial water usage causing a direct conflict. Although needs can be identified, many needs cannot be quantified.

Assumptions

Certain assumptions and findings can be made that should assist river managers in formulating future recreation management strategies. Some assumptions and findings indicate that specific actions would not compromise other nonrecreational uses. Other assumptions and findings may lead managers to alter site attributes to increase user satisfaction levels or to alter river flows and reservoir elevations to enhance visitor experiences. No water surface elevations or streamflows are suggested for the assumptions and findings listed below, because further studies would be needed to identify flow requirements for many of the recreation activities in the Red River Valley. Key assumptions and findings have been summarized.

Various types of recreational facilities and their consumptive water use were investigated as part of the Recreation Needs Assessment. An extensive search of the North Dakota State Water Commission water permit database was conducted to identify all recreational facilities that have historical water use. The only recreation facilities listed in the database were golf courses. Based on this it was assumed that all similar recreation facilities received their water supply under another rural or municipal water system's permit. It was assumed because of this that water needs for rural and urban recreation facilities such as ball fields, parks, and public swimming pools already are included in municipal and rural demands in the Needs and Options Report.

The Needs and Options Report assumes that the amount of consumptive water use for recreation directly corresponds to the size of the population served by a community or rural water system. This is particularly important in the major urban areas in the Red River Valley where population is projected to increase in the future. It is assumed that these communities will have a corresponding increased public demand for recreational facilities. The estimated future per capita water demand for all municipal and rural water systems will include recreational consumptive water use. As the population increases, the amount of consumptive water use for recreation will automatically be accounted for in the future water use demands.

It was assumed that as the population in the Red River Valley increases, golf will continue to be a popular choice for recreation and the need for more golf courses will increase with the population. Although national trends show that hunting and fishing activities are expected to decline in the future elsewhere, it was assumed that hunting and fishing in North Dakota and Minnesota will remain popular activities and are not expected to decline in the future in these states.

Nonconsumptive Recreational Problems, Needs, and Opportunities

SCORP Needs

The States of North Dakota and Minnesota, and local and Federal Government agencies currently supply the facilities, opportunities, and infrastructure necessary to accommodate the most popular recreation activities. However, as recreation increases over the next half century, many of the existing recreation sites may experience overuse and degradation unless additional facilities and opportunities are provided. To accommodate future demand, recreation providers will have to cooperate and plan for the future to anticipate necessary and appropriate facilities and opportunities.

SCORPs are a useful gauge to determine what the states deem as recreational priorities to the residents. User surveys help states determine what residents want to see improved regarding recreation.

Recreation priorities in North Dakota that apply to the Sheyenne River and the Red River of the North are to provide appropriate numbers of trails, sports courts, campgrounds, water access, open space parks, playgrounds/picnic areas, beaches, amphitheaters, historic parks, support facilities, and renovation of existing facilities. Some of these priorities may involve consumptive uses of water, but it has been assumed that they will be served by Municipal, Rural, and Industrial (MR&I) systems and will be accounted for in that section of the needs assessment.

Two issues that the State of North Dakota has to face are outmigration and an emphasis on tourism. Outmigration in rural communities has a major impact, given the large number of rural communities in the state. In addition, the state is also seeing many young adults moving out of state. Both populations have identified recreation as a major component for keeping them in the region. The state is also experiencing exploding growth in the tourism industry. The open landscape, rich history, and abundant nonconsumptive and consumptive recreational opportunities make the state a unique destination for travelers. Keeping these diverse needs in balance is a delicate task and one that requires great cooperation and resources (North Dakota SCORP 2003-2008).

In 1987, survey respondents reported that the types of recreation improvements most desired in the state were increased or improved river access followed by increased picnic and camping areas, riverfront park areas, and public swimming areas (ND Parks and Recreation Department 1987). Overall, outdoor recreation respondents to the 1995 SCORP household survey reported that playgrounds/picnic areas, developed campgrounds, and paved bicycle trails were the three most needed facility improvements (ND Parks and Recreation Department 1995).

Minnesota has developed seven priorities for recreation in the SCORP. They are to protect and restore the natural resource base on which outdoor recreation depends, sustain Minnesota's existing outdoor recreation facilities for future generations, reserve prime recreation lands such as shoreland and significant natural areas, respond to demands of Minnesota's changing population, expand nature-based outdoor recreation experiences for youth living in urban areas through "close-by" access to natural areas, and improve coordination of the recreation-related activities of governmental and nongovernmental providers.

