

Subject: **Northeast Wyoming River Basins Plan  
Future Recreational and Environmental Water Requirements  
Task 4**

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Prepared by: Watts and Associates, Inc.

## **INTRODUCTION**

This memorandum presents projections of the future water needs associated with recreational and environmental water uses in the Northeast Wyoming River Basins. Where practical, projections were developed for three planning scenarios:

1. Low Growth
2. Moderate Growth
3. High Growth

Unlike other water uses, recreational water uses are generally non-consumptive, while environmental water uses can be either consumptive or non-consumptive, depending upon circumstances. In both cases, quantification of the amount of water needed to meet future needs is difficult, and often must be addressed qualitatively. There is also considerable overlap between the two categories. For example, instream flows are considered an environmental water use for purposes of this water planning process because they are a form of natural resource stewardship undertaken by the State. One important purpose of such flows, however, is to maintain the habitat supporting recreational fisheries. As a result, there is some overlap in the discussion of future water needs for recreational and environmental uses presented in this technical memorandum.

## **FUTURE RECREATIONAL WATER REQUIREMENTS**

### **Background and Approach**

One of the more difficult problems in water resource planning is estimating the demand or “need” for water-based recreational opportunities in an area such as Wyoming’s Northeast Wyoming River Basins. There are several reasons for this difficulty, including the fact that many recreational resources are publicly owned and are utilized without the accounting activity that normally accompanies resource utilization in the private sector. It thus can be difficult to accurately estimate how much water-based recreational activity is currently taking place in a river basin. As a result, estimates of current and historical demands are best viewed as indicators rather than absolute quantities.

There are also problems associated with estimating the supply of water-based recreational resources (Harrington, 1987). Commonly used measures such as miles of stream and acres of standing water do not address issues such as resource quality or ease of access, which are also elements influencing supply. Nevertheless, such measures do provide indicators of resource supply that can be used for planning purposes.

In some instances, estimates of current recreational activity are available from survey data. For example, based upon Wyoming Game and Fish Department (WGFD) estimates, resident and non-resident anglers currently spend about 50,000 days annually fishing on standing waters in Northeast Wyoming River Basins. This estimate can be construed as a measure of the current demand for stillwater fishing in the planning area given the current supply of opportunities for such fishing. What it does not tell us,

however, is what demand would be if the supply of stillwater fisheries increases. For example, if a new reservoir fishery were developed, we would expect the demand for fishing to increase, but the amount of that increase is difficult to estimate without detailed site-specific studies.

Site-specific studies of water-based recreation demands are beyond the scope of this and other basin-wide planning studies. Instead, such studies usually adopt the convention of assuming that current activity rates will change in the future in proportion to changes in population, tourism, and angler preferences. Projected recreational activity rates are then compared to resource availability to determine if overcrowding or other unfavorable effects are likely to occur. That convention was followed in developing the recreational demand estimates described in this technical memorandum.

### **Current Recreation Activity**

The most popular water-based recreational activity in the Northeast Wyoming River Basins is fishing. Figure 1 shows that about 51 percent of planning area residents participated in fishing activities in 1989, the most recent year for which detailed survey information is available (University of Wyoming, 1990). The second most popular water-based recreational activity among residents is power boating, with 22 percent participation, followed by waterfowl hunting (7 percent participation), rafting and canoeing (6 percent participation), and sailing (5 percent participation). Other popular outdoor recreational activities include camping, picnicking, and big game hunting. These latter activities are not directly tied to water resources, however, and thus are not included in Figure 1.

Less information is available concerning the participation of tourists in water-based recreation in the Basin. According to surveys commissioned by the Wyoming Business Council (WBC), over 4.2 million tourists visited Wyoming in 1998, and approximately 10 percent of those visitors fished at least once while in the state (Morey & Associates, 1998). No estimates are available concerning the proportion of those tourists that fished or pursued other water-based recreational activities in Northeast Wyoming River Basins.

The WGFD provided estimates of the number of annual activity days of angling and waterfowl hunting in Northeast Wyoming River Basins.<sup>1</sup> These estimates were adjusted to a base year 2000 for purposes of comparison. The results are presented in Table 1, which shows that stillwater fishing on lakes and reservoirs accounts for 50,000 activity days annually. Most, but not all, of this fishing activity occurs at Keyhole Reservoir. Cook Lake in the Black Hills National Forest is also a popular fish site, as are several other small bodies of water scatter across the planning area.

