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April 22, 2013

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

RE: Transmittal of Idaho Comprehensive Basin and Aquifer Plans

Dear Secretary Bose:

In a recent review of the FERC List of Comprehensive Plans, dated April 2013, it was noted that several plans adopted by the state of Idaho for selected water basin have not been recognized. Attached please find copies of the following Comprehensive Basin and Aquifer Plans to be considered by the Federal Energy Regulatory Commission (FERC):

Upper Boise River Comprehensive Basin Plan (1992)
Henrys Fork Basin Comprehensive Basin Plan (1992)
South Fork Snake River Basin Comprehensive Basin Plan (1996)
South Fork Boise River Basin Comprehensive Basin Plan (1996, updated from 1990)

Article XV, section 7 of the Idaho Constitution requires the Idaho Water Resource Board (IWRB) to formulate, subject to legislative approval, a comprehensive state water plan for the optimum development of Idaho's water resources in the public interest. Idaho Code §42-1734A(1) sets out the criteria and standards for development of comprehensive plans. Idaho Code §42-1734A(2) sets out the criteria and standards for development of comprehensive plans in stages based upon waterways, river basins, drainage areas, river reaches, ground water aquifers, or other geographic considerations.

As required in Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 U.S.C. section 803 (a)(2)(A) , in order to ensure that any licensed project will be best adapted to a comprehensive plan for the waterway on which the project will be located, the FERC shall consider the extent to which a project is consistent with a state comprehensive plan for improving, developing, or conserving a waterway or waterways affected by the project. The plans describe a comprehensive approach to the improvement, development, and conservation of Idaho's water resources on all waterways within the State of Idaho.

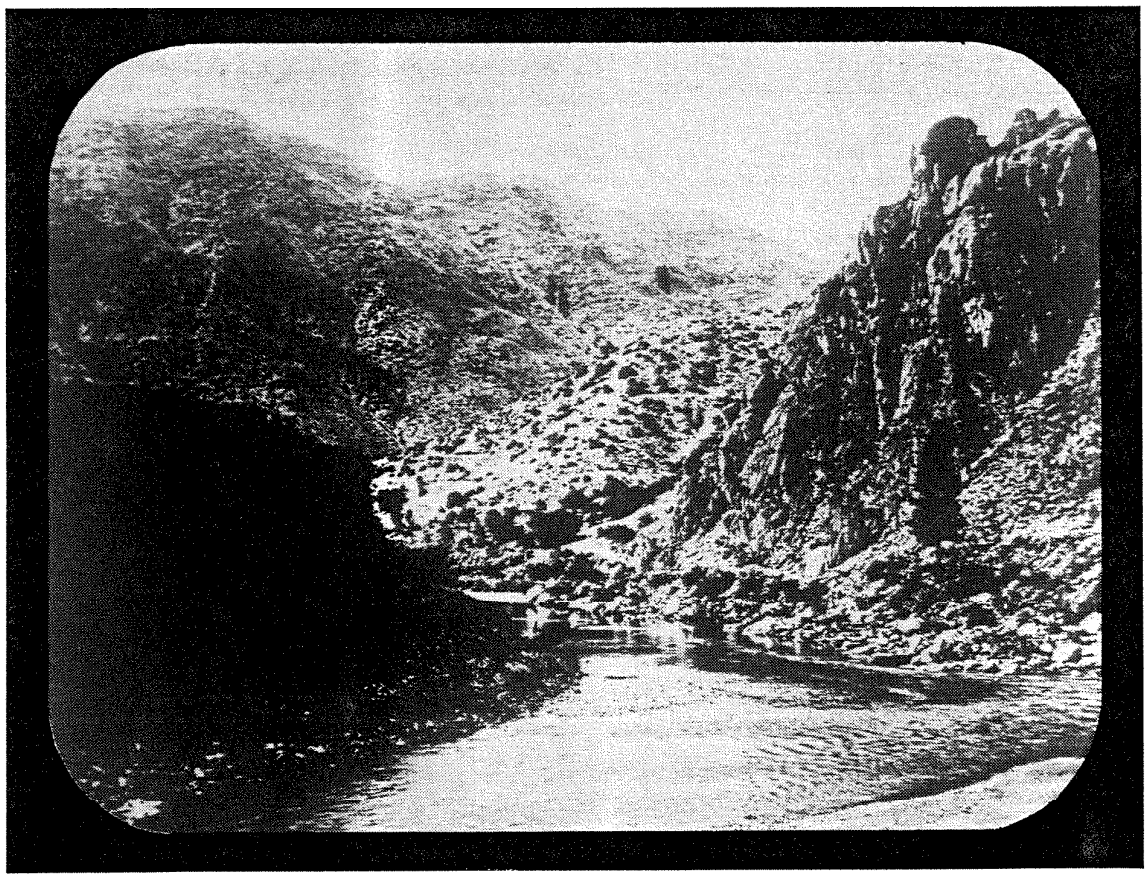
322 East Front Street, Boise, Idaho 83720 Tel: (208) 287-4800 Fax: (208) 287-6700

If you have any questions or need additional information, please contact Helen Harrington, Water Planning Section, Idaho Department of Water Resources, phone 208-287-4848; e-mail Helen.harrington@idwr.idaho.gov.

Sincerely,

Brian Patton
Acting Administrator
Idaho Department of Water Resources

Comprehensive
STATE WATER PLAN
Upper Boise River Basin



Arrowrock Damsite - circa 1910

Credit: Idaho Historical Society

Idaho Water Resource Board
1992

COMPREHENSIVE STATE WATER PLAN

Upper Boise River Basin

Idaho Water Resource Board

F.D. Rydalch, Chairman
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Gene Gray, Secretary
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Donald Kramer
William Platts
Mike Satterwhite

Adopted by IWRB

December, 1992

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EXECUTIVE SUMMARY

This component of the Comprehensive State Water Plan is prepared by the Idaho Water Resource Board (IWRB) for the upper Boise River basin (Fig. 1). This includes the Boise River and reservoirs upstream from Lucky Peak Dam, the North and Middle Forks of the Boise, and Mores Creek drainage. It does not include the South Fork of the Boise River; the South Fork Boise River basin Plan was completed by the Board in 1990 and approved by the legislature. There are roughly 1130 miles of rivers and their tributaries in the basin. While a portion of the basin is included in the Sawtooth Wilderness Area, reach descriptions and designations go only to the boundary of the Sawtooth Wilderness Area. Water development in the wilderness area is precluded by the federal government.

The average annual precipitation in the basin ranges from 20 to 50 inches per year, with the highest values in the eastern portion of the watershed. Stream flow rises in March, peaks in April through June and recedes to a base near the end of July. Low flows generally prevail from August through February. This basin contributes the majority of the runoff of the Boise River. Throughout most of the basin little groundwater exists. The water quality in the basin is generally considered to be good.

The basin lies in Ada, Elmore, and Boise counties. Though the past 30 years have seen Ada County experience a 145 percent population increase and Elmore County 222 percent, the basin is still sparsely populated (USDA, 1990a). Within the basin, there are two incorporated communities, Idaho City (1990 pop. 322) and Placerville (1990 pop. 14) and 5 unincorporated communities (Atlanta, Centerville, New Centerville, Pioneerville, and Quartzburg).

There is a total of 881,000 acres in the basin; 81% of that is within the Boise National Forest, 1.2% is managed by the Bureau of Land Management, 6.7% is state land, 9.6% is private and the remaining 1.5% is managed by the Bureau of Reclamation, Army Corps of Engineers, and U.S. Fish and Wildlife Service. The major commercial activities in the basin are timber, agriculture, mining, recreation, and power generation.

Protected river designations are made to protect and preserve the highly valued water resources of the basin (Final Actions and Recommendations, p. 52; Figure 4). Sheep Creek, including its forks and selected tributaries; the upper portion of the Roaring River, including its forks and selected tributaries; the North Fork Boise River from the Middle Fork Boise River to Rabbit Creek; the North Fork Boise River from Hunter Creek to Johnson Creek including selected tributaries; and Johnson Creek from its mouth to the Sawtooth Wilderness Area boundary including selected tributaries are designated as state Natural Rivers to preserve their aesthetic, recreational, and

biological values. Portions of the Boise River, the Middle Fork Boise River, the North Fork Boise River, Roaring River, Crooked River, Bear River, and Big Silver Creek are designated as state Recreational Rivers to preserve and protect recreational and biological values. Recreational designations are conditioned as needed to allow alterations in the streambed for construction and maintenance of bridges and culverts. The Board has made several recommendations primarily to state and federal resource management agencies, to further protect and manage the water resources in the basin.

The Board will apply for the establishment of minimum stream flows to protect the water quality and fish and wildlife habitat for portions of the Middle Fork Boise River, the Yuba River, the East Fork Montezuma Creek, Crooked River, and Elk Creek.

This plan does not impact existing water rights and uses or other vested rights, and has no direct impact on timber harvest or stock grazing. When a river reach is designated for protection in this plan, it is the purpose of the plan to protect the streambed from disturbances that are not in the public interest, and the stream water from diversion to out-of-stream uses. The plan does not impact private property rights in the riparian area. Implementation of this plan will not interfere with rights to water vested under state law or the delivery of water to its rightful user.

Unless the plan designating a particular waterway as a state protected river specifically requests the governor to seek inclusion of the waterway in the national wild and scenic rivers system, the designation of a waterway as a protected river shall not be a basis for seeking inclusion of such waterway in the wild and scenic rivers system [Idaho Code, Sec. 42-1734I].

INTRODUCTION

In 1988, the Idaho Legislature passed legislation amending state water planning requirements and providing for the development of a comprehensive State Water Plan (Chapter 17, Title 42, Idaho Code). The Comprehensive State Water Plan is developed in stages by developing comprehensive plans for each river basin, drainage area, river reach, aquifer, or other geographic considerations in the State. The law provides for a two-year period of interim protection while the Idaho Water Resource Board formulates a component plan.

On September 28, 1989 the Idaho Department of Fish and Game and Idaho Department of Parks and Recreation jointly petitioned the Water Resource Board to provide interim protection for the main Boise River, and the Middle and North Forks of the Boise River from the backwaters of Arrowrock Reservoir to their headwaters. The petition by the two agencies was largely a response to renewed interest in hydroelectric development at the Twin Springs site on the main Boise river by several Boise Valley irrigation districts. On April 6, 1990, the Board granted interim protection to all three river segments for a two year period. Idaho Code, Sec. 42-1734D (6) states that if a waterway is designated as an interim protected river, the Board must proceed to prepare a comprehensive state water plan for the waterway. The Board elected to prohibit all activities (see following page for natural river prohibitions) within the waterways over which they have authority, during the interim period.

The resources to be described in each plan are:

-navigation
-power development
-energy conservation
-fish and wildlife
-recreational opportunities
-irrigation
-flood control
-water supply
-timber
-mining
-livestock watering
-scenic values
-natural or cultural features
-domestic, municipal, commercial, or industrial uses
-other aspects of environmental quality and economic development

A summary of the various existing and planned uses of these resources is presented in the Basin Overview and Resource Summary. A supporting Technical Report (Appendix C, p. C-1) provides an in-depth description of the resources of the basin.

The 1988 law also provides for the designation of protected rivers, based on determination by the Board that the value of preserving a waterway outweighs that of developing the waterway for other beneficial uses. The protected designations are either as a natural or recreational river. A natural river is a waterway that possesses outstanding fish and wildlife, recreation, geologic, or aesthetic values, which is free of substantial existing man-made impoundments, dams or other structures, and where the riparian areas are largely undeveloped, although accessible in places by trails and roads [Idaho Code, Sec. 42-1731(7)]. A recreational river also must possess outstanding fish and wildlife, recreation, geologic or aesthetic values, but the segment might include some man-made developments within the waterway or within the riparian area of the waterway [Idaho Code, Sec. 42-1731(9)].

In designating a natural river, the Board shall prohibit the following activities within the streambed [Idaho Code, Sec. 1734A-(5)]:

-construction or expansion of dams or impoundments;
-construction of hydropower projects;
-construction of water diversion works;
-dredge or placer mining;
-alteration of the streambed, and
-mineral or sand and gravel extraction within the streambed.

In designating a recreational river, the Board shall decide which of the activities listed above shall be prohibited and may specify the terms and conditions under which activities that are not prohibited may go forward [Idaho Code, Sec. 42-1734A-(6)].

The identification of outstanding natural and recreational waterways in the basin involved an initial screening of those waterways that were potentially eligible for protection. The screening utilized a geographic information system (GIS) methodology to facilitate the process.

PLANNING PROCESS

Process Steps

The process used in preparing this plan is illustrated in Figure 2. Each step is described in the following sections.

Data Collection

Collection and scoping of data occurred concurrently for the following resources: navigation; power development; energy conservation; fish and wildlife; recreational opportunities; irrigation; flood control; water supply; timber; mining; livestock water; scenic values; natural and cultural features; domestic, municipal, commercial and industrial water uses. Information was obtained through review of literature, field reconnaissance, and contact with agency personnel and the public during the scoping process. A summary of this data is in the Basin Overview and Resource Summary section and in the Technical Reports (Appendix C).

Scoping and Public Input

Scoping involved the identification and assessment of local problems and issues. Rules and regulations of the Board require formation of a local advisory group to "inform the Board of local concerns" (Rule 5,1,2). An advisory group representing local interests was selected from a number of applicants for the upper Boise River plan (Appendix B, p. B-1). The Advisory Group met on several occasions to review and provide input on data collection, resource evaluation, and alternatives analyzed during the suitability analysis. Additionally agencies and other interested parties were contacted to review and provide input for appropriate sections of the plan.

Resource Maps

Maps of resource data were prepared at a scale of 1:100,000 using a geographic information system (GIS). Resource data were reviewed for accuracy by the Advisory Group, agencies, and interested public.

Screening

The objective of screening was to identify stream segments in the basin that are potentially eligible for protected designation because they possess outstanding fish, wildlife, recreational, scenic or geological values pursuant to Idaho code, Sec. 42-1731 (7) and (9). This process required

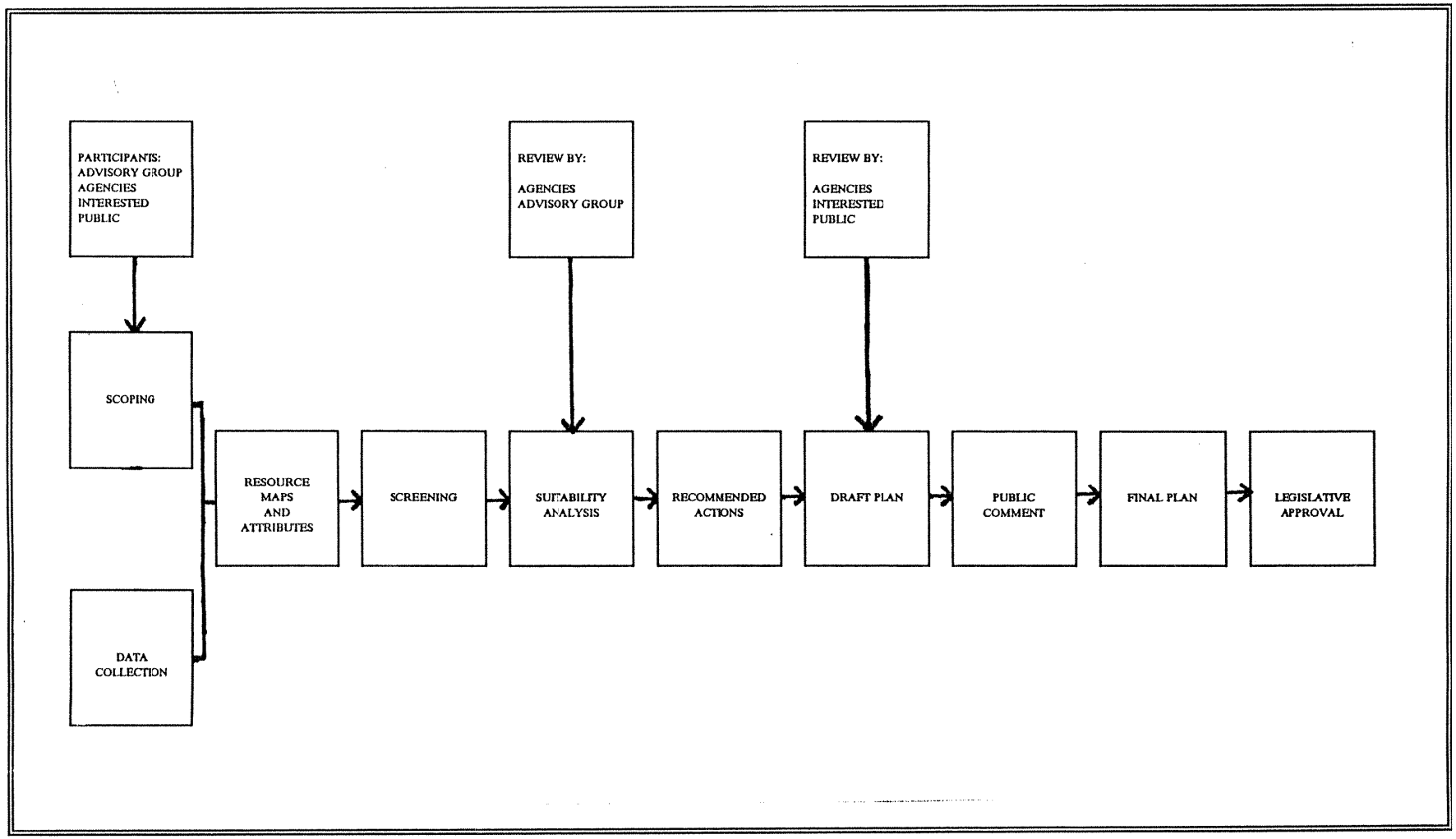


Figure 2: Basin Planning Process Flow Chart

evaluation of aesthetic (includes natural, cultural and geological features), biologic (fisheries and wildlife) and recreation data to identify which river segments possess these outstanding resource values.

The evaluation considered the uniqueness, rarity or significance of the resource from a national, regional and/or local perspective; the degree of protection accorded the resource through statute, regulation, rules, or agency management policy; and the potential for resource impact or opportunity to mitigate.