Instream Flows

Instream flows are attributes that can determine user satisfaction with a particular recreation site. Sufficient river flows increase the quality of the experience for users participating in both water-based and water-dependent recreation activities. Different recreation activities require different flows, and flow requirements vary between river segments. It is important to manage the Sheyenne and the Red Rivers as diverse river units, acknowledging the differences and opportunities along different reaches.

The volume and velocity of flows are important in sustaining a quality recreation experience over an extended period. The amount, timing, and duration of flow in the rivers needed to conduct a certain type of river recreation activity differ among the many river users. Optimum flow for a quality recreation experience for one river recreation activity is not necessarily optimum for another (i.e., optimum flows for river canoeing are not necessarily optimum for swimming or fishing). Ideally, instream flows could be established that benefit the greatest number of river recreation users at any one time, while not negatively affecting environmental resources.

Bankfull flows for both the Sheyenne and Red Rivers would not necessarily benefit most of the water-related recreation, as conditions along these rivers can change quickly and dramatically. River conditions may become more hazardous as the flow increases to bankfull conditions, and less than bankfull conditions most likely will not a decrease in satisfaction of a recreational experience.

Recreation quality will be impacted the most during extreme conditions -- dry and severely dry water years and years of severe flooding. Generally, more water enhances canoeing. Specifically, the ND Parks and Recreation Department and the USGS have determined minimum streamflow recommendations for portions of the Sheyenne River. The purpose of these recommendations is to assist canoeists in planning and scheduling canoe trips that avoid numerous portages around shallow areas during low flow. The recommendations for streamflow, as well as the percent of time the river sections flow at or above that level based on historic data, appear in Table 4.

Table 4. USGS Recommended Streamflow for Canoeing in the Sheyenne River.

*Percent of time is based on days during the open water season (Apr 1-Sept 30).

Cooperstown, ND	400	16.9
Baldhill Dam, ND	80	67.2
Lisbon, ND (near Ft. Ransom)	94	62.3

Source: USGS Sheyenne River Canoeing Recommendations Based on Streamflow and Stage retrieved 2003.

The river reach near Cooperstown historically has daily mean flows that meet or exceed recommended levels 16.9 percent of the time. Historic data reveals that times of adequate flow occur mainly in April and flows decrease throughout the rest of the summer.

The reaches of the Sheyenne River below Baldhill Dam and at Lisbon (near Fort Ransom State Park) meet or exceed the recommended flows for approximately two-thirds of the open water season. Typically, flows are highest in the spring, and slowly decrease throughout the summer falling below the recommended value in mid-August through September. The flow in these areas is affected by Baldhill Dam releases managed by the COE.

Data show that canoeing conditions could be improved by an increase in flow near Cooperstown during most of the open water season. This stretch of the river is above Baldhill Dam and is unregulated. The reaches of the river below the dam tend to have flows that are more regular, but could be improved towards the latter part of the summer to accommodate canoeing. There are no minimum streamflows recommended for the Red River.

Water Quality

Reaches of the Sheyenne and Red Rivers with impaired water quality, identified in the North Dakota and Minnesota 303(d) Clean Water Act Report, are specific areas needing water quality improvements. Certain recreation activities such as swimming, tubing, and floating are directly impacted by water quality and should not be permitted if public health standards are not maintained. Activities such as boating, canoeing, fishing, and hiking may not be affected as greatly by water quality problems. Participation in these activities is still possible and will generally not affect the health of the participant, although the experience may deteriorate if there are fish consumption advisories, impairments to aquatic life, or a visual degradation of water clarity.

Often recreationists do not know there is a water quality problem until it has degraded to a point that an area is closed to the public. At that point, user satisfaction with the site declines and visitation decreases. Unless efforts are immediately initiated to correct the problem and those efforts are routinely reported to the public, the public tends to avoid the site. Recreationists' perception that a site has a water quality problem will continue unless there is a concerted effort to fix the problem and inform the public the problem has been resolved.

Public Access

Generally, public access along the Sheyenne River is good. There are many roadside access points in addition to state and federal lands open to the public. However, improvements may be needed as the population of the Red River Valley increases through 2050. Examples of improvements are the remediation of stream hazards along many reaches of the river to facilitate canoeing; creating more campsites and stopovers for multi-day trips; adding potable water and restroom facilities; improving trails for hiking, biking, and horseback riding; and building more picnic and playground areas. Some of these improvements in public access may have consumptive demands, but it has been assumed that potable water and restroom facilities would be served by MR&I systems and accounted for in that section of the needs assessment.