**Table 1**  
**Water-based Recreational Activity Days – Northeast Wyoming River Basins**

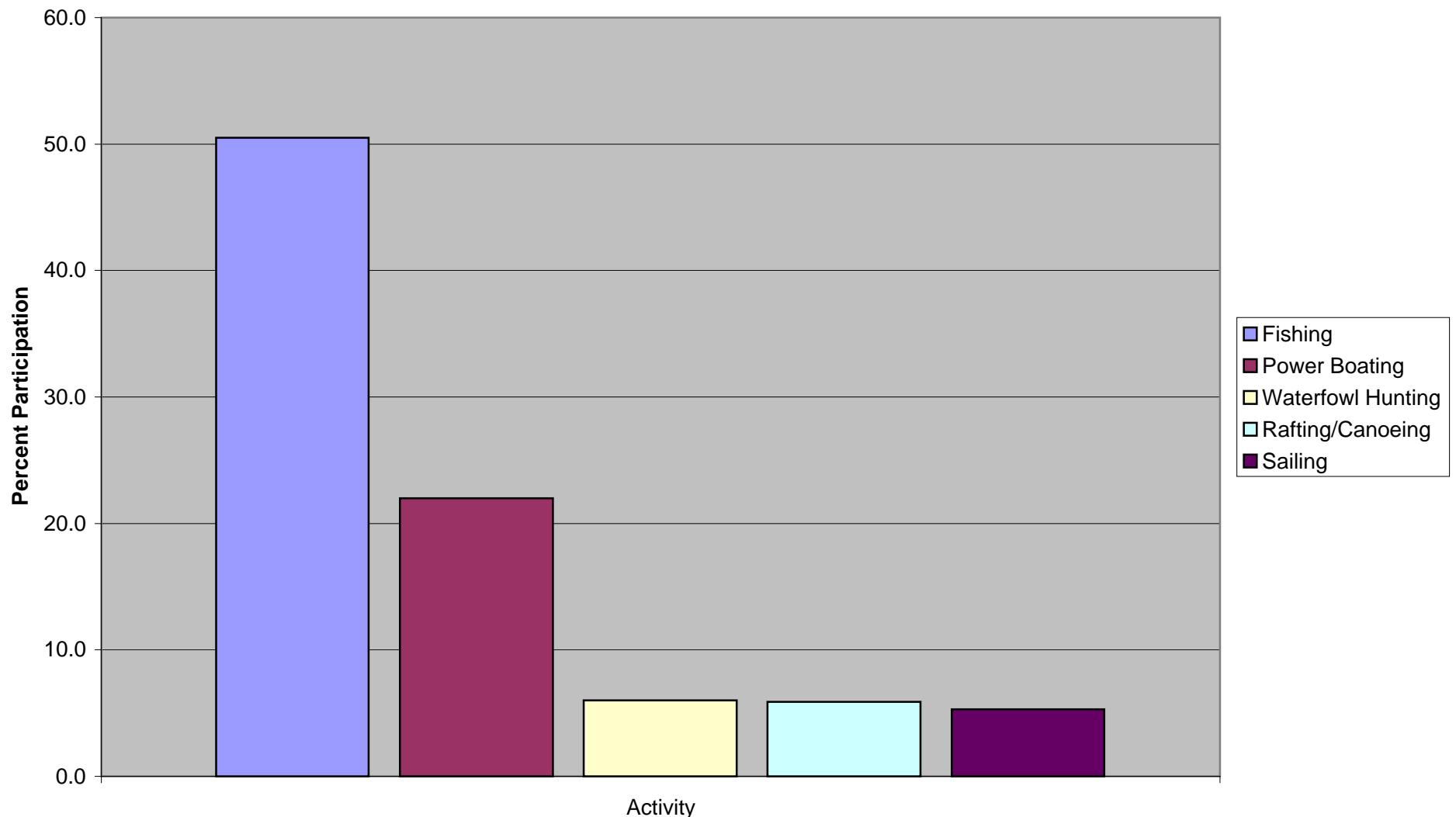
Activity	Activity Days
Stillwater fishing	50,000 <sup>1</sup>
Stream fishing	15,000 <sup>1</sup>
Boating/waterskiing	n/a <sup>2</sup>
Waterfowl hunting	3,000
Rafting/kayaking/canoeing	n/a <sup>2</sup>
Sailing/wind surfing	n/a <sup>2</sup>
Total	68,000

<sup>1</sup> Estimate by Watts & Associates based upon WGFD data.