Aesthetic, biologic and recreational resources evaluated as very high are unique, rare, or highly-valued by the public. Agency management designations or policy frequently provides protection of these resource values prohibiting or restricting development. Further, these resources are sensitive to disturbance with little possibility of mitigating impacts.

High values suggest resource characteristics that may be common to the region, but are still highly valued by the public. Although agency management may not prohibit development, the resource is sensitive to disturbance. Frequent opportunities exist to mitigate these affects to some extent.

Resources with moderate to low values may still experience adverse impacts, but are not legally protected and/or highly-valued by the public. Often opportunities exist to mitigate adverse impacts.

River segments with <u>at least one</u> very high resource value for aesthetic, biologic or recreation resources were determined to have outstanding values, and therefore, eligible for consideration as possible state protected rivers. Specific criteria for aesthetic, biologic and recreation resources to decide resource values in the Upper Boise River Basin Plan are described in the Screening Evaluations section (p. 40).

Suitability Analysis

Rivers with outstanding resource values identified during screening were considered for protection in the management alternatives. A full spectrum of alternatives were considered ranging from no recommended actions to protection of all outstanding river segments. Alternatives were developed considering the effects that recommendations, such as a protection designation or recommendation for a minimum instream flow, might have on identified resources and resource uses. This involved an evaluation of the existing and potential water constraints and public issues for each stream reach, including: (1) water allocations and projected uses; (2) water quality; (3) power

development; (4) flood control; and, (5) water and energy conservation. Alternatives were revised after consideration of agency and Advisory Group input. Alternatives considered are described in the Management Alternatives section, p. 47 and Appendix D.

Recommended Actions

The Board's management alternative was based on Advisory Group, public, and agency input, and included actions and recommendations for the management of water and related resources in the river basin. These include designations as state recreational or natural rivers, applications for minimum stream flows, and recommendations for additional special studies, special designations (i.e., Northwest Power Planning Council protected areas), and other basin management issues.

Draft Plan

A draft plan was completed documenting the planning process, resource information collection and recommended actions, and was distributed to the public and agencies for review.

Public Comment

Upon Board approval, a legal announcement was made on August 17, 1992 of the availability of the draft plan for public review. Pursuant to Idaho code and the Board's rules and regulations, a sixty (60) day period was allowed for public comment. During this period, information meetings were conducted, and public hearings were held providing opportunity for oral testimony. Written comments were accepted throughout the sixty day period.

Final Plan

The draft plan was revised by the Board, based on public and agency comments on the draft plan. The Board adopted a final plan containing its management recommendations on December 3, 1992.

Other Management Plans

This section summarizes local, state, and federal management plans that were considered in preparation of this plan.

County Plans

Elmore County Comprehensive Plan: The goals and objectives of the 1992 Elmore County Draft Plan were identified for each facet of the plan including water, timber, fish and wildlife, mining, recreation, agriculture and public utilities. The Elmore County Water Goal (Goal I) is to protect, develop and maintain the quality and quantity of our water resource. To accomplish this, they have identified eight (8) water objectives, of which the more relevant to the upper Boise River basin plan include:

-coordinating with the State Water Resources staff to monitor areas of declining groundwater levels and take necessary action to halt lowering before it becomes critical, including recharging from stream sources

-working with the IDWR and seeking approval to study and construct necessary water development projects in the Boise River drainage system to transfer water into arid portions of Elmore County

These goals and objectives are consistent with the 1992 State Water Plan objectives and policies (IWRB, 1992).

Ada County Comprehensive Plan (Ada County, 1990): Although only the northeast corner of the county lies in the basin, the residents of Ada County are the primary users of the upper Boise River basin. Upper Boise River basin activities and management practices have a direct impact on the lower Boise River basin, from Lucky Peak Dam through Boise to the confluence with the Snake River. The Ada County Comprehensive Plan addresses several aspects of water quantity and quality that are impacted by activities in the upper basin. The areas addressed include:

-sufficient stream flow in the Boise River necessary to maintain water quality and to support swimming, tubing, fishing and other water recreation

-identify aquifer recharge and watershed areas to preserve their functions in protecting surface and ground water quality

-examination of alternative methods of preserving the watershed resources through management practices and/or public land purchases

-runoff control integrated into a watershed plan in a manner to maintain natural runoff rates, reduce erosion and flood hazards and to maintain the area's water quality and recharge capabilities

State Plans

State Water Plan (IDWR, 1992): Each individual river reach, corridor or basin plan, such as this one, is guided by, and must be consistent with, the objectives and policies of the State Water Plan. The State Water Plan, which is reviewed by the IWRB every five years, addresses water use, conservation, protection, management and development, and specific concerns for the three major basins of the state.

IDFG Fisheries Management Plan 1991-1995 (IDFG, 1990a): Fish species considered in this management plan relevant to the upper Boise River basin plan include rainbow trout, cutthroat trout, bull trout, brook trout, whitefish and kokanee. The IDFG's Bureau of Fisheries is responsible for both the resident fishery and introduced or hatchery fishery, both of which may be impacted by this plan. Fishery policies of the IDFG that are relevant include the following:

-managing Idaho waters to provide optimum sport fishery, to give priority to wild fish populations, and to maintain self-sustaining populations of fish.

-opposing any activity that results in significant loss or degradation of habitat capable of supporting self-sustaining fish populations.

-working with FERC to insure that hydroelectric development on Idaho waters will have minimal impacts to aquatic resources.

-striving to insure that adequate flows remain in Idaho streams to protect aquatic and riparian resources and provide for fish- and wildlife-oriented recreation.

-opposing hydroelectric development on rivers designated as "protected" by the Northwest Power Planning Council unless the project has a benign impact on and provides an exceptional benefit to fish and wildlife resources.

-supporting efforts to develop a State Protected River system.

IDFG's specific objectives and programs for the Boise River Basin seek to improve reservoir management and establish minimum stream flows. This includes pursuing the establishment of a minimum pool in Arrowrock Reservoir. Special fishing regulations for the Middle Fork Boise River (Middle Fork and North Fork confluence to Kirby Dam) have been implemented to enhance the resident fishery.

IDPR Statewide Comprehensive Outdoor Recreation Plan (SCORP; IDPR, 1989): Idaho Department of Parks and Recreation (IDPR) is charged with developing and maintaining the Statewide Comprehensive Outdoor Recreation Plan (Idaho Code 67-4223 (f)). The IDPR through its comprehensive outdoor recreation planning process, identified the priority recreational needs for the southwest Idaho region as follow (in order of priority): picnic areas; trail facilities including hiking trails, exercise trails, trailhead parking, historic trails and nature trails; tent camping sites; and swimming beaches (IDPR, 1989). Most of these activities currently are available in the basin. The opportunity to develop additional facilities is also available.

Idaho Wetlands Conservation Priority Plan (IWCPP; IDPR, 1989): This plan was prepared by the Idaho Department of Parks and Recreation in response to section 303 of the Emergency Wetlands Resources Act of 1986 and is included in SCORP. IWCPP identifies wetlands that should receive protection. The IWCPP was compiled to help agencies focus their efforts on the most important wetlands in the state. The assessment criteria address wetland losses, threats, functions and values. No wetlands in the Boise basin are listed, but the basin has not yet been inventoried.

Federal Plans

Boise National Forest Land and Resource Management Plan and Final Environmental Impact Statement (USDA, 1990a; USDA, 1990b): The Boise National Forest Management Plan is a comprehensive blueprint for land and resource management on forest property for the next 10-15 years. It takes its direction from the Resources Planning Act (RPA) and the National Forest Management Act (NFMA). The Forest Plan focuses on a discussion of the forest resources, responses to issues, management direction and implementation. Relevant management guidelines include: conducting practices to be in compliance with state water quality standards, improving

facilities to enhance whitewater recreation experiences, implementing watershed improvement projects, obtaining water rights necessary to achieve Forest multiple use objectives, and maintaining riparian habitats.

Boise National Forest Timber Harvesting Five-Year Action Plan 1990-1995 (USDA, 1990c): Every year, the Boise National Forest updates their Five-Year Action Plan for harvesting on the forest. The crude volume of the proposed cut and the year projected for the harvest may change, as both are reevaluated at the time of the sale. The areal size and location of the sale doesn't usually change. The 1990-95 Action Plan for the Boise National Forest contains 18 prospective sales and cuts planned for the upper Boise River basin, and the estimated volume, acreage, location, and projected sale and cut years.

BLM Cascade Resource Management Plan (USDI, 1987): The Cascade Resource Management Plan was prepared in 1987 by the BLM with the intent of establishing a framework for managing their Cascade District over the next two decades. The basic purposes of this plan are: 1) to insure that the BLM lands are managed under the principles of multiple use and sustained yield; and 2) to insure that objectives and actions are responsive to the major issues and achieve an equitable and proper balance of resource use and protection.

As it impacts this basin, the plan has established management guidelines for the Boise Front ACEC that include restricting motorized vehicular use, regulating livestock grazing to maintain optimal habitat condition, not permitting any new roads to be built, and emphasizing native species management. In the Final EIS, the selected management objective emphasized preservation of significant natural resource features with moderate increases in commodity resource uses.

Northwest Conservation and Electric Power Plan (NWPPC, 1991): The Northwest Power Planning Council (NWPPC) originated with the 1980 Pacific Northwest Electric Power Planning and Conservation Act. The goal of the NWPPC's power plan is to ensure that the Pacific Northwest will have a reliable electricity supply well into the next century. The plan has several objectives: 1) to purchase more than 1350 megawatts of conservation and other low cost resources over the next 10 years; 2) to shorten the lead time for bringing new resources into the power system to improve flexibility; 3) to confirm costs and availability of additional resources; and 4) to encourage regulatory and other changes to facilitate plan implementation.

In addition to the 1350 megawatts of projected conservation energy, the Council recommends that BPA and the region's utilities begin siting, licensing, and designing facilities at cost-effective sites in the Northwest. It estimates that this would yield an additional 150 megawatts by 2000. The new projects must comply with the protected areas requirements (which are based exclusively on fish and

wildlife attributes) of the Council's Columbia River Basin Fish and Wildlife Program (below) and the Council's hydropower acquisition criteria.

Columbia River Basin Fish and Wildlife Program (NWPPC, 1987): As directed in the 1980 Power Act, in 1982, the Northwest Power Planning Council began to develop its Columbia River Basin Fish and Wildlife program. It represents a system wide approach to dealing with the affect of power production on the Columbia Basin's fish and wildlife. The program addresses: 1) salmon and steelhead; 2) resident fish and wildlife; and 3) general considerations (e.g., future hydropower development).

Salmon and steelhead no longer are able to migrate into the upper Boise River basin which means that the resident fish and wildlife facet of the program is the most directly used for this basin plan. Of greatest concern to the NPPC is development of mitigation plans for lost or altered fish and wildlife habitat with the development of hydroelectric dams and reservoirs.

Local Issues

Local issues were identified through the scoping process by the public, both at large and through the Advisory Group, and through federal and state agency input (Appendix B, p. B-1). Scoping was an ongoing process that entailed regular meetings of the Advisory Group and discussion with agency personnel. Throughout the planning process, issues emerged, were clarified, and prioritized. The result yielded, for the most part, the objectives of this basin plan (p. 38). At the initial Advisory Group meeting (May 23, 1991), the members began to discuss some of the more obvious issues that they felt needed to be addressed in this plan. A public issues meeting was held July 30, 1991 to which both the public and the Advisory Group were invited. Department staff distributed a survey questionnaire to help identify issues (see Public Issues Meeting, p. B-2). People were asked to consider the river basin attributes that they most valued and what they perceived to be the major threats to those attributes. That meeting was attended by 55 individuals, 35 of whom returned their surveys. Following that, the Water Resource Board issued a press release, soliciting comments from the public unable to attend the public issues meeting. The response resulted in a total of 44 surveys returned.

The (valued) basin attributes most frequently mentioned were water quality, quality recreation, free-flowing rivers, wilderness, and fish and wildlife (Table 3). Significant threats to the basin mentioned were population growth, dams and diversions, poor mining and logging practices, lack of recreational opportunities, and road construction (Table 4). Most of these contributions show that the main concern is maintenance of environmental, recreational and aesthetic qualities of the basin, while still being able to utilize the resources, such as timber and minerals. Most people

perceived hydropower development as a threat and free-flowing rivers as an attribute that was needed to maintain the primitive quality of the basin. Water quality was considered of critical importance in the basin because of the failure of Kirby Dam on the Middle Fork Boise River. At the time of the Public Issues Meeting, the future for Kirby Dam and its residual toxic sediments was not known.

Water Allocations and Projected Uses

Since January 1980, the IDWR has issued no water right permits for consumptive use of water during the period June 15 to November 1 on the Boise River and its tributaries above Lucky Peak Reservoir. In May 1992, a moratorium on most new ground and surface water uses was imposed by IDWR for the duration of the current drought. Water rights issued prior to 1980, upstream of Arrowrock and Lucky Peak, are summarized in Appendix C, Table 38, p. C-49.

All Arrowrock's active capacity of 286,600 AF has been allocated by the Bureau of Reclamation for irrigation (IDWR, 1974). Lucky Peak, on the other hand, has 111,950 AF allocated to irrigation companies or canal districts, and 152,300 AF that is allocated or reserved for stream flow maintenance, 50,000 AF of which IDFG can use (USACE, 1988a). Table 5 provides the breakdown of those allocations for both Arrowrock and Lucky Peak.

Table 3. Attributes Identified by the Public as Important for the Upper Boise River Basin.*

Water Quality	Watershed Management for Irrigation/Water Quantity
Recreation	Managed Forestry
Free-flowing Rivers/Protection/Instream Flows	Hydropower Site
Wilderness/Primitiveness	Mining Laws/Restrictions
Fishery	Few Roads/Good Road Maintenance
Wildlife	Water Conservation
Multiple-Use Land/Public Land	Healthy Native Vegetation
Scenic Value Preservation	Flood Control
Healthy Riparian Areas	Seclusion
Comprehensive Basin Plan/Management Monitoring	Hot Springs
Accessible from Major Urban Areas	

*Forty-four people responded, listing anywhere from 1 to 5 valued attributes each.

Table 4. Important Threats to the Resources of the Upper Boise River Basin Identified by the Public.*

Population growth: development, habitat abuse	Heavy Natural Resource Use
Dams and Diversions	No Monitoring of Conditions
Poor Mining Practices	Spread of Introduced Weeds
Poor Logging Practices	Open Pit/Heap Leach Mining
No Recreational Opportunities/Recreation Over-use	Outside Interests (Feds, CA,etc)
Road Building/Road Paving	Structures in Streambed
Erosion	Publicity
No Planning	Insufficient Flood Control
Increasing Power Costs	Reservoir Fluctuations (no minimum pool established)
No IWRB Action	Private Economic Gain Over Public Gain
Hazardous Wastes	Economics More Important Than Watershed Health
Poor Land Management	Sale of Private Land
Legal Red Tape	

*Forty-four people responded, listing anywhere from 1 to 5 threats each.

Table 5. Space Allocations in Arrowrock and Lucky Peak Reservoirs, 1988 Status (USACE, 1988a).

Name	Arrowrock	Lucky Peak
The Districts	200,816	
Nampa & Meridian Districts	55,055	
Pioneer Irrigation District (Phyllis)	21,018	16,000
Farmers Union Ditch Company	2,874	10,000
Settlers Irrigation District	1,778	10,000
Farmers Co-op Canal Company	1,227	
Ridenbaugh Canal Company	3,832	35,000
Ballentyne Ditch Company		1,300
Boise City Canal Company		1,000
Boise Valley Ditch Company		2,500
Bubb (South Boise Mutual)		500
Canyon County Water Company		6,000
Capitol View Irrigation District		300
Davis Ditch (Village of Garden City)		1,500
Eagle Island Water Company		7,650
Eureka Water Company No. 1		2,800
Little Pioneer (Pioneer Ditch Co.)		500
Middleton Irrigation Association		6,380
Middleton Mill Ditch Company		4,620
New Dry Creek Ditch Company		3,000
New Union Ditch Company		1,400
Rossi Mill (South Boise Water)		700
Thurman Mill		800
Idaho Fish & Game		50,000
TOTAL	286,600	161,950

Minimum Stream Flows

There are no minimum stream flows established in the upper Boise River basin. IDWR policy considers the basin above Lucky Peak Dam to be fully appropriated from June 15 to November 1. Because of the potential impacts of even nonconsumptive uses, the Board is considering application for minimum stream flows on key reaches (Final Actions and Recommendations #2, p. 57).

Water Quality

Throughout the planning process, the public indicated that the greatest attribute of the basin streams is the high water quality.

The federal Clean Water Act (section 319) requires states to develop Best Management Practices (BMP) to minimize pollution from nonpoint sources, such as timber harvesting and agriculture. The Idaho Forest Practices Act, Rules and Regulations, mandates that timber harvests must follow the BMP as established by the rules of the Act. If a stream reach is designated as a Stream Segment of Concern (SSOC) because of a timber harvest threat to water quality in the watershed, a Local Working Committee (LWC) is usually established by the Department of Lands. The role of the LWC is to review the BMP for the watershed and where appropriate, establish a site specific BMP. There are two SSOCs in the basin, the North Fork Boise River and Crooked River.

With the failure of Kirby Dam on May 26, 1991, the water quality of the Middle Fork Boise River and main Boise River was impacted. Historic mining activity above Kirby Dam, caused high levels of arsenic and mercury in the sediments that were impounded and now have been partially released into the Middle Fork. The Forest Service estimated that 90,000 cubic yards has washed down stream with 160,000 to 210,000 remaining behind the dam (McIntyre, 1991). Water, sediment, and fish sampling done after the Kirby failure by the DEQ found levels of both arsenic and mercury in the water exceeding accepted standard levels, and "hot spots" in the sediments. Fish tissue levels were not statistically different than fish sampled elsewhere in the basin (McIntyre, 1991). The unreleased sediments remaining above Kirby led to reconstruction of the dam during the winter of 1991-92.

Flood Control

Because of the lack of development in the basin, the potential for municipal and residential flood damage above Lucky Peak Dam is not extreme. The only serious concern for flood damage has

been near Idaho City. Flooding along Mores Creek drainage and tributaries, such as Elk Creek, has generally been due to a midwinter (frequently December) warm-temperature snowmelt, often combined with a rain-on-snow event. The historic mine tailings on Elk Creek have gradually displaced the stream causing it to shift westward, posing a potential flood problem. The debris can fill the channel during a flood, particularly at the Centerville Road bridge area, and divert additional floodflows back into Idaho City (FEMA, 1988). Beaver activity along Elk Creek has also been known to create minor flooding problems. Because Idaho City's water is supplied by Elk Creek, any flooding causes concern about the community's water quality.