Public access improvements are needed along the Red River. Public land is limited, boat ramps are few, and eight rock dams limit Red River recreation. There are proactive organizations working to improve and promote recreational opportunities along the Red River. Some of the improvements needed include additional boat ramps, campsites, and stopovers for canoeists; development of green space along the river; and reduction of hazards. Recreational opportunities on the Red River can be limited because of natural condition such as muddy banks, high turbidity, and flooding. These conditions make undesirable beaches, limit suitable camping areas, and make boat ramps inaccessible. Because these are naturally occurring limitations, it is difficult to improve the situation or to quantify recreational needs for this river. These natural conditions may explain the decrease in fishing pressure on the Red River between 1994 and 2001, documented in the creel surveys conducted by the MNDNR.

Consumptive Recreational Water Needs

It is assumed that population growth in the Red River Valley will increase the need for more urban recreation facilities. Urban recreation facilities were investigated to determine future water demands for urban parks, ball fields, swimming pools, and golf courses. The investigation found that water use data for urban parks, ball fields, swimming pools, and some golf courses were included in overall municipal historical water use records. Some golf courses have individual water permits. It was determined that parks, ball fields, and swimming pools are mainly served by municipal systems or in the case of parks and ball fields not irrigated. The water

needs for these areas will be accounted for as part of the municipal or rural per capita demands as mentioned previously in this report.

Golf courses are the only consumptive water use not completely served by municipal or rural water systems. There are 29 golf courses in the 13 eastern counties of North Dakota and the Minnesota cities of East Grand Forks and Moorhead. Twelve of the golf courses are served by municipal systems and the balance served from individual surface or groundwater permits.

According to U.S. Golf Participation (2001), Minnesota is the top ranked state for a population over age 12 that golf and North Dakota ranked sixth. Based on this popularity the recreation needs assessment will assume that golf will continue in its popularity and demand for golf courses will grow as population increases.

To determine water demand for future golf courses, an evaluation to estimate the need for new golf courses in the Red River Valley in 2050 was conducted. It was assumed that additional golf courses would be needed in counties with population growth, and that counties with little or no growth would have sufficient facilities through 2050. Using population projections for 2050 from Reclamation's 2003 report, the number of new golf facilities and associated water demand were determined for Cass and Grand Forks Counties in North Dakota and Clay County in Minnesota (Table 5).

The water demand estimates for Cass, Clay, and Grand Forks Counties were calculated using reported annual water use data from the past 15 years. Using these data, the average and maximum water use per hole was determined. Assuming the number of golf courses will increase in relation to an increase in population, the total average water demand in 2050 would increase by 267 acre-feet per year. The maximum demand would increase by 384 acre-feet per year. An average water demand would occur during a non-drought year and maximum water demand would be during droughts.

Richland County, North Dakota, and Polk County, Minnesota, have slight increases in their population projections; however, analysis determined the demand for a new golf course is less than one 9-hole golf course based on current population. Otter Tail County in Minnesota shows measurable population growth and is included in Table 5. The additional water needs for golf in these counties are not included in the recreation water need, but will be included in the hydrology surface water modeling analysis because it is a potential additional withdrawal from the surface water supply.

Table 5. Projected golf courses and associated water demands in 2050.

	Cass	Clay¹	Grand Forks	Totals for Recreational Water Needs	Otter Tail²
Current Number of Golf Course Holes in County	126	54	72	252	18
Percent Served by Surface or Groundwater Permit	50%	33%	25%	--	100%
Percentage Population Increase through 2050	206.9%	162.9%	162.0%	--	142.8%
Number of New Golf Holes	135	34	45	213	8
Number of New Golf Holes Served from Water Permit	67	11	11	90	8
Average Annual Water Use Per Hole (ac-ft)	3.0	3.0	3.0	--	3.0
Average Annual Water Demand (ac-ft)	201	34	33	267	23
Maximum Year Water Use Per Golf Hole (ac-ft)	4.3	4.3	4.3	--	4.3
Maximum Year Annual Water Demand (ac-ft)	288	48	48	384	33

¹ Clay County demands reflect the increase water needs only for Moorhead, Minnesota.