<sup>2</sup> Data not available.

<sup>1</sup> Activity days are defined as days during which at least some part of the day is spent angling or waterfowl hunting. The number of hours per day spent in these activities varies. The sources of the activity day estimates are listed in a technical memorandum by HKM Engineering (2002a).

**Figure 1**  
**Resident Participation in Water-based Recreational Activities**  
**Northeast Wyoming**



Stream fishing in planning area accounts for only about 15,000 activity days annually. Stream fishing opportunities are limited in most parts of the planning area, although there are some good streams, such as Sand Creek, which arise in the Black Hills.

Waterfowl hunters spend about 3,000 days annually in the pursuit of ducks and geese that inhabit or pass through the Northeast Wyoming River Basins. Activity day estimates are not available for other water-based recreational pursuits, including boating, water skiing, rafting, canoeing, sailing, and wind surfing.

### **Recreation Demand Projections**

Future demands for recreational water resources in the Northeast Wyoming River Basins depend upon numerous factors, including population growth, tourism growth, and participation rates in various water-based recreational activities. Future participation rates depend upon changes in preferences over time as well as the availability of water resources and the amount of congestion encountered at recreational sites. Changes in future recreational preferences are hard to predict, so the projections described in this section are based upon the assumption that participation rates remain constant over the planning horizon. This assumption means that projected recreational demands are proportional to growth in population and tourism.

Projections of population growth in the Northeast Wyoming River Basins are described in a technical memorandum by that title (Watts, 2002). Those projections are summarized in Table 2 in terms of average annual growth rates for the low, moderate, and high growth planning scenarios. These annual average growth rates range from 0.52 percent for the low growth scenario to 1.51 percent for the high growth scenario. Table 2 also gives projections of tourism growth over the planning horizon for low, moderate, and high growth scenarios. The range for these growth rates is from 1.00 to 3.00 percent.

**Table 2**  
**Projected Annual Growth Rates In Northeast Wyoming River Basins**  
**Population and Tourism — (2000-2030)**

Scenario	Average Annual Growth Rate	
	Basin Population	Tourism
Low growth	0.52%	1.00%
Moderate growth	0.75	2.00
High growth	1.51	3.00

Source: See text.

The tourism growth rate projections are based upon data from a variety of sources that provide indications of tourism growth rates in the planning area and the State of Wyoming. For example, The Wyoming Department of State Parks and Cultural Resources (WDSPCR) estimates that visitation at Wyoming's state parks increased at an average annual rate of 0.50 percent annually during the period from 1995 through 1999. During the same period, visitation at Wyoming's historical sites (perhaps a better gauge of tourism than state parks) increased at an annual rate of 1.90 percent (WDSPCR, 2000).

A study of tourism in Wyoming by Morey and Associates and the University of Wyoming found that Wyoming tourism increased at an average annual rate of 3.6 percent during the three- year period from 1996 through 1999, although that growth rate is based upon a very short time period (Morey and Associates, various years). BBC Research and Consulting prepared projections of tourism for the Bear River Basin. Those projections are for tourism to increase at an average annual rate of between 1.6 and 2.9 percent between 2000 and 2030(Harvey and Jeavons, 2000). Based upon the above data, a range of one to three percent for average annual tourism growth was used to project future demands for water-based recreational activities.

The other information needed to project future recreation demand is a breakdown of recreational activity between residents and nonresidents. No precise estimates exist, but based upon what information is

available and the judgment of professionals in the WGFD, it was assumed that 80 percent of future hunting and fishing activity would be by Wyoming residents and 20 percent by non-residents.

This information, in conjunction with the data in Tables 1 and 2, was used to project future recreational activity days over the 30-year planning horizon from 2000 to 2030. Those projections are given in Table 3. The demand for stillwater fishing is projected to expand significantly over the next three decades. From a current level of 50,000 activity days annually, demand would grow to 62,000 days in 2030 under the low growth scenario, an increase of 24 percent. For the moderate growth scenario, demand would grow to 72,000 activity days, a 44 percent increase. For the high growth scenario, stillwater fishing demand would rise to 93,000 activity days by 2030, an increase of 86 percent over current levels.