Bear Run Creek, an intermittent tributary of Elk Creek, which runs through Idaho City, has exceeded its banks on several occasions (summer and winter) and flooded Main Street. Flooding of other small tributaries to Mores Creek, can be due to intense thunderstorms. Mores Creek has also been subject to ice jam flooding, particularly at the highway bridges. The state has recently been modifying some of these problem areas (FEMA, 1988).

Flood control below Lucky Peak Dam is dependent on the management of the three major dams in the basin. By an agreement between Corps of Engineers, Bureau of Reclamation, and the IDWR, the regulation objective discharge at Glenwood Bridge in Boise is 6500 cfs (USACE, 1988a). The spill at Diversion Dam can have flows up to 8000 cfs and the river will still be at 6500 cfs below town because of irrigation diversions.

The proposed Twin Springs project would increase the flood control space in the Boise basin by more than 30 percent according to the irrigation districts' study (Boise-Kuna Irrigation District et al., 1990). The study also states that with Twin Springs dam, the minimum combined flood control space in Lucky Peak and Arrowrock Reservoirs can be reduced from 165,000 to 132,000 AF, because of the additional space in a Twin Springs reservoir. During wet years, the increased storage including Twin Springs Reservoir, would limit flood damage resulting from discharges above the regulated 6500 cfs at Glenwood or from use of Lucky Peak emergency spillway. Since the dam was constructed (1955), there were 12 different years in which the flow at Glenwood exceeded 6500 cfs and 8 months (2 in 1974 and 1986) in which the average was in excess of 6500 cfs (USACE, 1988a). According to a study done in 1974 by the IDWR, the probability of a maximum regulated flow exceeding 6500 cfs in Boise is 30 percent (IDWR, 1974).

Flood control below Lucky Peak has created unnatural conditions on the lower Boise River that may actually lead to increased flood damage. With the prevention of the annual beneficial process of floodplain scouring, sediment deposition and vegetation growth have reduced the volume capacity of the channel. This means that in the arrival of a future flood, the damage to the ever-increasing development on the floodplain could be extensive. Secondly, there is serious concern

among plant ecologists that the cottonwoods are not sexually reproducing because the seedbed for germination is poor due to the lack of flood-related deposition from overland flow or flood events (Tiedemann, 1991).

River Protection

Historic and Existing River Protection

Northwest Power Planning Council (NWPPC) Protection: The NWPPC Columbia River Basin Fish and Wildlife protection program identifies those river reaches that warrant protection against any future hydropower development (NWPPC, 1990). The NWPPC designated 95 distinct reaches on 38 separate streams in the basin for protection (Table 6). This is based exclusively on their fish and wildlife attributes. The information the Council uses to make their designations is based on recommendations from several organizations including the USFS, BLM, indian tribes, and local interests. The IDFG manages the data base and recommends most updates.

Table 6. Northwest Power Planning Council's Protected Areas Designations, Upper Boise River Basin (Allen et al., 1986).

Name	Reach	Name	Reach
Mores Creek and Main Boise River Watershed		**Middle and North Fork Boise Watershed**	
Boise River	Lucky Pk. Dam to confluence North and Middle Forks	Middle Fork Boise River	Confluence with North Fork Boise to Headwaters
Mores Creek	Lucky Peak Res. to headwaters	Browns Creek	Mouth to headwaters
Robie Creek	Lucky Peak Res. to headwaters	Roaring River	Mouth to headwaters
Daggett Creek	Mouth to headwaters	Roaring River, E FK.	Mouth to headwaters
Smiths Creek	Mouth to headwaters	Hot Creek	Mouth to headwaters
Grimes Creek	Mouth to headwaters	Blackwarrior Creek	Mouth to headwaters
Macks Creek	Mouth to headwaters	Queens River	Mouth to headwaters
Granite Creek	Mouth to headwaters	Little Queens River	Mouth to headwaters
Elk Creek	Mouth to headwaters	King Creek	Mouth to headwaters
Bannock Creek	Mouth to headwaters	Yuba River	Mouth to headwaters
Deer Creek	Lucky Peak Res. to headwaters	Decker Creek	Mouth to headwaters
Grouse Creek	Lucky Peak Res. to headwaters	Grouse Creek	Mouth to headwaters
Willow Creek	Mouth	Sawmill Creek	Mouth to headwaters
Wood Creek	Mouth to headwaters	French Creek	Mouth to headwaters
Cottonwood Creek	Lucky Peak to headwaters	Meadow Creek	Mouth to headwaters
Logging Gulch Creek	Mouth to headwaters	Rabbit Creek	Mouth to headwaters
Browns Creek	Mouth to headwaters	Crooked Creek	Mouth to headwaters
Sheep Creek	Mouth to headwaters	Big Owl Creek	Mouth to headwaters
		Bear Creek	Mouth to headwaters
		Johnson Creek	Mouth to headwaters

Federal Wild & Scenic River System: The Boise National Forest 1990 Land and Resource Management Plan lists 11 river segments (segments = reaches) in the basin that they propose to study for their suitability to be eligible for inclusion into the national Wild & Scenic Rivers System (Table 7). In order to be eligible for inclusion, the segment must be both 1) free-flowing, and 2) possessing one or more outstandingly remarkable values. Until eligibility studies are completed, the segments are managed to protect outstanding values (USDA, 1990a).

On February 14, 1991, Governor Andrus signed a memorandum of understanding with the Forest Service and Bureau of Land Management stating that the state would coordinate its future river planning efforts with Federal Wild & Scenic Rivers studies. To this end, the IDWR and BNF have attempted to coordinate their studies on several coincident reaches (Middle Fork Boise, Yuba and Roaring Rivers). The only limitations have been that IDWR began this basin study well before the BNF and planned for legislative review in 1993. Consequently, the extent of collaboration has been limited primarily to sharing data and planning resources.

Table 7. Streams Proposed for Study as Federal Wild and Scenic Rivers, Upper Boise River Basin (USDA, 1990).

Stream	Segment	Potential Designation	Potential Outstandingly Remarkable Values
Crooked River	Whoop-Em-Up Cr. to N.F. Boise	Wild	Fish
Bear River	Headwaters to N.F. Boise	Wild	Wildlife
N.F. Boise River	Wilderness Boundary to Johnson Cr.	Recreational	Wildlife, Fish, Natural Features, Recreation
N.F. Boise River	Johnson Cr. to Hunter Cr.	Wild	Wildlife, Fish, Natural Features, Recreation
N.F. Boise River	Hunter Cr. to Rabbit Cr.	Recreational	Wildlife, Fish, Natural Features, Recreation
N.F. Boise River	Rabbit Cr. to M.F. Boise R.	Wild	Wildlife, Fish, Natural Features, Recreation
M.F. Boise River	Forest Boundary to Willow Cr.	Recreational	Wildlife, Fish, Natural & Cultural Features
Yuba River	Headwaters to Trail Cr.	Wild	Fish
Yuba River	Trail Cr. to M.F. Boise	Recreational	Fish
Roaring River	Headwaters to where river crosses FS Rd. 255	Wild	Wildlife, Natural Features
Roaring River	Where river crosses FS 255 to M.F. Boise R.	Recreational	Wildlife, Natural Features

Scenic and Recreational Values

Preservation of scenic and recreational values within the upper Boise River basin was one of the issues most often cited by the public during the planning process. Related attributes identified in the scoping process included wilderness, proximity to populations, fisheries, wildlife, access, solitude and hot springs. Potential impacts and issues cited relative to these values include over-use, increased population, maintenance needs of existing facilities, need for more developed facilities, and protection of primitive areas. The Boise National Forest predicts recreational use on the forest will increase by 14.78% for the next decade (1990-2000) and 12.90% for the following decade (2000-2010) (USDA,

1990a). Recreational activity on forest lands within the basin for 1991 increased by 2.2% from the previous year.

Interviews with various recreational users including campers, hikers, trail bikers, and fishermen have suggested that scenery is the major reason for selecting an area to recreate. A 1991 recreation study conducted in the Boise River system found 59% of those surveyed cited the aesthetic values of the river corridors as the reason for visiting the area (Long, 1991). A 1987 angler survey found fisherman placed high values on the "beauty of an area" and water quality when selecting an area to fish (Reid, 1989). All of these surveys and public response during the planning process indicate the importance of aesthetics to the recreation experience.

From the standpoint of aesthetics in river corridors, immediate threats could include changes in water quality or quantity, development in land areas immediately adjacent to the river corridors, impacts to riparian areas, and erosion of streambanks. Many of these potential impacts may occur from resource utilization such as logging, mining, hydropower construction, or development of private land changing the natural character of the landscape. Yet, recreation use itself can cause substantial aesthetic impacts through lack of developed facilities and subsequent over use leading to degradation of riparian areas and streambanks. Development of additional recreation sites will also change the natural setting valued by many to a more developed character.

The need for expansion of developed campgrounds and trail opportunities within the basin was cited often by agencies and users during the planning process. This is especially critical in river corridors such as the Middle Fork Boise River and North Fork Boise River where dispersed camping use exceeds available developed facilities resulting in adverse recreational impacts. Provision of developed facilities may reduce impacts to riparian areas and erosion to fragile streambanks. Any additional developed recreation sites should to be balanced with preserving the more pristine natural camping and recreational experiences preferred by many. This may be accomplished by locating campgrounds in areas that already receive heavy dispersed use because of accessibility. A need exists for environmental education regarding low impact recreational activities in the river corridors.

Substantial trail use occurs in the basin, particularly along streams and river corridors. Many trails are poorly maintained and signed. Sedimentation and riparian impacts are likely from stream crossings and trail erosion. The public and SCORP have identified trail maintenance and expansion of trail facilities as a high priority need.

Effects to recreational resources may occur from resource utilization in the basin. Timber and mining occur within the basin. Short- and long-term effects are possible from these activities

including changes in landscape aesthetics, increased traffic and noise on basin roads. Hydro project proposals will result in permanent impacts to some recreational activities.

If constructed, the Twin Springs project could modify boating activities on portions of the mainstem, North and Middle Forks Boise River. Given reports of boating conflicts and safety issues on Lucky Peak, there may be additional need for this type of boating (Hoedt, 1992). Twin Springs would not be a viable alternative for meeting flatwater boating needs, because access conditions would make it less attractive than Lucky Peak. However in low water years, the Twin Springs project may supplement water levels at Lucky Peak extending boating use and providing more surface area to reduce boating conflicts (Boise-Kuna Irrigation District et al., 1990). More study would be necessary to find the current cause of conflicts on Lucky Peak and whether Twin Springs is a feasible alternative to resolving this problem.

Whitewater boating opportunities for novices on the main Boise River and Middle Fork Boise River and advanced user opportunities available on the North Fork Boise River from Rabbit Creek to the confluence would be reduced if the Twin Springs project was found feasible and constructed. Beginning level opportunities are available further upstream on the Middle Fork. However, the advanced stretch on the North Fork Boise River could not be replaced in the immediate vicinity of Boise. A more advanced whitewater experience is available on the South Fork Boise; however, this stretch already receives significant use (Lucachick, 1992). Whitewater experiences near Boise of similar challenge with similar visual and solitude characteristics are the unroaded section of the South Fork Salmon, and the unroaded portion of the Deadwood River (Lucachick, 1992).

Basin Objectives

The following objectives are based on the issues and concerns identified for the Basin:

1. Maintain and improve the water quality of the streams and lakes in the basin. Particular attention needs to be paid to the Middle Fork Boise River and North Fork Boise River, Crooked River, Mores Creek, Grimes Creeks, and Beaver Creek.

2. Maintain high quality recreation typically associated with free-flowing and unpolluted rivers.

3. Insure that fish and wildlife habitat, particularly along the Middle and North Forks Boise River, is not further degraded by reduced water quality and habitat destruction.

4. Encourage multiple-use management practices outside the Sawtooth Wilderness Area, recommended Ten Mile Wilderness Area, and protected river corridors.

5. Encourage sound, state-of-the-art watershed and riparian area management practices to insure water quality and groundwater recharge, and healthy ecosystems.

6. Encourage good land stewardship through implementation of BMPs for forestry, mining, and grazing.

7. Protect outstanding free-flowing rivers in the basin through either state protection or minimum instream flows.

8. Protect scenic values in the basin, particularly in areas that are threatened such as Mores Creek which parallels State Scenic Highway 21.

9. Protect potential hydropower sites, such as Twin Springs, from uses and threats (e.g., upstream diversions) that may compromise that potential.

10. Maintain the primitive character of the basin, particularly along the Middle and North Forks Boise River. Existing roads should be maintained, particularly access to Atlanta, but new road building and upgrading, and new development, should be limited.

11. Continue to assess opportunities for development of upper Boise River basin water resources for beneficial use within and outside the basin.

SUITABILITY ANALYSIS OF RIVER REACH DESIGNATIONS

An analysis of the suitability of river reaches for inclusion in a state protected river system consists of two steps: 1) a screening process followed by 2) an examination of management alternatives.

Screening Evaluations

Individual reach boundaries are based on the following: 1) USGS reach designations (largely based on natural hydrographic distinctions), and 2) commonalities defined by the screening results. Reaches that fall entirely or largely within the Sawtooth Wilderness Area were not considered because they receive *de facto* protection being within an established Wilderness Area.

Waterways possessing outstanding fisheries, wildlife, recreation, aesthetic or geologic resource values are eligible for state designation as natural or recreational waterways (Idaho Code, Sec. 42-1731). The objective of the screening process is to identify river corridors possessing these outstanding resource values. This was accomplished by evaluating aesthetic, biologic, and recreation data for importance using one of three categories - very high, high, or moderate to low. Resources evaluated as very high are considered to possess *outstanding resource values*.

Outstanding resources are defined as: *unique*, *highly-valued*, and/or *extremely sensitive resources*. This may be shown by 1) legal protection excluding or limiting development; 2) special agency management designations protecting the resource; 3) significant public concern voiced for its protection; and/or 4) resources susceptible to adverse impacts with little possibility of mitigating these impacts. Specific criteria for aesthetic, biologic and recreation resources to determine outstanding resource values were developed for the Upper Boise River Basin Plan and are described below. River segments with at least one outstanding resource value are identified in Plate 15.

Screening Evaluation for Biological Resources (Fish, Wildlife, and Biological Communities)

Data collected for the upper Boise River basin biological evaluation focused on three areas: fisheries, wildlife and special management areas or unique biological communities. The data were either provided by fish and wildlife biologists with state and federal agencies or obtained directly from the professional literature.

Evaluation Criteria: Fish and wildlife species that are listed by the U.S. Fish and Wildlife Service as threatened, endangered or candidates were considered in screening evaluation as were species listed by the Conservation Data Center (CDC--formerly Idaho Natural Heritage Program). The CDC evaluates sensitive species in regard to their global status and their local (state) status, then ranks them from 1 (most threatened) to 5 (least threatened). The combined global and local values were calculated so that the evaluation would not be biased by either local or global status.

Federal and CDC listed fish and wildlife species of concern that were considered in this plan are listed in Table 8. Species listed by the USFWS are either endangered, threatened, or candidate species.

Table 8. USFWS Threatened, Endangered, and Candidate Species and Conservation Data Center's Global and State Ranks for Sensitive Species in the Upper Boise River Basin (Moseley and Groves, 1992).

Species	USFWS Listing	Global Rank*	State Rank*
Fisher (Martes pennanti)		5	1
Wolverine (Gulo gulo)	**candidate**	4	2
Fringed myotis bat (Myotis thysanodes)		5	1
River otter (Lutra canadensis)		5	4
Gray wolf (Canis lupus)	**endangered**	4	1
Bald eagle (Haliaeetus leucocephalus)	**endangered**	3	3
White-headed woodpecker (Picoides albolarvatus)		5	1
Goshawk (Astur atricapillus)	**candidate**	4	4
Flammulated owl (Otus flammeolus)		4	3
Bull trout (Salvelinus confluentus)	**candidate**	4	2
Westslope cutthroat trout (Oncorhynchus clarki)		5	2
Tiehm's rush (Juneus tiehmii)		5	2
Pine woods cryptantha (Cryptantha simulans)		4	1
Tall swamp onion (Alium validum)		4	1
Wilcox's primrose (Primula wilcoxiana)	**candidate**	2	2
Silvery whitlow grass (Draba argyraea)	**candidate**	3	3
Idaho goldenweed (Haplopappus aberrans)	**candidate**	3	3
Giant helleborine (Epipactis gigantea)		4	3
Idaho douglasia (Douglasis idahoensis)		2	2

(**bold type** are those species listed by USFWS)

* CDC ratings

1 = critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction

2 = imperiled because of rarity or because of other factors demonstrably making it very vulnerable to extinction

3 = either very rare and local throughout its range or found locally in a restricted range or because of other factors making it vulnerable to extinction

4 = apparently secure, though it may be quite rare in parts of its range, especially at the periphery

5 = demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery

Fisheries: The attributes of the fishery resource that were considered were habitat, abundance, and sensitive fish species. The Habitat Condition Index (HCI) is a fish habitat evaluation method used primarily by the Forest Service that considers streambank stability, streambank cover,

stream flow, water quality, and sediment. A percentage value is calculated and anything above 85% is considered very high quality habitat, between 80-84% is considered high quality habitat, and below 80% moderate to low.

Idaho Department of Fish and Game fisheries biologists describe a very high population abundance of wild rainbow trout density as having greater than 10 juveniles or 4 adults per 100 m^2 of stream, a high abundance would range from 4-10 juveniles or 2-4 adults, and anything below that would constitute a moderate to low abundance.

The sensitive fish species listed in this basin are the bull trout (formerly called Dolly Varden) which is listed as a candidate, and the cutthroat trout. Because the bull trout habitat is cosmopolitan in the basin, being a candidate, would give every reach in the basin a high rating. The cutthroat trout has been planted in the basin and probably not threatened. Consequently, the more discriminatory criteria of habitat and population abundance were used.