² The additional water needs for future golf holes in Otter Tail County will be used in hydrology modeling, but is not included in the Recreational Needs Assessment because it is not located on or near the Sheyenne or Red Rivers.

CONCLUSION

North Dakota and Minnesota rivers are important to residents and nonresidents who participate in recreational activities in both states. The peak season for water-based and water-dependent river recreation often occurs at the same time water is in great demand for other purposes such as agriculture, flood control, MR&I, and fish and wildlife which makes balancing use difficult. The way in which rivers are managed throughout a recreation season may benefit some recreation users but disappoint others. Water quantity requirements for a specific recreation activity are typically different for different river segments and for different recreation activities. The combination of river width, depth, gradient, volume, and other natural conditions such as scenic beauty, natural hazards, float time, and river length affect the quality of the recreation experience.

Studies of visitor attitudes and preferences indicate that water is a fundamental component of many forms of recreation on public lands and can contribute to recreationists' satisfaction with a site (Rollins and Chambers 1990, as cited in USDA 2003). Studies of campground users consistently have found that access to water is one of the most important characteristics that recreationists want in a campsite (Bumgardner et al. 1988; Clark et al. 1984; Lime 1971; Lucas 1970; Moore et al. 1990, as cited in USDA 2003).

It is assumed the need for urban recreation facilities will increase in the future based on population increases through the year 2050. Future water demands can be estimated for golf facilities based on historic annual use data. Urban parks and ball fields were evaluated and found to be served by municipal and rural water systems and accounted for elsewhere in the need assessment. Assuming the number of golf courses will grow in relation to an increase in population, the total average water demand in 2050 would increase by 267 acre-feet per year. The maximum demand would increase by 384 acre-feet per year. Future water demands for golf facilities will be evaluated during hydrologic modeling.

Instream flows recommended by the ND Parks and Recreation Department along the Sheyenne River range from 400 cfs near Cooperstown, North Dakota, to 80 cfs below Baldhill Dam. If instream flows are adjusted during the recreation season for the benefit of aquatic species and habitat, and those flows are greater than historic flows, the opportunities for achieving a favorable recreation experience would likely be enhanced. However, instream flow requirements that optimize a recreational experience are not necessarily beneficial to fish, wildlife species, and their associated riparian habitats. Impact to recreation, fish and wildlife, and riparian habitats will be evaluated in the EIS.

Public use of recreation sites along the Sheyenne and Red Rivers should be monitored to determine if the state's water quality standards and the physical, social, facility, and environmental carrying capacities are being exceeded. Improvements in water quality in the stretches of the Sheyenne and Red Rivers, and Lake Ashtabula, that are identified as impaired or threatened would be required. Causes of water quality problems such as agricultural runoff should be identified and mitigated. Maintaining water quality and adequate instream flows to accommodate the greatest number of recreation opportunities should be prioritized by managers who make water-related management decisions. Monitoring can also determine the level of user satisfaction with a site and identify if an attribute is being properly maintained or if the site attribute should be modified to accommodate a different recreation activity to meet increased public demand.

Consumptive uses of water for agriculture, industrial, or municipal purposes are usually quantified and well documented, whereas nonconsumptive uses of water for recreation purposes are not typically quantified or well documented. The most popular method of quantifying water levels/flows that a recreation user desires is a public user survey (questionnaire) that solicits pertinent information from the public. User surveys should be conducted over several recreation seasons to compensate for differences in flow from year to year.

Water resource managers need to consider how future recreation trends might influence future demand for the creation of new or different types of water-related

outdoor recreation facilities and opportunities. Decisionmakers also need to understand the different attributes that make a particular recreation site appealing to a recreation user. Instream flows and water quality are two of the most important attributes that can contribute to a user's satisfaction of a water recreation site. If certain attributes are not provided or well maintained, user satisfaction declines and visitation to the site decreases because user expectations are not met.

Federal, county, and city governments need to cooperate in providing the appropriate number and types of recreation facilities and opportunities to meet future recreation demand in the Red River Valley. A particular recreation site or area cannot be all things to all people. Decisionmakers should cooperate in providing a wide variety of recreational opportunities on a regionwide basis. Decisions should be based on individual site attributes within individual river segments. Increased dialog among water users, a broader societal perspective among decisionmakers, and more flexible and creative river and lake operations can result in major improvements to the recreation environment within the Red River Valley without abandoning existing water resource purposes or benefits.

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