Similar increases are projected for stream fishing demands in the planning area. The projections in Table 3 show that demand would increase from a current level of 15,000 activity days to between 19,000 and 28,000 activity days by 2030, depending upon the growth scenario chosen. The high growth scenario projects a 56 percent increase in stream fishing demand over the next 30 years.

The demand for waterfowl hunting is also expected to increase over the planning horizon, but at a lesser growth rate than for fishing. Total annual activity day demand is projected to increase from a current level of about 3,000 activity days to between 3,500 and 5,000 activity days by 2030, depending upon the planning scenario.

### Adequacy of Existing Resources to Meet Projected Demands

The issue of the adequacy of water resources to meet projected demands is difficult to assess because it involves subjective judgments. There are no absolute standards for determining the number of miles of stream fisheries or acres of reservoir fisheries that are needed to accommodate a given number of anglers. Similarly, there are no absolute standards for the water resources needed to meet demands for boating or waterfowl hunting.

**Table 3**  
**Current and Projected Water-based Recreational Activity Days**  
**Northeast Wyoming River Basins — 2000-2030**

Activity	Activity Days			
	Current	Low growth	Moderate growth	High growth
Stillwater fishing	50,000	62,000	72,000	93,000
Stream fishing	15,000	19,000	22,000	28,000
Water fowl hunting	3,000	3,500	4,000	5,000
Totals	68,000	84,500	98,000	126,000

Source: See text.

The WGFD in the past has estimated the supply of water resources available to meet the demands of fishermen in various regions of the state (WGFD, 1989). These supply estimates were expressed in terms of fishermen days, and reflect the amount of pressure that the Department believed at that time (1988) that publicly accessible fisheries could withstand without significant deterioration. Although these estimates have not been updated in the past decade, they serve as one benchmark for judging the capacity of fisheries in the Northeast Wyoming River Basins to meet projected future demands. Unfortunately, the WGFD did not estimate fishery supplies separately for the Northeast Wyoming River Basins, but for an area including both the Powder/Tongue River Basin and Northeast Wyoming River Basins. Nevertheless, it is useful to review these supply estimates as background for assessing resource adequacy.

According to the WGFD, the Northeast Wyoming River Basins and Powder/Tongue River Basins combined provide an annual supply of 405,000 activity days of fishing opportunities. With the exception of Keyhole Reservoir, however, almost all of this supply is located in the Powder/Tongue River Basin.

Fishery resources in the Northeast Wyoming River Basins are limited, with Keyhole providing the only large body of standing water available. Visitation data for Keyhole Reservoir show a strong correlation between visitation and storage contents, an indication that water availability is a limiting factor in recreation under current conditions (HKM, 2002a). Without provisions for additional storage in Keyhole, or the development of new storage sites, the planning area's ability to handle future increases in demand is limited (Pistono, 1999). The few other small streams and reservoirs in the planning area provide only limited opportunities to handle future growth in demands.

The projections of future demands for fishing opportunities described above range from 81,000 to 121,000 activity days annually by the year 2030, depending upon the growth scenario used. There is a relatively fixed supply of streams that are suitable for maintaining recreational fisheries, and new reservoir development is constrained by compact restrictions and cost considerations. As a result, the demand for recreational fishery resources is expected to exceed the supply throughout the thirty-year planning horizon. One inference that can be drawn from this statement is that future activities that would denigrate existing recreational stream fisheries could have significant negative recreational effects, while activities that enhance fisheries habitat could have significant positive effects.

The other water-based recreational pursuit for which demand projections were developed is waterfowl hunting. Those projections indicate that demand is expected to ride from a current level of 2,000 activity days to between 3,000 and 5,000 activity days by the year 2030 (Table 3). The WGFD has not estimated the supply of waterfowl hunting opportunities in the planning area, partially because populations are migratory and hunting seasons and bag limits are established in accordance with guidelines established by the U.S. Fish and Wildlife Service (USFWS). These guidelines are intended to maintain sustainable populations of migratory birds that are subject to hunting in several states along their migratory routes (USFWS, 1996).