Wildlife: A very high wildlife evaluation for sensitive or game species (mule deer, elk) would require that the most critical habitat is located on or adjacent to their breeding grounds or fawning, calving or nesting areas. Winter roosting areas for bald eagles would be given a very high evaluation. Also included would be federal threatened and endangered species or CDC species with combined global and state values no greater than 4 (Table 8). Wildlife ranges have been mapped by USFS wildlife biologists for the entire Boise N.F. Wintering areas for elk, deer, and mountain goat were designated high. USFWS Candidate species or CDC species with combined values of 5 or 6, were given a high evaluation. CDC species with combined values greater than 6 were designated moderate to low.

Unique or Protected Communities: These areas are usually managed by federal and state agencies and include: Research Natural Areas (RNA), Areas of Critical Environmental Concern (ACEC), Wildlife Management Areas (WMA), Wilderness Areas (WA), Special Interest Areas (SIA), or wetlands listed by the USFWS National Wetland Inventory (NWI), or other recognized inventory.

Special communities that are evaluated as very high include designated wetlands, Research Natural Areas, Wildlife Preserves, or Wilderness Areas (existing or recommended). The EPA has identified the North Fork Boise River as a "priority wetland" but the USFWS National Wetland Inventory and the State Comprehensive Outdoor Recreation Plan (SCORP) have not yet identified and designated any wetlands in the basin. However, their inventories are not finished and therefore the possibility exists that the basin contains additional valuable wetlands. Special communities that were evaluated as high include Special Interest Areas (USFS designation), Areas of Critical Environmental Concern (BLM designation) or IDFG Wildlife Management Areas.

Results: The results of the biological evaluation of the basin are presented in Table 9 and illustrated in Plate 12 (map pocket). The plate depicts river basin areas and stream reaches categorized as very high, high, and moderate. Table 9 summarizes specific resources satisfying these criteria.

Screening Evaluation for Aesthetic Resources (Scenic Values and Natural Features)

Data collection for the upper Boise River basin aesthetic analysis identified scenic landscape values, viewer characteristics, and agency aesthetic management objectives summarized in the resource summary section and described in more detail in Appendix C. The aesthetic evaluation identified landscapes: 1) possessing outstanding scenic values; 2) viewed from the most sensitive viewpoints (see Appendix C, p. C-21; viewer characteristics); and 3) managed specifically to protect scenic values. Aesthetic resources were evaluated as very high, high, or moderate to low (Table 10 and Plate 13).

Evaluation Criteria: Aesthetic resources evaluated as very high include landscapes with outstanding or unique scenic qualities, viewsheds from extremely sensitive viewpoints, and landscapes managed to protect the aesthetic values of the area. These are resources which are easily impacted with little potential to mitigate.

Landscapes evaluated as very high are characterized by unusual, distinctive, unique or outstanding scenic values (Appendix C, p. C-20). Landscapes so identified are considered the most outstanding scenery in the basin.

Identification of extremely sensitive viewpoints was accomplished through review of inventory data compiled by the Boise National Forest. Additional viewpoints were added to the inventory, and sensitivity levels reviewed and revised to reflect current sensitivity of the user. Extremely sensitive viewpoints were identified as viewpoints where the activity is highly dependent on the aesthetic environment, and visual impacts would be difficult to mitigate. These were evaluated as very high.

Agency aesthetic resource management objectives were reviewed. Landscapes managed to allow only ecological changes to the characteristic landscape indicate very high aesthetic resource values. Additionally, special agency designations which are instituted to specifically, or in combination with other resource objectives, protect aesthetic resources were examined.

Table 9. Screening Evaluation Criteria and Results for Biological Resources, Upper Boise River Basin.

Very High	Boise Basin	High	Boise Basin	Moderate to Low	Boise Basin
Fisheries		Fisheries		Fisheries	
USFS Current Habitat Condition Index (HCI) rating of 85 or greater or Rainbow adult density greater than 4.0 fish/100 m2 or Rainbow juvenile density greater than 10.0 fish/100 m2 or Federal LE species or Conservation Data Center (CDC) Global and State rating no greater than 4 OR	Sheep Creek (12.01)	USFS HCI rating 80-84 or IRIS high abundance rating or Rainbow adult density 2-4 fish/100 m2 or Rainbow juvenile density 4-10 fish/100 m2 or Federally Listed Candidate habitat or Conservation Data Center (CDC) Global and State rating 5 or 6 OR	Roaring River (8.6), Yuba River (4.4), Rabbit Creek (4.5), Johnson Creek (8.6) Bull trout	USFS HCI rating below 80 or Rainbow adult density less than 2.0 fish/100 m2 or Rainbow juvenile density less than 4.0 fish/100 m2 or Conservation Data Center (CDC) Global and State rating greater than 6 OR	M. Fork Boise (all sections) N. Fork Boise (all sections) Queens River (2.9), Crooked River (2.9) Bear River (1.6)
Wildlife		Wildlife		Wildlife	
Critical habitat for natives and migrants (federal listed species; nesting, roosting, calving, etc.) or Federal LE species or Conservation Data Center (CDC) Global and State rating no greater than 4 OR	Bald eagle, Gray wolf	Winter range for native game or nongame species or Federal Candidate species or Conservation Data Center (CDC Global and State rating 5 or 6 OR	Elk, deer, mt. goat winter ranges Wolverine, Fisher, White-headed woodpecker, Fringed myotis bat	Conservation Data Center (CDC) Global and State rating greater than 6	Flammulated owl, Goshawk, River otter, Westslope cutthroat trout
Plants	Wilcox's primrose, Idaho douglasia	Plants	Tall swamp onion, Silvery whitlow grass, Idaho goldenweed	Plants	Giant helleborine, Tiehm's rush
Unique or protected communities		Unique or Protected Communities			
Wetlands: EPA or NWI or SCORP listing or Research Natural Area or Wildlife Preserve or Wilderness Area/ Recommended Wilderness	Bannock Creek RNA, N. Fork Boise RNA (p), Roaring River RNA (p), Sawtooth Wilderness Area, Ten Mile Wilderness Area (recommended)	Special Interest Area/ Area of Critical Environmental Concern or State Wildlife Management Area	Boise Front WMA Boise Front ACEC		

Table 10. Screening Evaluation Criteria and Results for Aesthetic Resource, Upper Boise River Basin.

Evaluation Class	Criteria	Upper Boise River Basin Plan
Very High	Landscapes possessing outstanding scenery or unique, rare features. Viewpoints where viewers are extremely sensitive to changes in the visual landscape. Agency management restricting visual change to ecological occurrences.	Landscapes with class A scenic values (Appendix C, p. C-20) Sawtooth Wilderness Area Recommended Ten Mile Wilderness Area
High	Scenic landscapes visible within the foreground of high sensitivity viewpoints. **and** Agency management requiring visually compatible or harmonious changes to landscape.	Landscapes with class B scenic values viewed from foreground viewshed of viewpoints with high sensitivity. **and** VQO retention (Appendix C, p. C-22) VRM class II (Appendix C, p. C-22)
Moderate to Low	Scenic landscapes viewed beyond foreground views. Landscapes with minimal scenic variety. Landscapes viewed from moderate to low sensitivity viewers. Agency management allowing visual changes that may visually dominate the landscape.	Landscapes with class B scenic values and viewed from the middleground and beyond from viewsheds. Landscapes with class C scenic values. Landscapes viewed from viewpoints with moderate to low sensitivity. VQO - Modification or maximum modification. VRM Class IV

Rivers identified as eligible for wild and scenic river suitability analysis received no special consideration in the aesthetic analysis for the upper Boise River basin plan. The eligibility finding serves an initial inventory function highlighting the need for detailed suitability studies. These detailed studies have not been completed, and therefore, no information is provided to support suitability.

Resources with high aesthetic values are not unique or outstanding regionally, but are highly valued by the public. Although agency management may not prohibit development, the resource is sensitive to disturbance, and changes could not easily be mitigated.

High aesthetic resource values in the Upper Boise basin include scenic landscapes (Class B) visible from the foreground (up to 1/4-1/2 mile) of highly sensitive viewpoints. Activities within the foreground viewshed are more likely to result in high visual impacts because of the proximity to the viewer. Consequently, impacts are also less likely to be mitigated successfully. Agency management requiring visual change be compatible with characteristic landscape patterns also signifies high viewer

sensitivity and aesthetic values. Mitigation of visual impacts in these management areas are more difficult.

The remaining basin was categorized as moderate to low for aesthetic values. This encompasses lands which possess landscape scenic values common to the region or with minimal variety (Class B or C), as seen by viewers, and/or viewed at a distance (beyond 1/4 to 1/2 mile) from highly sensitive viewpoints are less likely to experience significant visual impacts, and therefore, were evaluated as moderate to low.

Results: Plate 13 depicts the river basin areas categorized as very high, high, or moderate to low for aesthetic values. Table 10 summarizes these resource values.

Screening Evaluation for Recreation Resources

The recreation evaluation focused on opportunities occurring within specific river corridors. The evaluation entailed identification of recreation units; analysis of the recreational diversity and importance for each recreation unit. Categorization of a final evaluation value was done for each recreation unit (very high, high or moderate to low).

Rivers and streams within the basin were grouped into discrete recreation units. These units were delineated on the basis of landform, hydrology, land use patterns, visual character, and information received from the Advisory Group and agencies. A total of 33 recreation units were identified for the following drainages: main stem Boise, North and Middle Forks Boise, Mores Creek, Grimes Creek, Roaring River, Yuba River, Bear River, Queens River, Sheep Creek, Black Warrior Creek, Swanholm Creek, Johnson Creek, and Phifer Creek (Plate 14).

Evaluation Criteria: Recreational diversity is a measure of the variety of recreational activities available in the recreation unit. Four criteria were assessed to arrive at a diversity value -- land-based recreation activities, water-based recreation activities, natural features and access level.

Land-based and water-based recreation activities occurring within the river corridor were identified through review of developed facilities described in agency documents and maps; communications with various agencies and user groups; and review of a recreational survey conducted in the summer of 1991 along the main, North and Middle Forks of the Boise (Long, 1991). Land-based activities include camping, hiking, or hunting. Water-based recreation includes fishing, swimming and boating.

Natural features were identified which enhance recreation opportunities or experiences. These include water characteristics influencing the type of boating activity possible; aesthetic values of the unit; special wildlife habitat characteristics providing increased opportunities for wildlife observation; and general viewing characteristics within the river corridor.

Level of access was described to provide information regarding the types of recreational activities possible, potential use volumes, and opportunities for a primitive versus more developed recreation experience. Assessment of land and water-based recreation activities, natural features and access levels resulted in a diversity rating for the recreation unit of very high, high, moderate or low.

Recreational importance was determined through review of four criteria: 1) unique or rare features which enhance the recreation experience were identified, i.e., unusual landforms, hot springs, water falls or rapids, or significant fisheries; 2) public concern for the recreational value of the unit was determined from public and advisory group input, and agency consultation, 3) use volume for a recreation unit was based on recreational survey data collected in the summer of 1991 and agency consultation, and 4) special designations or agency recreation management objectives were reviewed. The compilation of these four criteria resulted in an importance rating of very high, high, moderate, or low.

A final evaluation class for each recreation unit was based on an assessment of the diversity and importance of recreational opportunities. Final evaluation classes possible include very high, high, and moderate to low.

A recreation unit evaluated as very high fulfills at least one of the following: a) provides outstanding recreation opportunities encompassing a great diversity of recreational activities; b) provides a unique or rare experience within the region or basin; c) receives the highest use; and/or d) possesses an agency designation indicating national or regional significance.

A recreation unit evaluated as high is characterized by river segments a) receiving high use but providing opportunities typical for the region; b) providing a moderate diversity of recreational opportunities; and/or c) having an agency recommended designation indicating the national or regional significance of the recreation resource.

Moderate to low designations define those river segments with typical recreational opportunities and moderate to low use. Numerous stream segments did not receive recreation evaluation classes because insufficient data were available to complete an analysis.

Results: Recreation evaluation criteria and the results of the recreation evaluation are summarized in Table 11 and displayed in Plate 14. Specific recreational features of these units are summarized in the Department's planning files.

Resource and Development Summaries of Outstanding Reaches

The reaches in the basin that emerged from the screening process with at least one outstanding value, whether it be biological, aesthetic, or recreational are described in Table 12 and Plate 15.

Management Alternatives

The suitability analysis process involves comparing several different management alternatives and developing a single alternative that best meets the objectives of the basin plan. Four alternatives were prepared, ranging from no action to protection of all river reaches possessing outstanding resource values. These four alternatives (A-D), which were discussed by the Advisory Group, are presented in Appendix D, p. D-1. Maps of each alternative are available for review in IDWR files.

Table 11. Recreation Evaluation Criteria and Screening Results, Upper Boise River Basin.

Evaluation Class	Criteria	Recreation Units
Very High	Significant recreational opportunities available as indicated by a great diversity of activities including unique or rare experience; highest use areas; or agency **designation** indicating the national or regional significance of recreational opportunities.	• River Segments within Sawtooth Wilderness • Sheep Creek (William Pogue National Recreation Trail) • North Fork Boise from Black Rock to Troutdale - Continuous Class IV whitewater in roadless setting • North Fork Boise from Swanholm Road to Johnson Creek - Unroaded segment of "highest-valued fishery resource" • North Fork Boise from Black Rock to Barber Flat and Boise from Willow Creek to Troutdale - Highest recreational use volume
High	River segments with a high use volume and moderate recreation diversity or recreation opportunities typical for the region; or agency **recommended designation** indicating the national or regional significance of the recreation resource.	• River segments within Recommended Ten Mile Wilderness • Sections of the North and Middle Forks Boise - High diversity • Lucky Peak - High diversity • Mores Creek (above Idaho City) - High diversity • Swanholm Creek - High diversity • Crooked River (two segments) • Roadless stretch of Bear River
Moderate to Low	River segments with low use volume and providing recreational opportunities typical and abundant within the region.	• Mores Creek (below Idaho City) • Grimes Creek • Arrowrock Reservoir • Yuba River • Roaring River • Portion of Bear River
Unknown	Insufficient data to evaluate.	• Portion of Crooked River • Middle Fork Roaring River • Black Warrior Creek

Table 12. Resource and Development Summaries of Outstanding Reaches, Upper Boise River Basin.

Reach	Outstanding Values	Development Potential
Boise River (Lucky Peak Dam to North and Middle Fork confluence)	bald eagle winter roosting habitat outstanding recreational value above Arrowrock reservoir (2nd most popular segment in 1991 IDPR recreation study) high recreational diversity NWPPC protection eligible for Wild & Scenic River study	3 geothermal hot springs in reach 3 inactive hydropower study sites on reach 1 inactive reservoir study site roaded entire reach
Sheep Creek (Main Boise to headwaters)	outstanding juvenile wild rainbow trout abundance William Pogue National Recreation Trail NWPPC protection	
Middle Fork Boise River (North Fork Boise confluence to Roaring River)	bald eagle winter roosting habitat past Roaring River IDFG manages as quality wild trout fishery NWPPC protection eligible for Wild & Scenic River study	8 geothermal hot springs along reach roaded entire reach 2 inactive hydropower study sites on reach recreational dredging
Roaring River (East and Middle Forks confluence to headwaters)	outstanding scenic quality in headwaters (Trinity Lakes) eligible for Wild & Scenic River study candidate Research Natural Area in reach NWPPC protection	
Phifer Creek (upper portion to headwaters)	outstanding scenery	roaded
Hot Creek (upper portion to headwaters)	outstanding scenery NWPPC protection	
Black Warrior Creek (Middle Fork confluence to headwaters)	outstanding fish habitat NWPPC protection	area has mining potential for several types of ore deposits
Queens River (Middle Fork confluence to Sawtooth Wilderness Area boundary)	outstanding fish habitat recreational access to Sawtooth Wilderness Area NWPPC protection	roaded entire reach
Yuba River (Middle Fork to confluence with Decker Cr.)	outstanding fish habitat eligible for Wild & Scenic River study NWPPC protection	roaded reach mining potential as identified by Atlanta Gold Corp.
Yuba River (Decker Cr. to headwaters)	outstanding fish habitat eligible for Wild & Scenic River study outstanding scenic quality in headwaters NWPPC protection	mining potential as identified by Atlanta Gold Corp.
Decker Creek (Yuba R. to headwaters)	outstanding fish habitat outstanding scenic quality in headwaters NWPPC protection	roaded lower portion mining activity and potential as identified by Atlanta Gold Corp.

Table 12. Resource and Development Summaries of Outstanding Reaches, Upper Boise River Basin.

Reach	Outstanding Values	Development Potential
North Fork Boise River (Middle Fork Boise confluence to Rabbit Cr.)	outstanding fish habitat advanced whitewater through unroaded canyon eligible for Wild & Scenic River study candidate Research Natural Area in reach NWPPC protection	
North Fork Boise River (Rabbit Cr. to Little Owl Creek)	outstanding fish habitat from Rabbit Cr. to Roaring River (less than half of reach) outstanding recreational value and diversity (contains highest used rec. seg.) eligible for Wild & Scenic River study NWPPC protection	roaded entire reach 3 inactive hydropower study sites on reach
North Fork Boise River (Hunter to Johnson Creek)	outstanding fish habitat outstanding scenery unroaded, wilderness quality eligible for Federal Wild & Scenic River study NWPPC protection recommended Ten Mile Wilderness	3 inactive hydropower study sites on reach area has mining potential for several types of ore deposits
North Fork Boise River (Johnson Creek to Sawtooth Wilderness Area boundary)	outstanding fish habitat outstanding scenery eligible for Federal Wild & Scenic River study NWPPC protection recommended Ten Mile Wilderness	area has mining potential for several types of ore deposits
Crooked River (North Fork confluence to FS road 384)	outstanding fish habitat eligible for Wild & Scenic River study NWPPC protection	
Crooked River (Above FS road 348 to headwaters)	outstanding fish habitat roaded portion of reach recommended Ten Mile Wilderness Area NWPPC protection	
Beaver Creek (east fork portion to headwaters)	elk calving area highway 21 runoff sediments impact Crooked River NWPPC protection	roaded
Edna Creek (upper portion to headwaters)	elk calving area	
Bear River (North Fork Boise confluence to FS road 348)	outstanding fish habitat NWPPC protection eligible for Wild & Scenic River study	roaded for a very short portion

Table 12. Resource and Development Summaries of Outstanding Reaches, Upper Boise River Basin.