## **FUTURE ENVIRONMENTAL WATER REQUIREMENTS**

### **Background and Approach**

Current environmental uses of water in the Northeast Wyoming River Basins are described in a separate technical memorandum (HKM, 2002b). Those uses include:

- instream flows and reservoir bypasses;
- minimum reservoir pools;
- maintenance of wetlands, riparian habitat, and other wildlife habitat; and
- direct wildlife consumption.

Unlike recreational water requirements, environmental water requirements are not necessarily related to changes in population or tourism. Instead, environmental water requirements are at least partially a function of human desires concerning the type of environment in which people want to live. These desires are expressed in many ways, including environmental programs and regulations promulgated by elected representatives at the state and federal levels. Thus, future environmental water requirements in the Northeast Wyoming River Basins will be determined, at least partially, by existing and new legislation dealing with environmental issues at the state and federal levels, and how that legislation is implemented by federal and state agencies.

Examples of such legislation include Wyoming Statutes S41-3-1001 to 1014, which stipulate that instream flows are a beneficial use of Wyoming's water and specify procedures for establishing such flows using unappropriated water. This legislation authorizes the WGFD to specify stream segments and flow requirements for an instream flow filing. The WWDC is authorized to file an instream flow application with the State Engineer and perform hydrologic analyses on filings recommended by the WGFD. The State Engineer can then issue a permit for an instream flow water right following a public hearing.

Future water requirements for instream flows in the Northeast Wyoming River Basins (and other river basins throughout the state) depend largely upon how Wyoming's instream flow legislation is implemented over the 30-year planning horizon. Projecting the outcome of this process quantitatively would be difficult, and is perhaps unnecessary because instream flows and other environmental water uses are largely non-consumptive. Instream flow designations can conflict with potential new out-of-stream uses at specific locations, however.

### **Instream Flows and Reservoir Bypasses**

Wyoming's instream flow statutes recognize the obvious economic fact that water resources in the Northeast Wyoming River Basins have value in non-consumptive uses such as instream flows. Such flows not only contribute to aesthetic character and biological diversity of the planning area, they also support recreational fisheries.

The WGFD has a goal of maintaining and enhancing existing fisheries in the planning area through the statutory designation of instream flow segments and other management strategies. Procedurally, the WGFD identifies stream segments for instream flow filings and forwards the recommendations to the WWDC. The WWDC evaluates the recommendation to assure there is available water and then files the application with the State Engineer's Office. The State Engineer then issues a permit if the application is approved. To date, only one application for an instream flow right in planning area has been filed with the State Engineer. That application is for a 2.5-mile segment of Sand Creek, a tributary of Redwater Creek in Crook County.

The extent to which future instream flow requests may conflict with potential storage developments for supplemental irrigation water in the planning area is unknown, but is probably not a significant issue given the relative scarcity of stream fisheries and compact restrictions on reservoir development in many parts of the planning area. If conflicts did occur, they would have to be resolved on a case-by-case basis, weighing the potential benefits of water to the state in instream versus out-of stream uses.

Another tool for maintaining fisheries habitat is the provision of minimum flow bypasses at reservoir sites. Currently, there are no mandatory minimum bypasses for reservoirs in the planning area (HKM, 2002b). Any development of additional reservoir storage in the future would likely bring about requests by the WGFD and others for such minimum flow bypass requirements.

### **Minimum Reservoir Pools**

Another environmental water use is the provision of minimum reservoir pools for fish and wildlife purposes. None of the reservoirs in the Northeast Wyoming River Basins have mandatory minimum pool requirements. Several years ago, the State of Wyoming attempted to procure a minimum pool in Keyhole Reservoir through a cooperative agreement with the Crook County Irrigation District. That attempt was unsuccessful, but the possibility exists that an agreement could be worked out in the future. One possible arrangement would be for the State to help develop one or more small irrigation reservoirs on tributaries of the Belle Fourche River below Keyhole in return for relinquishing some storage in Keyhole Reservoir that could be dedicated to recreation. Given the current federal regulatory environment, it is likely that any additional storage development would have to have a portion of its storage devoted to fish and wildlife purposes also.

### **Wildlife Habitat**

Another environmental use of water in the Northeast Wyoming River Basins is the provision of habitat for wildlife. Wildlife habitat exists in wetland and riparian areas on public and private lands throughout the planning area, some of it occurring naturally and some of it as a result of human activity. A tabulation of wetlands wildlife habitat areas has been undertaken as a part of the geographical information system developed for this study. A description of the information in this database is contained in a separate technical memorandum.

Three federal programs, the Conservation Reserve Program (CRP), the Wetlands Reserve Program (WRP), and the Wildlife Habitat Incentives Program (WHIP) encourage the development of wildlife habitat on private lands. The CRP program is administered by the Farm Service Agency of the U.S. Department of Agriculture (USDA), and provides incentive payments for various conservation practices that will enhance wildlife habitat, as well as improve water quality and reduce erosion.

The WRP is administered by the Natural Resources Conservation Service (NRCS) of the USDA. It is a voluntary program that provides financial and technical assistance to private landowners to reestablish wetlands on their property. The WHIP is also administered by the NRCS, and provides technical and financial assistance to private landowners interested in improving wildlife habitat on their property. None of these programs result in significant amounts of consumptive water use. As a result, no projections of future water needs for such programs were developed as a part of this water plan.

### **Direct Wildlife Consumption**

There are no current estimates of consumptive water use by wildlife for the Northeast Wyoming River Basins. An estimate developed for the Green River Basin puts consumptive use by big game and wild horses at about 500 acre-feet of water annually (Tyrrell, 2000). The comparable figure for the Northeast Wyoming River Basins is probably no larger and may be smaller than 500 acre-feet. This level of consumptive use is relatively small and is not expected to change significantly over the planning horizon.

### **SUMMARY AND CONCLUSIONS**

The Northeast Wyoming River Basins are under-endowed water-based recreational resources. Existing resources are barely adequate to meet current needs for recreation, and will come under increasing pressure in the future as the demand for recreational opportunities increases among the planning area residents and tourists. Future activities that denigrate fisheries would have significant negative impacts upon recreation in the planning area, while activities that enhance fisheries habitat would have significant benefits.

Other environmental uses of water in the planning area are largely for the maintenance and development of wildlife habitat. These activities involve only minor amounts of consumptive use and are not expected to conflict with other water uses.

## **REFERENCES**

- Harrington, Winston. 1987. *Measuring Recreation Supply*. Resources for the Future. Washington D.C.
- Harvey, Edward and Doug Jeavons. 2000. *Task 4. Bear River Basin Water Demand Projections, Memo 2: Future Economic and Demographic Scenarios*. Technical Memorandum. BBC Research and Consulting. October 6.
- HKM Engineering Inc. 2002a. *Northeast Wyoming River Basins Plan: Recreational Water Uses, Task 2D*. Technical Memorandum. February.
- HKM Engineering. 2002a. *Northeast Wyoming River Basins Plan: Environmental Water Uses, Task 2E*. Technical Memorandum. February.
- Morey and Associates, Inc. Various years. *Report on the Economic Impact of the Travel Industry in Wyoming*. Prepared in conjunction with the University of Wyoming, Department of Economics and Finance for the Wyoming Business Council. 1996, 1997, 1998, 1999.
- Pisttono, Robert. 1999. Wyoming Game and Fish Department, Fisheries Division. Personal communication. Cheyenne. March.
- Tyrrell, Pat. 2000b. *Green River Basin Plan: Environmental Uses*. Technical Memorandum. States West Water Resources Corporation. December 5.
- U.S. Fish and Wildlife Service. 1996. *Adaptive Harvest Management: Considerations for the 1996 Duck Hunting Season*. Department of the Interior.
- University of Wyoming. 1990. *1990 Wyoming State Comprehensive Outdoor Recreation Plan*. Prepared for the Wyoming Department of Commerce, State Parks and Historical Sites, by the Department of Geography and Recreation.
- Watts and Associates, Inc. 2002. *Northeast Wyoming River Basins Plan: Population Projections, Task 4*. Technical Memorandum. February.
- Wyoming Department of State Parks and Cultural Resources. 2000. *Visitor Use Program 1995 – 1999*. Division of State Parks and Historical Sites. January.
- Wyoming Game and Fish Department. 1989. *A Strategic Plan for the Comprehensive Management of Wildlife in Wyoming 1984 – 1989*.