Reach	Outstanding Values	Development Potential
Bear River (from FS road 348 to headwaters)	outstanding fish habitat outstanding scenic quality recommended Ten Mile Wilderness Area NWPPC protection eligible for Wild & Scenic River study	
Bear Creek (Bear River confluence to headwaters)	outstanding fish habitat NWPPC protection outstanding scenic quality recommended Ten Mile Wilderness Area	roaded reach
Johnson Creek (North Fork confluence to Sawtooth Wilderness Area boundary)	outstanding fish habitat outstanding scenic quality access trail to Sawtooth Wilderness Area NWPPC protection recommended Ten Mile Wilderness Area	area has mining potential for several types of ore deposits
Elk Creek (Deer Creek to Headwaters)	outstanding fish habitat elk calving area in headwaters NWPPC protection	roaded most of the reach water supply for Idaho City active mineral exploration

FINAL IWRB ACTIONS AND RECOMMENDATIONS

Consistent with the objectives of this plan and with substantial input from the Advisory Group and the public hearing process, the Board takes the following actions and recommendations to protect and manage the water resources of the upper Boise River basin in the public interest. The river protection designations and actions were developed from the draft alternatives described in the previous section.

1. Designations of State Protected Waterways (Fig. 4)

A. Boise River (13.2 miles)

The main Boise River from the backwaters of Arrowrock Reservoir to the confluence of the North and Middle Forks of the Boise River is designated as a state Recreational River, and is conditioned to allow alteration of the streambed for construction and maintenance of bridges and culverts. The Board shall prohibit the following activities on the aforementioned reach:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Construction of water diversion works
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed

B. Sheep Creek and tributaries (17.8 miles)

Sheep Creek, mouth to terminus of perennial water, and the following tributaries are designated as state Natural Rivers:

- South Fork Sheep Creek to terminus of perennial flow
- Devils Creek to terminus of perennial flow
- East Fork Sheep Creek to terminus of perennial flow

C. Middle Fork Boise River (14.5 miles)

The Middle Fork Boise River from its confluence with the North Fork Boise River to the mouth of Roaring River is designated as a state Recreational River, and is conditioned to allow alteration of the streambed for construction and maintenance of bridges and culverts. The Board shall prohibit the following activities on the aforementioned reach:

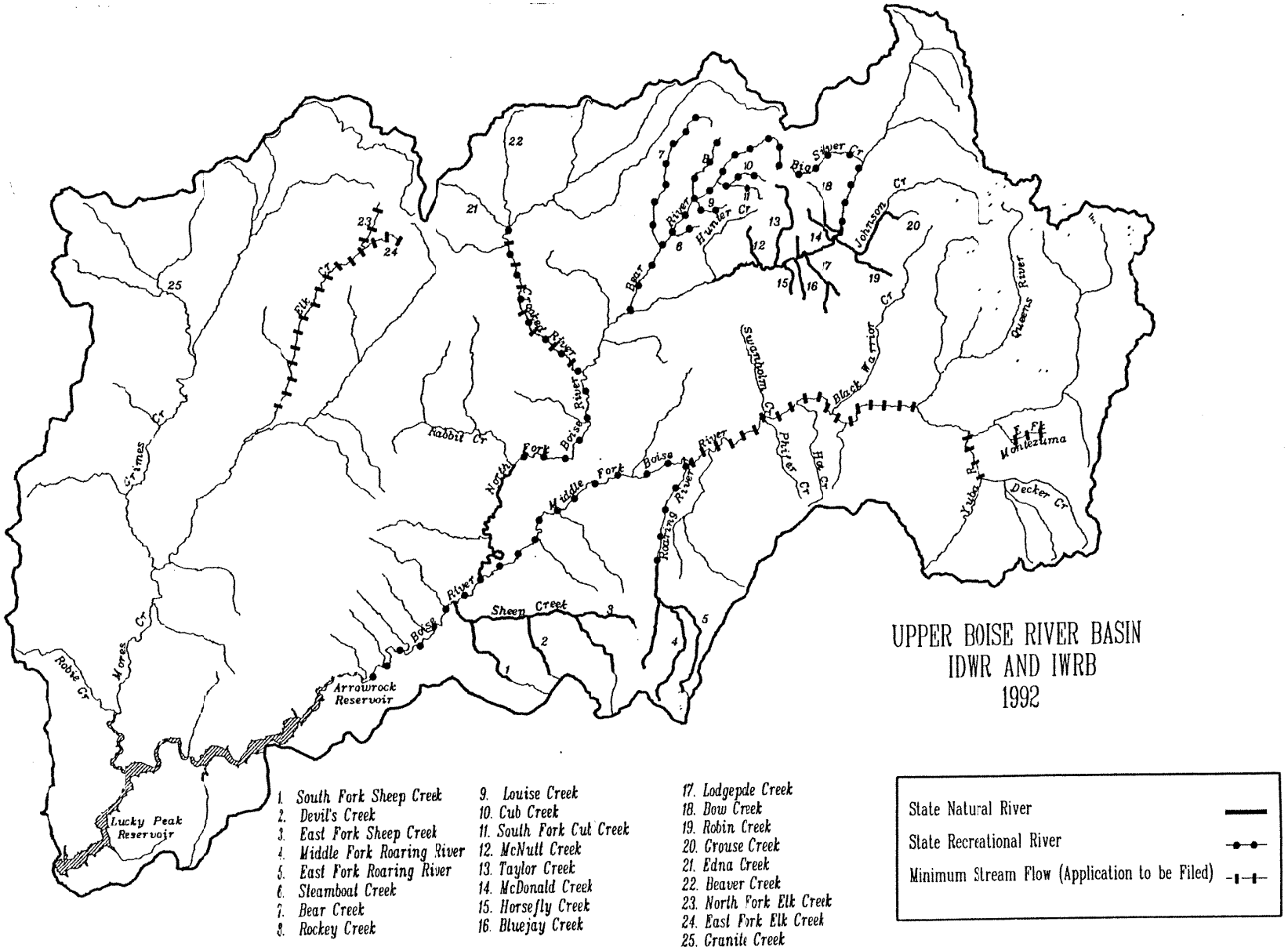


Figure 4: Protected Rivers Designations and Minimum Stream-Flow Reaches

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Construction of water diversion works
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed

D. Roaring River (5.6 miles)

The Roaring River from its confluence with the Middle Fork Boise River to the point where Forest Service road 255 crosses Roaring River is designated as a state Recreational River, and is conditioned to allow alteration of the streambed for construction and maintenance of bridges and culverts. The Board shall prohibit the following activities on the aforementioned reach:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Construction of water diversion works
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed

E. Roaring River and tributaries (17.0 miles)

The Roaring River and tributaries from the point where Forest Service road 255 crosses Roaring River to its headwaters and the following forks are designated as a state Natural Rivers.

- East Fork Roaring River to Little Roaring River Lake
- Middle Fork Roaring River to Twin Sisters Lake

F. North Fork Boise River (9.1 miles)

The North Fork Boise River from its confluence with the Middle Fork Boise River to the mouth of Rabbit Creek is designated as a State Natural River.

G. North Fork Boise River (9.1 miles)

The North Fork Boise River from the mouth of Rabbit Creek to the mouth of Crooked River is designated as a state Recreational River, and is conditioned to allow alterations of the streambed for construction and maintenance of bridges and culverts. The Board shall prohibit the following activities on the aforementioned reach:

- Construction or expansion of dams or impoundments

- Construction of hydropower projects
- Construction of water diversion works
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed

H. North Fork Boise River and tributaries (28.6 miles)

The North Fork Boise River from the mouth of Hunter Creek to the mouth of Johnson Creek and the following tributaries are designated as state Natural Rivers.

- McNutt Creek to terminus of perennial flow
- Taylor Creek to terminus of perennial flow
- McDonald Creek to terminus of perennial flow
- Horsefly Creek to terminus of perennial flow
- Bluejay Creek to terminus of perennial flow
- Lodgepole Creek to terminus of perennial flow
- Bow Creek to terminus of perennial flow

I. North Fork Boise River and tributaries (8.4 miles)

The North Fork Boise River from the mouth of Johnson Creek to the boundary of the Sawtooth Wilderness Area and Big Silver Creek, mouth to headwaters, are designated as state Recreational Rivers, and are conditioned to allow alterations of the streambed for the construction and maintenance of bridges and culverts. The Board shall prohibit the following activities on the aforementioned reach:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Construction of water diversion works
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed

J. Crooked River (10.1 miles)

The Crooked River from its mouth to the mouth of Edna Creek, is designated as a state Recreational River, and is conditioned to allow alterations of the streambed for the construction and maintenance of bridges and culverts; and dredge or placer mining and recreational dredge mining. The Board shall prohibit the following activities on the aforementioned reach:

- Construction or expansion of dams or impoundments

- Construction of hydropower projects
- Construction of water diversion works
- Mineral or sand and gravel extraction within the streambed

K. Bear River and tributaries (30.0 miles)

The Bear River from its mouth to terminus of perennial flow and the following tributaries are designated as state Recreational Rivers, and are conditioned to allow alterations of the streambed for the construction and maintenance of bridges and culverts; and dredge or placer mining and recreational dredge mining.

- Bear Creek to terminus of perennial flow
- Rockey Creek to terminus of perennial flow
- Cub Creek to terminus of perennial flow
- South Fork Cub Creek to terminus of perennial flow
- Louise Creek to terminus of perennial flow
- Steamboat Creek to terminus of perennial flow

The Board shall prohibit the following activities on the aforementioned reaches:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Construction of water diversion works
- Mineral or sand and gravel extraction within the streambed

L. Johnson Creek and tributaries (7.9 miles)

Johnson Creek from its mouth to the Sawtooth Wilderness Area boundary and the following tributaries are designated as state Natural Rivers.

- Robin Creek to terminus of perennial flow
- Grouse Creek to terminus of perennial flow

2. Protection of Minimum Stream Flows. Processing of these minimum stream flows is dependent upon the data and resources available to supporting agencies, and workloads of the staff at IDWR. The Idaho Water Resource Board will make applications for permit to maintain minimum stream flows on the following stream segments:

A. Middle Fork Boise River from the mouth of Roaring River to the mouth of Queens River (16.3 miles), for the purposes of fish spawning and rearing and maintaining recreational quality.

B. Yuba River from the confluence with the Middle Fork Boise River to the mouth of Decker Creek (2.8 miles), for the purposes of maintaining water quality and fish spawning habitat.

C. East Fork Montezuma Creek from city of Atlanta's diversion Sec. 2, T 05 N, R 11 E, to its headwaters (1.9 miles), for the purpose of protecting Atlanta's water supply.

D. Crooked River from the confluence with the North Fork Boise River to the mouth of Edna Creek (10.1 miles), for the purposes of fish spawning and rearing.

E. Elk Creek from Idaho City's diversion in Sec. 26, to the headwaters, T 06 N, R 05 E, and the following tributaries (15.4 miles), for the purpose of protecting Idaho City's water supply.

- North Fork Elk Creek to its headwaters
- East Fork Elk Creek to its headwaters

3. Recommendations

A. The Water Resource Board will nominate the Boise River and the Middle Fork Boise River from Kirby Dam to the backwaters of Arrowrock Reservoir to the Water Quality Advisory Working Committee for designation as a Stream Segment of Concern (SSOC) because of the sediments and toxic chemicals released when Kirby Dam failed.

B. The Water Resource Board will retain the Twin Springs project in the State Water Plan as a potential water storage site. Furthermore, if the need for the project can be demonstrated and found to be in the public interest, the protected river designation in this basin plan could be amended.

C. The Water Resource Board recommends that priority be given to construction of new power facilities at existing dams, such as Arrowrock.

D. In 1982, the State Board of Land Commissioners withdrew the Boise River and the Middle Fork Boise River from Arrowrock Dam to Roaring River from mineral entry and exploration to protect recreation and public use. Recently, there has been interest in opening this section up to recreational dredge mining. The IDFG is opposed to opening the reach because of concerns for the sensitive fishery (made more sensitive by the Kirby Dam failure). The IDPR has serious questions about impact on the aesthetics and current recreational use. The federal Bureau of Reclamation, which has withdrawn lands along the river, has no objection to recreational dredge mining in the channel. The North Fork Boise River is not withdrawn from entry but is currently closed to mining through the recreational dredging one-step permit system.

The IWRB is not necessarily opposed to recreational dredge mining on the Boise and Middle Fork Boise rivers. However, relying on input from IDFG and IDPR, the Board does not wish to seek a change at this time. The Board does recommend that the IDL review the status of the North Fork Boise River with regard to opening it to recreational dredge mining (Appendix C, Table 40, p. C-55 for listing).

E. Since 1980, there has been a moratorium placed on granting further consumptive water rights during the irrigation season above Lucky Peak Dam by IDWR. In the spring of 1992, the moratorium was extended to year-round because of the current severe drought conditions in southwestern Idaho. The Water Resource Board recommends that the moratorium be retained beyond the end of the current drought, and that no new consumptive water rights be granted in the upper Boise River basin except for domestic purposes.

F. Crooked River and the North Fork Boise River have been designated Stream Segments of Concern (SSOC) because of sediments originating from highway runoff into Beaver Creek. Mores Creek (adjacent to the highway) is vulnerable to scenic degradation, sedimentation and highway runoff. The Water Resource Board recommends that the IDT take special effort to protect the Mores and Beaver Creek corridors, because of the proximity to Highway 21, a State Scenic Byway, and to reduce sedimentation and toxic loading into both Mores Creek and Beaver Creek.

G. Timber harvesting has intensified on the Boise National Forest and on state lands because disease and drought have produced unhealthy forests. Good watershed management is

particularly critical during periods of forest stress to maximize the amount of water getting to the trees. The Water Resource Board encourages the Boise National Forest and the Idaho Department of Lands to seek strict adherence of their contractors to the Forest Practices Act, the Antidegradation Agreement, and applicable BMPs involving logging activities.

H. The Water Resource Board recommends that the U.S. Forest Service and other resource management entities establish limits of acceptable change for those reaches impacted by recreation use. The anticipated population growth for the Boise area will put additional pressure on the recreational resources of the basin.

Responses to Basin Objectives, Issues, and Considerations

Water Quality

Water quality is not currently a major issue in the basin but there are several reaches that could eventually face serious problems. Minimum stream flows are recommended for sensitive water supplies above Idaho City and Atlanta and for those reaches that possess potentially threatened fisheries and recreational assets, such as the Crooked River and the Middle Fork Boise River. The Middle Fork Boise River above the Recreational protected segment, will have a minimum stream flow and a recommendation for a Stream Segment of Concern designation to address the water quality concerns below Kirby Dam.

Hydropower

Prior to the districts voluntarily surrendering their preliminary permit for Twin Springs hydroelectric project to FERC (Olowinski, 1991), the main hydropower controversy in the basin centered around Twin Springs. The permit surrender followed an economic analysis done by Morrison-Knudsen on the feasibility of the project. It concluded the project was not economically feasible at this time. The actions of the Board regarding Twin Springs leave open the opportunity for going ahead with the project should it be demonstrated at a later date to be hydrologically and economically feasible, and in the public interest.

Recreation

Public and agency input received during the planning process identified the recreational opportunities in the basin as one of the more highly-valued qualities. Specifically, scenic values, wilderness, proximity to populations, fisheries, wildlife, access, opportunities for seclusion and hot springs were mentioned. Potential impacts and issues cited relative to these values include over-use, increased population, maintenance needs of existing facilities, need for more developed facilities, and protection of primitive areas.

The actions by the Board will help protect reaches that currently and potentially receive the greatest recreational use, namely the Middle and North Forks of the Boise River.

Fish, Wildlife and Aesthetics

There is considerable public concern about the potential for deterioration of the fish and wildlife habitat and aesthetic quality of the basin. The Main, Middle and North Forks of the Boise River, because of accessibility, are likely candidates to receive considerable pressure in the future from recreation. Logging activity will undoubtedly accelerate in the next few years because of Boise National Forest's need to move swiftly to manage an ill forest. The actions and recommendations by the Board, by focusing on the critical reaches, have improved the likelihood that future impacts to the biological and aesthetic qualities of the waterways, will be as minimally detrimental as feasible.

Economics

Contribution of Hydropower and Energy Conservation: Hydropower has the reputation of being a clean and renewable form of energy. Traditionally, hydropower projects provide jobs and can add to the local tax base. The Twin Springs Project, if it were ever to be built, would be located on the Boise and Elmore County lines. Both counties suffer from rather depressed economies, particularly Boise County (Table 13). If the Twin Springs project were built, there is no guarantee that the work force would come from the two rural counties, rather than the City of Boise.

Table 13. Annual Unemployed Labor Force and Income % of National Averages for Boise, Elmore and Ada Counties (Idaho Dept. Commerce, 1989).

County	1988 % Labor Force Unemployed	1987 Income % of National Average
Boise	8.4	68.5
Elmore	5.0	67.1
Ada	3.9	95.4

The hydroelectric benefits from Twin Springs were estimated in a recent study done by Boise-Kuna Irrigation District et al. (1990). The estimated initial annual revenue from hydropower production, based on a medium level energy value [32 (off-peak) to 49 (summer) mills/kWh], was $11,847,000. Values for other benefits were estimated at $1,000,000 for irrigation, $75,000 for flood control, $177,000 for recreation and $250,000 for water quality (Boise-Kuna Irrigation District et al., 1990). Annual values for all benefits totalled an estimated $13,349,000.

The Northwest Power Planning Council (NWPPC) in the 1991 draft of their Northwest Conservation and Electric Power Plan, ranked the top 40 available energy resources over the next 20 years. The resource category for nine of their top ten was conservation, one was small hydropower. Only about 5% of the forecast total megawatt production would come from small hydropower generation.

Given the results of the irrigation districts' 1990 study and NWPPC's prognosis for the energy future of the Northwest, the Board does not consider the economic potential for hydropower in this basin to be great in the near future. However, the Board did identify the Twin Springs Reservoir site in the 1992 State Water Plan as a potential reservoir site. It does not preclude Twin Springs should it ever become necessary for additional storage and power and is demonstrated to be economically and hydrologically feasible. The project would have to be found to be in the public interest by the Water Resource Board and this basin plan would have to be amended. The amendment process will include public hearings and legislative review. Furthermore, it is a policy of the Board to support and give priority to construction of power facilities at existing dams, such as Arrowrock (Policy 4E-State Water Plan, 1992).

Contribution of Mining: Currently, the only major mining project that shows serious intentions in the basin is backed by Atlanta Gold Corporation. In 1989, two engineering firms from Denver conducted an economic feasibility study on the Atlanta gold and silver reserves and estimated reserve figures of 1,024,000 ounces of gold and 2,516,000 ounces of silver (Atlanta Gold Corp., 1991). At $375 or $400/ounce for the gold, they calculated that an open pit mining operation would be economically feasible.

Contribution of Recreation and Tourism: The 1987 Idaho Leisure Travel and Recreation Study concluded that travelers visiting the southwest region of the state, which would include the Boise River basin, spent an average of $172 over a two day period. The state average was $149 with the highest region being the Sun Valley area with an average of $256.

Tourism contributes approximately $1.5 billion to Idaho's economy in 1991 making it Idaho's third largest industry (Bond, 1992). Average expenditures on each trip totaled approximately $482 per individual (IDC, 1991).

An approximation of the average net economic value for recreational activities within the planning basin are quantified in Table 14. These values represent the average consumer surplus or net willingness to pay above actual expenditures for the recreational experience taking into account travel time and distance. Net economic values for the upper Boise River basin approximated $38 million based on 1991 recreation participation in the basin (Table 14). This value is based on the estimated use for various recreational activities as calculated by the Boise National Forest and BLM, the USACE for Lucky Peak facilities in the basin, and the IDFG for the Boise Wildlife Management Area and hunter days for big game, upland game and upland birds. Because recreational use is derived differently by different management agencies, the calculations for the estimated use values in Table 14 are not included here but can be obtained from IDWR planning staff.

Table 14. Estimated Average Net Economic Use Value* of Recreation Activities in the Upper Boise River Basin. Real 1991 dollars are derived from recreational use data from following sources: USDA, 1991b; USDI, 1992; Scholten, 1992; USACE, 1992; IDFG, 1990; Sorg and Nelson, 1986; Donnelly and Nelson, 1986; Sorg et al., 1985; Young et al. 1987; and Sorg and Loomis 1984.

Activity	1991 Estimated Annual Use Value
Camping	$2,850,500
Trail Use	
Motorized	550,800
Non-motorized (hiking, horseback riding, biking)	995,900
Boating	
Motorized	2,930,600
Non-motorized	2,524,700
Hunting[1]	
Big Game	3,874,800
Upland Bird/Game	2,012,400
Fishing	4,317,900
Water Play (swimming, water skiing, diving, beach)	2,139,600
Winter Recreation (snowmobiling, cross country skiing, sledding, snowplay)	746,300
Pleasure Driving	1,031,400
Picnicking	1,862,200
Other Land-based (sightseeing,nature study, sports, tours, gathering forest products, miscellaneous)	12,159,500
TOTAL	**$37,996,600**

* Economic use value = average consumer surplus value.

[1] Based on 1990 hunter days.

This method of recreational economic value does not consider nonconsumptive values such as for preservation, option or bequest. It does give an approximation of the benefits of recreation in the basin compared to other resource uses. This approach is the standard measure used in cost-benefit analyses by the USACE, Bureau of Reclamation, Soil Conservation Service and Forest Service (Young et al., 1987).

Effects of Final Actions and Recommendations

In designating a natural river, the Board prohibits the following activities: construction or expansion of dams or impoundments; construction of hydropower projects; construction of water diversion works; dredge or placer mining; alterations of the streambed; and mineral or sand and gravel extraction within the streambed (Idaho Code, Sect. 42-1743A). In designating a recreational river, the Board determines which of the above mentioned activities shall be prohibited, and which activities, if any, may go forward. In this plan, recreational river designations are all conditioned to allow alterations of the streambed for construction and maintenance of bridges and culverts. The Board has elected to prohibit the remaining above listed activities on recreational rivers protected by this plan.

With a natural or recreational protection designation of state waterways in place, proposed activities that would occur within the stream channel (between high water marks) could be affected and even prohibited. While protection itself cannot limit, restrict, or conflict with approved application for water appropriation or vested property rights on the date of enactment (Idaho Code, Sect. 42-1734F), once a stream channel is protected, a land management agency, such as the USFS or BLM, may choose to strengthen their management practices if they feel the values that led to the designation are being threatened.

Even though the authority of the Water Resource Board does not extend beyond a protected waterway, agencies and entities responsible for the management of the watershed containing protected reaches are encouraged to follow the Board's recommendations and continue to exercise good environmental stewardship to ensure the preservation of the outstanding values that support those designations.

APPENDIX A: GLOSSARY

AF or acre-foot, means the volume of water required to cover 1 acre of land (43,560 sq. ft.) to a depth of 1 foot; this is equivalent to 325,851 gallons.

BLM means Bureau of Land Management.

BNF means Boise National Forest.

BOR means Bureau of Reclamation.

cfs or cubic foot per second, means a unit of discharge for measurement of a flowing liquid equal to a flow of 1 cubic foot per second, 449 gallons per minute, or 1.98 AF per day.

DCMI means domestic, commercial, municipal and industrial uses.

DEQ means Division of Environmental Quality.

FERC means Federal Energy Regulatory Commission.

IDC means Idaho Department of Commerce.

IDFG means Idaho Department of Fish and Game.

IDHW means Idaho Department of Health and Welfare.

IDL means Idaho Department of Lands.

IDPR means Idaho Department of Parks and Recreation.

IDT means Idaho Department of Transportation.

IDWR means Idaho Department of Water Resources.

IWRB or Board means Idaho Water Resource Board.

RVD means recreational visitor days. One RVD is equivalent to one person spending 12 hours at a particular activity.

SCORP means State Comprehensive Outdoor Recreation Plan.

USACE means United States Army Corps of Engineers.

USFS means United States Forest Service.

USFWS means United States Fish and Wildlife Service.

Adjudicated means ownership or management that has been legally established in a court of law.

Alteration means any activity using mechanized equipment that moves or overturns gravel or earth.

Anion means a negatively charged ion in a chemical compound.

Annual sustained yield means that the yield of timber harvested in a given year is equivalent to the tree replacement during that same time period.

Anadromous means fish species that spend most of their adult life in the ocean and migrate to fresh water to spawn.

Benthic invertebrates means small spineless animals such as aquatic insects and worms, that typically live on the bottoms of streams and lakes.

Candidate species means species for which there is sufficient information available to propose their listing as threatened or endangered.

Cation means a positively charged ion in a chemical compound.

Chernozem means the black earth soils of prairies through which percolation is incomplete.

Cogeneration means production of two useful forms of energy such as thermal and electricity from the same process.

Comprehensive State Water Plan means the plan adopted by the board pursuant to section 43-1734A, Idaho Code, or a component of such plan developed for a particular water resource, waterway or waterways and approved by the legislature.

Consumptive use means the difference between the total quantity of water withdrawn from a source for use and the quantity of water returned to the source. It includes mainly water transpired by plants and evaporated from the soil.

Confluence means the flowing together of two or more bodies of water.

Director means the director of the Idaho Department of Water Resources.

Dredge mining means to recover minerals with the use of a dredge boat or sluice washing plant whether fed by bucket line or separate dragline or any other method including suction dredges.

Endangered species means a species in danger of extinction throughout all or a significant portion of its range.

Evapotranspiration means the loss of moisture by evaporation from soil and transpiration from plants.

Hydropower project means any development which uses a flow of water as a source of electrical or mechanical power, or which regulates the flow of water for the purpose of generating electrical or mechanical power. A hydropower project includes all powerhouses, dams, water conduits, transmission lines, water impoundments, roads, and other appurtenant works and structures.

Idaho batholith means the massive body of intrusive granitic rock. It covers an area about 250 miles long and a maximum of 100 miles wide throughout much of central Idaho. It is approximately 100 million years old, which would place its origin in the Cretaceous Period.

Interim protected river means a waterway designated pursuant to section 42-1734D or 42-1734-H, Idaho Code, as protected for up to two (2) years while a component of the comprehensive state water plan is prepared for that waterway.

Low-head dam means a dam with less than 20 meters (66 ft) of head.

Mean high water mark means a water level corresponding to the natural or ordinary high water mark as defined in Section 58-104(9), Idaho Code, and is the line which the water impresses on the soil by covering it for sufficient periods of time to deprive the soil of its terrestrial vegetation and limit its value for agricultural purposes.

Minimum stream flow means a minimum flow or lake level necessary to protect fish and wildlife habitat, aquatic life, water quality, navigation, transportation, recreation, and/or aesthetic beauty. Under Idaho Law (Chapter 15, Title 42, Idaho Code), minimum stream flows are valid water rights, held by the Idaho Water Resource Board in trust for the people of the state.

Natural river means a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values, which is free of substantial existing man-made impoundments, dams or other structures, and of which the riparian areas are largely undeveloped, although accessible in places by trails and roads.

Outstanding resources means unique, highly-valued, and/or extremely sensitive resources. This may be indicated by 1) legal protection excluding or limiting development; 2) special agency management designations protecting the resource; 3) significant public concern voiced for its protection; and 4) resources susceptible to adverse impacts with little possibility of mitigating these impacts.

Podzol means soil with a bleached topsoil horizon, typical of boreal forests.

Recreational dredge mining means dredge mining using a suction dredge with a nozzle of 5 inches or less, and that moves less than 2 cubic yards per hour.

Recreational river means a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values, and which might include some man-made development within the waterway or within the riparian area of the waterway.

Riparian area means that area within 100 feet of the mean highwater mark of a waterway.

River basin is the total drainage or catchment area of a river and its tributaries.

Stream means a natural water course of perceptible extent with definite bed and banks, which confines and conducts continuously or intermittently flowing water. Definite beds are defined as having a sandy or rocky bottom which results from the scouring action of water flow.

Stream channel means a natural water course of perceptible extent with definite beds and bands which confines and conducts water. The channel referred to is that which exists at the present time, regardless of where the channel may have been located at any time in the past. The beds of lakes and reservoir pool areas are not considered to be stream channels.

Threatened species means a species likely to be classified as endangered within the foreseeable future throughout all or a significant portion of its range.

Vested rights means those rights that are fixed and not contingent upon any future actions.

Waterway means a river, stream, creek, lake or spring, or a portion thereof.

APPENDIX B: PUBLIC INVOLVEMENT

Local Advisory Group and Affiliation or Occupation

Mrs. Rosemary Ardinger
Idaho City, Idaho
(teacher)

Mr. Greg Arndt
Boise, ID 83702
(mining consultant)

Mrs. Kristen Cheyney
Boise, ID 83712
(Idaho Rivers United)

Mr. Ron Davison
Mountain Home, ID 83647
(rancher)

Mr. Stephen Garman
Wilder, ID 83676
(farmer)

Mr. Alfred Larson
Boise, ID 83703
(retired forester)

Ms. Sue Anne Mason
Boise, ID 83704
(Account executive)

Mr. Ralph J. McAdams
Boise, ID 83702
(retired, U.S. West)

Mr. Ken E. Meierotto
Boise, ID 83704
(Boise Cascade supervisor)

Mr. Sam Roeber
Atlanta, ID 83601
(retired, IDT)

Mr. Ronald L. Sherer
Eagle, ID 83616
(Middle Fork landowner)

Mrs. Marcella Stewart
Nampa, ID 83686
(farmer)

Mr. James E. White
Idaho City, ID 83631
(retired)

Mr. Jerry M. Whitehead
Boise, ID 83706
(Middle Fork landowner)

Mr. J.A. Bob Williams*
Meridian, ID 83642
(farmer)

Ms. Raedean Inama**
Cascade, ID
(U.S. Postal Service)

* Deceased, (June 1, 1992). Mr. Williams was an active member through the final advisory group meeting.
** Ms. Inama moved from Atlanta after the first meeting of the Advisory Group.

Summary of Public and Advisory Group Meetings

Public Information Meeting (February 13, 1991)--This meeting initiated the public input facet of the planning process for the upper Boise River basin. The meeting was held in the IDT auditorium and attended by 31 individuals. Department staff discussed the planning process and schedule, public participation role of the Advisory Group, and a summary of the resources of the basin. A biographical sketch and application form was available for those interested in serving on the Advisory Group.

During the interim between the Public Information Meeting and the first meeting of the advisory group IDWR had received 27 applications from individuals interested in serving, of which 16 were selected. The first Advisory Group meeting, and most subsequent meetings, were held in the IDWR conference room.

Boise River Advisory Group Meeting (May 23, 1991)

Members Present: Ardinger, Arndt, Cheyney, Davison, Garman, Inama, Larson, Mason, McAdams, Meierotto, Roeber, Stewart, White, Whitehead, and Williams

The Rules and Regulations of the Comprehensive State Water Plan and the role of the Advisory Group in the planning process were discussed. Additional presentations included the planning process and schedule, and an overview of the basin's resources. The members asked a number of questions and had some specific concerns about the process and how IDWR interacts with the Forest Service in their wild & scenic river study process. The Advisory Group also discussed some of the important local issues that it felt needed to be addressed in the plan.

Boise River Advisory Group Meeting and Upper Boise River Basin Public Issues Meeting (July 30, 1991)

Members Present: Cheyney, White, Garman, Mason, Whitehead, McAdams, Meierotto, Williams, Roeber, Arndt, and Larson

This meeting, which was open to the general public and held in the Hall of Mirrors, was attended by 55 individuals. The meeting opened with a discussion of the purpose of the issues meeting and the sections of the Idaho Code that were relevant to river basin planning. Small groups of about 5-8 individuals each were formed to discuss the basin issues. The discussion for each group was facilitated by a member of the Advisory Group. Participants were asked to respond to several written questions: 1) best case scenario--what they would like to see the basin look like in 20 -50

years; 2) worst case scenario--what they would not like to see; and 3) what they considered the main attributes of the rivers and the threats to those attributes. The response was very positive; most participants felt they had provided input.

Boise River Advisory Group Meeting and Basin Field Trip (September 21, 1991)

Members Present: Ardinger, Arndt, Larson, Mason, McAdams, Meierotto, Roeber, Stewart, White, Whitehead, Williams, and Robbins (proxy for Cheyney)

The second Advisory Group meeting was combined with a field trip of the basin. The Advisory Group visited Mores Creek, North Fork Boise River, and Middle Fork Boise River, stopping at Kirby Dam. The meeting was held at Jerry Whitehead's summer home on the Middle Fork Boise River, where lunch was served.

One of the intentions of the meeting was to discuss cooperative river planning efforts with the Forest Service (i.e., the MOU between the State, the USFS and BLM) but this was postponed because the Boise National Forest staff, was unable to attend. The planning schedule and direction were presented (i.e., presentation of the options available). Possible objectives of the plan were discussed, based in large part on identified issues.

Boise River Advisory Group Meeting (October 17, 1991)

Members Present: Garman, Robbins (proxy for Cheyney), McAdams, Williams, Meierotto, Stewart, and Platts (IWRB)

The Advisory Group met at IDWR to discuss planning options and to hear from the Forest Service about the wild & scenic river study process. Vicki Lawson, from Boise National Forest staff, discussed how the two agencies' river planning efforts might be integrated.

The Advisory Group responded to a preliminary draft of possible reach delineations and protection potential for those reaches, based on the best available information to date. An adjusted planning process and schedule was presented to the Advisory Group, that included the screening process for identifying reaches eligible for protection.

Boise River Advisory Group Meeting (February 20, 1992)

Members Present: Arndt, Roeber, Williams, Garman, McAdams, Whitehead, Larson, Cheyney, Meierotto, White, Ardinger, and Platts (IWRB)

This meeting, held at IDWR, included a status report of the upper Boise River basin planning process. The screening process was presented along with the evaluation criteria for the three screening categories: biological (fish and wildlife), aesthetic (scenic and geologic features), and recreational. The Advisory Group studied the resource inventory and evaluation maps and provided input regarding changes and possible errors. Additional time was provided for examination of the inventory and evaluation maps at a subsequent open house.

Boise River Advisory Group Open House (March 3, 1992)

Members Present: Whitehead, McAdams, Arndt, Larson, Williams, Stewart, Davison, Garman, and Meierotto

An informal open house provided to members of the group with additional time to continue their examination of the inventory and evaluation maps and to provide input.

Boise River Advisory Group Meeting (April 30, 1992)

Members Present: Cheyney, Davison, Garman, McAdams, White, Larson, Whitehead, Meierotto, Arndt, Stewart, Ardinger, Williams, and Platts (IWRB)

Modified screening, inventory and evaluation maps were reviewed by the Advisory Group. This was followed by a discussion of river protection alternatives for the basin. These alternatives included a no protection alternative (A), an alternative that focused on those reaches with outstanding water quality, biological and recreational combinations (B), an alternative that exempted reaches with high development potential from possible protection (C), and a total protection alternative (D). Alternatives B and C included some proposed minimum stream flows. Advisory Group comments were recorded and each member received a copy of the comments.

Boise River Advisory Group Meeting (May 13, 1992)

Members Present: Meierotto, Davison, Whitehead, Roeber, Larson, McAdams, Williams, White, Arndt, Mason, Ardinger, Robbins (for Cheyney), and Stewart

Subsequent to the April 30 meeting, the planning staff developed a draft recommended alternative that reflected the comments received from the Advisory Group at the previous meeting. As a result of the discussion of that draft alternative, the Advisory Group:

- Supported the draft recommended alternative.

- Requested that the language in the State Water Plan identifying the Twin Springs site as a potential irrigation storage site be retained.

- Recommended the following be taken into consideration if Twin Springs were ever needed: 1) a scaled-down version of the most recent proposal thus reducing the reservoir size; 2) establishing a minimum pool level; and 3) establishing a minimum stream flow below the dam.

- Supported state protection over federal protection, and requested that the federal wild & scenic river designation not be supported in the plan.

- Recommended all tributaries to be protected be listed by name, if possible.

- Recommended that recreational river designations be conditioned to allow for road construction activities on or near recreational rivers.

APPENDIX C: TECHNICAL REPORT

Water Supply: Water Quantity

The area covered by this plan includes the upper Boise River basin which is the majority of the watershed for the intensely agricultural lower Boise River basin. Even though the majority of this report pertains only to the planning area, some references are made to the lower Boise River basin because of its interdependence with the upper basin.

The North and Middle Forks of the Boise represent a hydrologic unit which drains approximately 830 square miles, while the Mores Creek watershed drains 400 square miles. These three main streams from the upper Boise River basin feed into the Lucky Peak-Arrowrock reservoir complex. The total stream mileage in this basin, excluding the reservoirs, is approximately 1130 miles. The two reservoirs, Lucky Peak and Arrowrock, account for an additional 26 miles.

Precipitation and Snow Surveys

Data compiled by the Army Corps of Engineers (1988b), show the annual mean precipitation throughout the basin ranges from about less than 20 to over 50 inches per annum (USACE, 1988b; Table 15). This does not include recent snow study data which may increase those values up to 15% when completed (Molnau, 1991). Generally, a precipitation gradient occurs from west to east across the basin, with the lowest precipitation occurring in the west at the lower elevations and the highest values in the Sawtooth Mountains to the east. Mean values from the seven stations in the basin are included in Table 15.

Table 15. Mean Annual Precipitation in Upper Boise River Basin, 1961-1985 (USACE, 1988b; USDA, 1987b).

Station	Elevation (ft)	Mean Annual PPT. (in)	Monthly Min-Max Ppt. (in)
Arrowrock Dam	3275	18.71	0.0 - 9.09
Idaho City	3965	22.96	0.0 - 10.74
Centerville	4440	27.91	0.0 - 12.25
Graham G.S.	5690	32.70	
Mores Cr. Summit	6100	43.30	
Atlanta Summit	7600	46.50	
Trinity Mt.	7770	52.40	

At the higher elevations, snowfall contributes the bulk of the precipitation. There are four Snotel (snow telemetry) stations in the basin that provide snow precipitation data. The Snow Water Equivalents (SWE) that have accumulated by April at the Trinity Mt. Snotel station (elev. 7770) is 44.1 inches (total precipitation = 52.4 in.), while at the Graham G.S. Snotel station (elev. 5690), the SWE is 16.7 inches (total precipitation = 32.7 in.). The mean SWE accumulation at Atlanta Summit (elev. 7600) is 35.3 inches and at More's Cr. Summit (elev. 6100) it is 34.2 inches (USDA, 1987b).

Stream Discharge Data

Recording Stations and Flow Data: Stream discharge data is collected at three stream gages (a-c listed below), one of which is located just outside of the basin below Lucky Peak dam (Table 16). These are:

(a) Boise River - near Twin Springs (#13185000). This station is located 3.2 miles downstream from Twin Springs, 13 miles upstream from Arrowrock Dam, (mile 88.5) within the Boise National Forest (elev. 6350 ft.). There is no significant diversion or regulation above this gage. Seasonal variation of the flows at the Twin Springs gage is shown in Figure 5, and the historic annual discharges in Figure 7.

(b) Mores Creek above Robie Creek - near Arrowrock Dam (#13200000). This station is located on the left bank, 1.7 miles upstream from Robie Creek, 5.0 miles northwest of Arrowrock Dam (mile 5.8; elev. 3120 ft.). There is no significant diversion or regulation above this gage. Seasonal variation of the flows at the Twin Springs gage is shown in Figure 6, and the historic annual discharges in Figure 8.

(c) Boise River near Boise (#13202000). This station is located at the Lucky Peak Dam, 1.8 miles upstream from New York Canal diversion dam and 7.5 miles downstream from Mores Creek (mile 63.6). Records were kept from 1895 through 1916 and ceased until 1950 when they were restarted. Flows at this location are regulated by Anderson Ranch, Arrowrock and Lucky Peak reservoirs. There are no significant diversions upstream of the reservoirs.

In addition, water surface elevations are recorded for both Arrowrock and Lucky Peak reservoirs (Table 16).

Table 16. Recording Stations - North and Middle Forks Boise River and Mores Creek (USDI, 1990).

Station	Gage Type	Period of Record	Drainage Area (sq. mi.)	Average Runoff Volume (AF/annum)	Flow for the Period (cfs)		
					ave.	max.	min.
13185000 Boise R. near Twin Springs	River	1911 - pres.	830	864,300	1193	18,800	105
13200000 Mores Cr. above Robie Cr.	River	1950 - pres.	399	210,000	298	5,440	7.4*
13202000 Boise R. near Boise	River	1895 - 1916; 1950 - pres.	2680***	2,100,000***	2899	35,500	0.0**
13194000 Arrowrock Res. at Arrowrock Dam	Reservoir	1917 - pres.	2210				
13201500 Lucky Pk. Lake	Reservoir	1954 - pres.	2680				

* 1992 flows will be lower but official flows have not been published.

** This is not natural flow but a flow regulated at Lucky Peak Dam.

*** Figure includes South Fork Boise River contribution.

Normal Stream-Flow Behavior: Each year high flows occur in the spring as temperatures rise and snow melts. Stream flow rises in March, peaks between April 15 and June 15 and gradually recedes to base flow in July. Low flows generally prevail from August through February. From 1895 to 1980, the natural annual discharge volume of Boise River below Lucky Peak Dam averaged 2,040,00 AF annually. Approximately 78% of this volume comes off during the March through July snowmelt period. Occasionally, winter rainstorms will expedite snowmelt discharge, and this can severely intensify the peak flows during the winter. However, most of these winter discharges are of short duration and limited volume (USACE, 1988b).

The majority of the stream flow from the Middle and North Fork Boise River sub-basin is recorded at the Twin Springs gage (Fig. 5). Measurements at this station show more than 75% of the flow of the Boise River below Lucky Peak is contributed by approximately 60% of the total drainage area (Table 17). The discharge recorded at the Twin Springs gage gradually increases from March until it reaches a peak flow in May-June when it begins to decline to a low lasting from September through February (Fig. 5).

The contribution to the Boise River stream flow from the Mores Creek drainage is 20% (Fig. 6). The Mores Creek watershed represents less than 30% of the total basin (Plate 2). Mores Creek discharge begins increasing in February and peaks in April (Fig. 6).

Table 17. Stream Flow and Drainage Area Composition of North and Middle Forks Boise River and Mores Creek Drainages, Exclusive of the South Fork Boise (USDI, 1990b).*

Gage	Drainage Area (sq. miles)	Mean Discharge (cfs)	Volume/annum (1000 AF)	% of Total Basin Flow	% of Total Basin Area
Mores Cr.	399	298	216	19	29
Twin Spr.	830	1204	872	77	60

*Information is based on the two river gages within the basin. Mores Creek and Twin Springs values are exclusive of the Boise South Fork's contribution and what occurs below the two gages.

Extreme Stream-Flow Behavior: Significant rainstorm-snowmelt flood events occurred numerous times in the basin, but most notably in November 1909, December 1955, and December 1964. A December 1964 flood event in Boise with a computed instantaneous peak discharge of approximately 44,000 cfs was estimated to have been in excess of a 100-yr. event (IDWR, 1974). High annual flow volumes recorded at the Twin Springs gage occurred in 1943, 1965, and 1974 (Fig. 7). At the Mores Creek gage, high annual flows occurred in 1965, 1971, and 1983 (Fig. 8).

Droughts: The single lowest runoff year of record was 1977 at the Twin Springs gage and 1992 at the Mores Creek gage, both well under half the normal averages (Figs. 7, 8). The current drought, which began in 1987, is the most severe in recorded history. Prior to that, the period from 1931-1935 was the driest period.

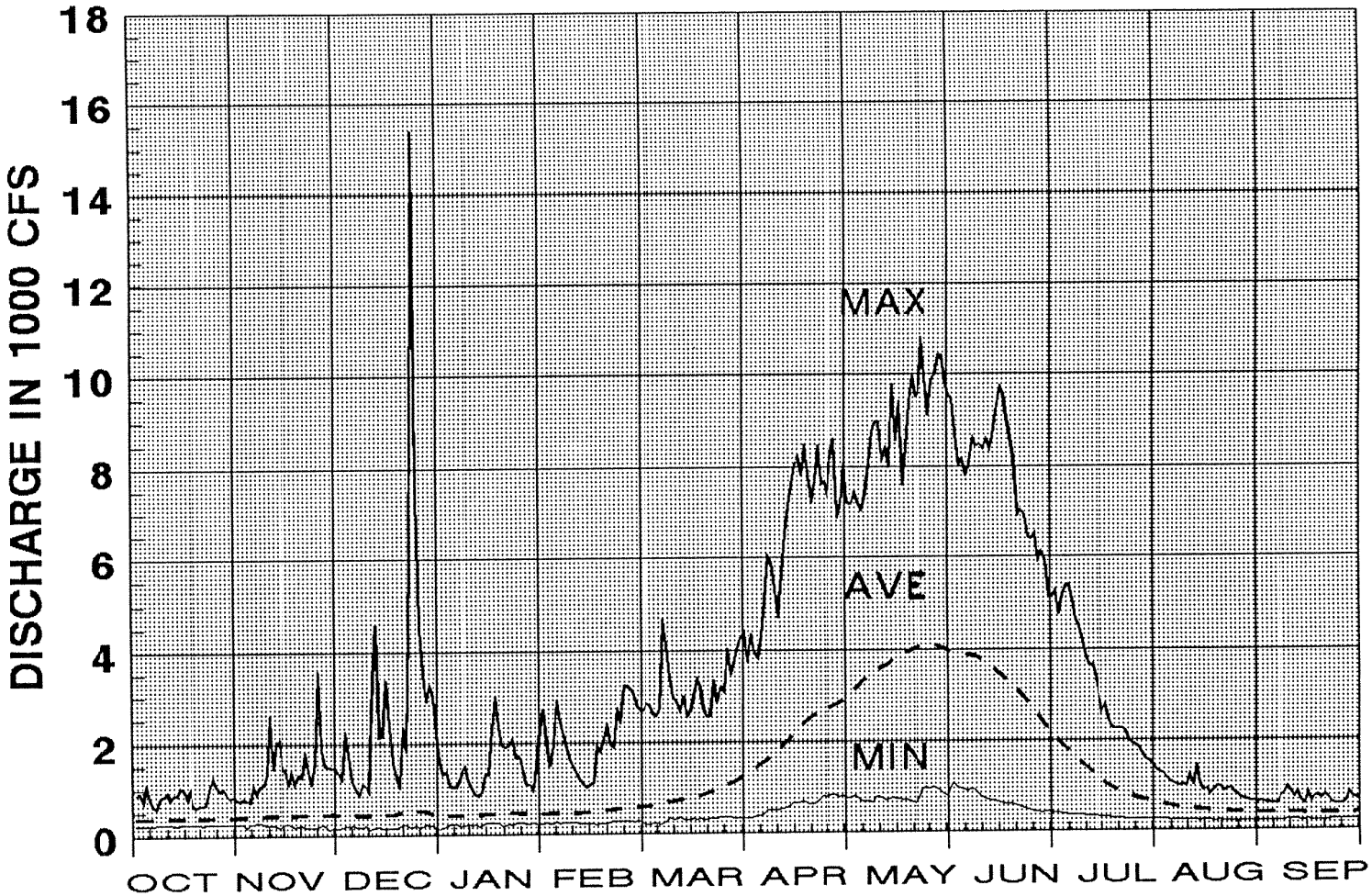
Storage and Flood Control Facilities

Within the entire Boise River basin, there are four separate federal reservoirs which are operated as one coordinated system. These are Anderson Ranch, Arrowrock, Lucky Peak and the Lake Lowell complex (Diversion Dam and New York Canal) (USACE, 1988b). Anderson Ranch is on the South Fork Boise but regulates flows into Arrowrock. Lake Lowell, an offstream storage facility in the lower valley, is below Lucky Peak Dam. Anderson Ranch and Lake Lowell are discussed here because of their significance to the Arrowrock and Lucky Peak operations and release schedules. Flood control and irrigation are the primary uses for Anderson Ranch, Arrowrock, and Lucky Peak. Additional uses of Lucky Peak water are for stream flow maintenance (50,000 AF) and non-contracted space (102,300 AF) that is for additional stream flow maintenance. At the end of the irrigation season (April through October), reservoir operation manuals recommend that Arrowrock

Figure 5.

MINIMUM, MAXIMUM, AND AVERAGE DAILY DISCHARGE, BOISE RIVER

NEAR TWIN SPRINGS, IDAHO

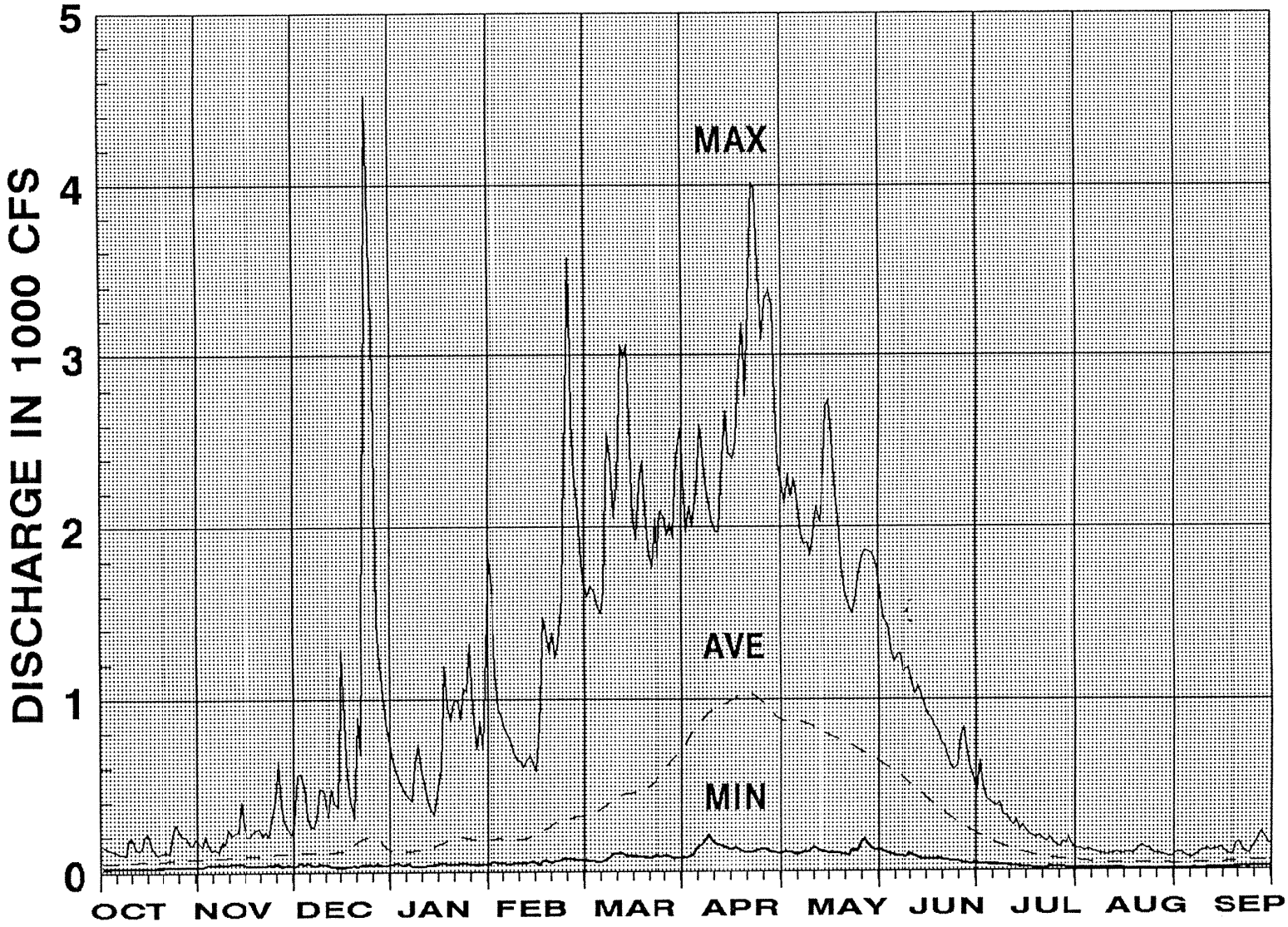


Source: IDWR, 1992.

Figure 6.

MINIMUM, MAXIMUM, AND AVERAGE DISCHARGE, MORES CREEK

ABOVE ROBIE CREEK NEAR ARROWROCK

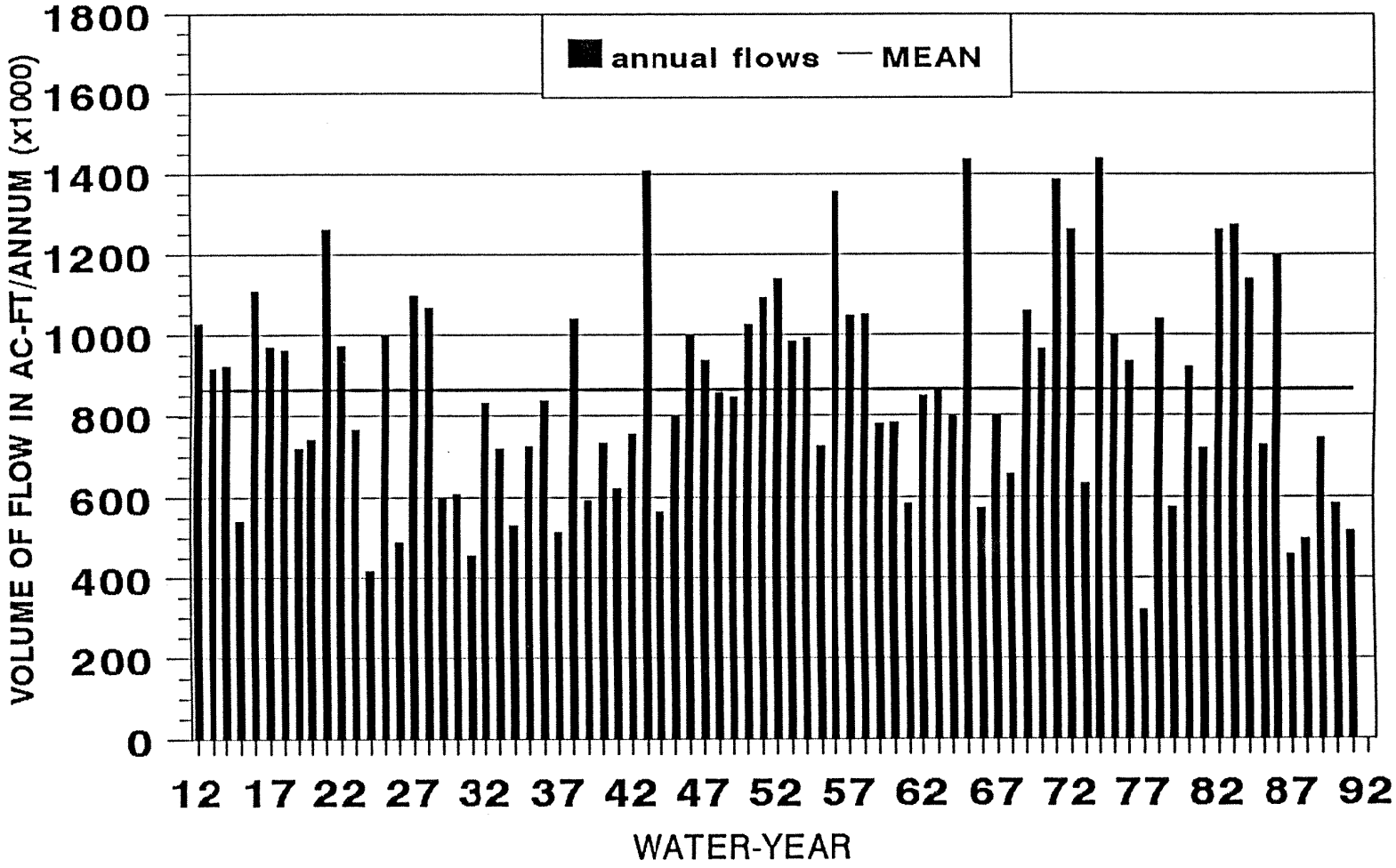


Source: IDWR, 1992.

Figure 7.

HISTORIC FLOW, BOISE RIVER

NEAR TWIN SPRINGS, IDAHO



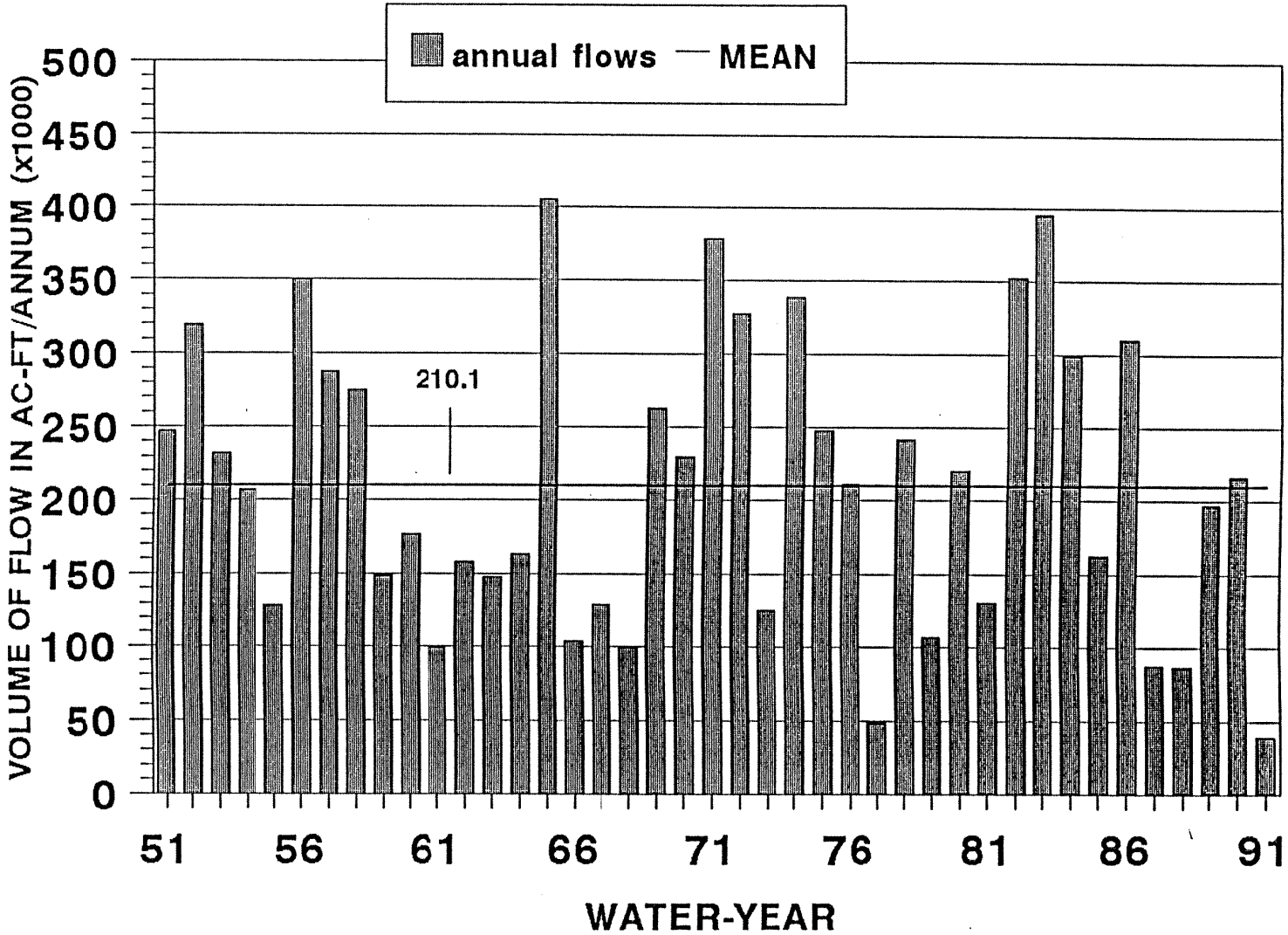
MEAN = 864.8 KAF

Source: IDWR, 1992.

Figure 8.

HISTORIC FLOW, MORES CREEK

ABOVE ROBIE CREEK NEAR ARROWROCK



MEAN = 210.1 KAF

Source: IDWR, 1992.

and Lucky Peak not be drawn down below minimum fish conservation pools of 28,700 AF and 28,767 AF respectively (USACE, 1988b). The operation of the Boise reservoirs is coordinated jointly by the U.S. Army Corps of Engineers, the Bureau of Reclamation, and the Boise River Watermaster.

The Arrowrock project was completed in 1915 by the U.S. Bureau of Reclamation and has a maximum capacity of 298,230 AF of water which includes 11,630 AF of surcharge space. It is located 12 miles above Lucky Peak Dam (USACE, 1988). During high pool periods, water within Lucky Peak Reservoir is backed up to the downstream face of Arrowrock Dam. The total watershed area above Arrowrock Dam, but below Anderson Ranch Dam, is 1230 sq. mi. The major use of storage in Arrowrock is for irrigation. Other purposes are: 1) flood control, 2) recreation, and 3) regulation of releases from Anderson Ranch.

Presently, Arrowrock has no power generating facilities, but the dam was designed so three units could be installed. Recently the local irrigation districts received a FERC license (#4646-002) to construct and operate a 60 MW powerplant at Arrowrock Dam. Releases are coordinated with releases from Anderson Ranch, Lucky Peak, and Lake Lowell to maximize all uses (irrigation, recreation, flood control, hydropower, and stream flow maintenance) within the Boise River system. In years when it is not possible to fill the entire system, the Bureau releases water first from Arrowrock (instead of Anderson Ranch) to Lucky Peak to keep the pool up for recreation and to maintain the power head and the fishery at Anderson Ranch and for stream flow maintenance below Anderson Ranch.

Lucky Peak Reservoir began filling in October, 1954 (dam construction was not completed until February, 1955 by the Army Corps of Engineers) (USACE, 1988b). It holds 307,043 AF which includes 13,905 AF of surcharge space. The dam is located 64 river miles above the mouth of the Boise River, several miles east of the City of Boise. The watershed between the two dams is 470 square miles. The reservoir pool level at the dam normally fluctuates between elevations of 2905 ft. (top of active conservation pool) and 3055 ft. (normal full pool), a draft of 150 ft. (USACE, 1988b).

In 1988, a hydropower project was completed at the Lucky Peak dam. Three generating units were installed to provide a total capacity of 106.5 MW of power. The power project is owned and operated by local irrigation districts, but power generation is supervised by Seattle City Light under a 50 year (1988-2038) purchase contract (Morgan, 1991).

Irrigation releases from Anderson Ranch and Arrowrock pass through Lucky Peak reservoir. Because of high recreation demands on Lucky Peak, it is normally the last of the reservoirs in the system to be drawn down. Power head at Lucky Peak is not a consideration in water movement

within the system because Anderson Ranch has priority to maintain head for power and irrigation (and secondarily, by an informal agreement between BOR and IDFG, to maintain fish flows in the South Fork Boise River).

Anderson Ranch Reservoir, while not in the study basin, is being included because its operation is coordinated with the other reservoirs in the system. It holds 503,682 AF which includes 10,504 AF of surcharge space at maximum capacity and is located on the South Fork Boise River 25 miles above the confluence with the mainstem Boise River. The watershed area covers 980 square miles and extends eastward to the Smoky Mountains. The reservoir provides storage for irrigation, flood control, power generation, and recreation. It also maintains a permanent dead storage pool for fishery maintenance and silt control, and an inactive storage pool for power head. Irrigation releases from Anderson Ranch flow down through Arrowrock and Lucky Peak reservoirs and are coordinated with releases from Arrowrock and Lucky Peak to meet diversion requirements in the lower Boise valley.

Water is diverted from the river into the New York Canal at Diversion Dam, located 1.8 miles downstream of Lucky Peak Dam. The New York canal follows a southwesterly route for 40 miles to Lake Lowell, an off-stream storage reservoir located 27 miles southwest of Boise. Its storage capacity is 177,000 AF, supplying water for about 50,000 irrigated acres. During the winter and spring runoff seasons, excess flows from the Boise River are delivered to Lake Lowell for storage. During the irrigation season, water from the river and from storage release is diverted through the New York Canal and delivered to users both along the canal's route and through Lake Lowell to users in the lower Boise Valley. Like Anderson Ranch, Lake Lowell is located out of the immediate basin of study but is operated as part of the Boise River system.

Groundwater and Associated Geology

This upper Boise River basin is mountainous and roughly 90 percent of it is covered with granitic soils overlying the parent granite of the Idaho Batholith. Canyon-filling basalts occur in the lower Boise River and Mores Creek. The streams of much of the upper Boise River basin typically occupy narrow canyons and are still downcutting with little deposition. Some groundwater exists along the river corridors, as it does in the Mores Creek and Grimes Creek drainage associated with alluvial deposits and fissures in the bedrock. There are no reported instances of ground water contamination.

Water Conservation

Since 1987, southwestern Idaho has been in the midst of a drought. Based on the historic precipitation records since 1900, the statewide mean annual precipitation has gone from 23 per year to 26 per year. There has been a seasonal shift of precipitation, and the trend has been toward drier winters and wetter summers (Molnau, 1991). This means less recharge and spring runoff and greater evaporation in the summer, which may mean less water available for storage and irrigation. This is exactly what has happened in regard to the Boise River reservoir system. The reservoir system has not filled for several years and by the end of July, 1991, storage in the Boise basin was 34% of capacity and 45% of normal which resulted in a reduction of the winter flow in the Boise River through town from a normal 150 cfs to 80 cfs (USBR, 1991).

The 1976 State Water Plan recommended that the state should establish a water supply bank for water reallocation by sale or lease. This was formalized by the Idaho Legislature in 1979 and Idaho now has three banks, one of which was started in the Boise basin in 1988. One of the original purposes of the banks is to provide water for irrigation companies during drought years. For example, the Upper Snake Water Bank was utilized to provide drought relief in 1988.

Although little water is removed from the upper Boise River basin for any use, since 1980, the IDWR has a moratorium on issuing water right permits for consumptive uses during the irrigation season, June 15 to November 1. Good watershed and riparian management practices are therefore needed to prevent unnecessary water loss from the system. If indeed the climate pattern is shifting toward drier winters and wetter summers, then increasing pressure from users can be anticipated to maximize storage in the Boise reservoir system.

Water Supply: Water Quality

Physical and Chemical Quality of the Water

Based on samples collected by the USGS over the past two decades (1973-1990) at three stream gages in the basin, the overall water quality in the basin is good (Table 18). The temperature range for the Middle and North Fork Boise River, as indicated by data from the Twin Springs gage, stays below the 22.0 degrees C° required to maintain cold-water biota (salmonid fish, aquatic insects). However, Mores Creek experiences summer water temperatures that exceed cold-water biota maximum. Even though no domestic water supplies are taken from Mores Creek or the Middle Fork Boise River, concentrations of dissolved solids have been well within secondary drinking water standards at all three sample locations. The pH of the water tends to be slightly basic (greater than 7), which is normal for cold-water streams of the Northwest that flow through granitics.

Anions, cations, and nutrients generally remain within established standards for domestic water supplies and water quality criteria supporting aquatic life (Table 18).

Data reported for Mores Creek near Lucky Peak Reservoir exceeded water quality criteria for total phosphorus (Table 19).

Table 18. Physical and Chemical Water Quality in the Upper Boise River Basin (USDI, 1990a).

USGS Gage Stations	Boise River near Twin Spr.			Mores Creek			Boise R., below Lucky Pk.			DEQ Water Quality Standards or EPA Water Quality Criteria for Aquatic Life
Constituents	Sample Size	Mean	Range	Sample Size	Mean	Range	Sample Size	Mean	Range	
Temp. (deg. C)	29	8.76	<.01-20.5	149	8.34	<.01-28.5	95	8.71	<.01-35.0	
Specific Conductance (umhos/cm)	164	75.26	29-380	147	96.9	8-166	106	85.2	43-263	
dissolved solids (mg/l)	2	52.58	32-69	13	71.77	44-97	22	54.23	35-70	15,000 (EPA)
pH (range)	36		6.4-8.7	13		6.5-8.5	41		6.0-8.5	6.5-9.0 (EPA)
ANIONS										
HCO3 (bicarbonate, mg/l)	34	38.85	18-50	8	55.38	28-78	37	43.43	24-66	
CO3 (carbonate, mg/l)	33	.03	<.01-1.0				38	.08	<.01-3.0	
Cl (chloride, mg/l)	38	.35	<.01-2.0	13	.90	0.1-2.0	41	.46	<.01-2	
SO4 (sulfate, mg/l)	38	2.96	0.4-8.0	13	4.69	0.6-12.0	41	3.3	<.01-9	
F (fluoride, mg/l)	38	.52	0.1-0.9	13	.28	0.1-0.6	41	.31	.2-.4	
CATIONS										
Ca (calcium, mg/l)	38	9.91	5-14	13	12.52	6.7-18	41	10.15	6.6-14.0	
Mg (magnesium, mg/l)	38	.61	.1-1.9	13	1.89	1.1-2.4	41	1.4	.6-2.8	
Na (sodium, mg/l)	38	4.15	1.5-7.4	13	5.62	3.3-8.3	41	4.03	2-5.8	
K (potassium, mg/l)	38	.62	.3-1.6	13	.85	.4-1.1	41	.79	.5-1.4	
NUTRIENTS										
NO2 + NO3 (mg/l as N)	12	.08	.01-.40	13	.21	<.01-2.1	14	.13	<.01-.3	
NO3 total (mg/l N)	26	.27	<.01-0.6				26	.58	.1-1.3	
Phosphorus total (mg/l as P)	12	.01	<.01-.05	13	.03	.01-.06	14	.04	.01-.11	.05 (EPA)
Phosphate total (mg/l as P)	4	.02	<.01-.06	6	.10	<.01-.18	5	.07	<.01-.12	

Measurements were made from 1973 to 1990 at three USGS stream gages within the basin. Measurements compared against IDHW/DEQ Water Quality Criteria Standards and EPA Water Quality Criteria for Aquatic Life.

Table 19. Total Phosphorus Concentrations on Mores Creek (USDI, 1990a).

Sampling location	Sampling period	# Samples	mean (mg/l)	range (mg/l)	EPA Water Quality Criteria for Aquatic Life (mg/l)
Robie Cr., near mouth	11/78 - 9/79	6	.11	.04-.25	.05
Mores Cr., near mouth	11/78-9/79	6	.06	.03-.11	.05
Mores Cr., below Grimes Cr.	11/78-9/79	6	.07	.01-.10	.05
Grimes Cr., near mouth	11/78-9/79	6	.23	.01-1.07	.05

Impacts to Specific Waterways

In 1988, the Idaho Department of Health and Welfare, DEQ completed their survey and assessment of Idaho stream water quality in regard to nonpoint sources of pollution. Nonpoint pollution is diffuse and intermittent and usually related to surface activities such as agriculture, logging, and mining. The concern of the DEQ was whether or not beneficial uses, such as domestic and agriculture water supplies, salmonid spawning, cold water biota, and primary and secondary contact recreation, are being adversely affected by these activities. Assessment of the major streams within the upper Boise River basin follow:

North Fork Boise River: The only nonpoint source pollution listed for the entire North Fork Boise River, from the headwaters to the Middle Fork Boise River, is grazing and its impact is considered low (DEQ, 1988). There is some timber harvest activity in the watershed and its impact is also considered low at this time. The North Fork Boise River supports all beneficial uses.

The North Fork Boise River has also been placed on the EPA's priority wetlands list as part of an effort to identify wetlands that may require special attention. As of 1988, there were 149 such identified wetlands in Idaho. The EPA listed habitat alterations from forest practices, placer mining, and hydrologic modification (dam construction, removal of riparian vegetation, etc.) as threats to the North Fork wetlands.

The North Fork Boise River, from the Sawtooth Wilderness boundary, to its confluence with the Middle Fork Boise River, along with Crooked River, a major tributary to the North Fork Boise River, have both been designated Stream Segments of Concern (SSOC) because of timber harvest

activities (Dunn, 1990). When the designation is due to timber harvest activities, Rules and Regulations pertaining to the Idaho Forest Practices Act provides for the development of site-specific best management practices (BMP). Sediment may impact Beaver Creek, a tributary of Crooked River, by the Idaho Department of Transportation (IDT) when work is done on State Route 21.

Middle Fork Boise River: The Middle Fork Boise River was defined as including everything from the Sawtooth Wilderness boundary to the upper end of Arrowrock Reservoir. The Middle Fork Boise River does not presently support salmonid spawning as a beneficial use due to sedimentation of habitat. The sediment is believed to be from a combination of sources including the failure of Kirby Dam, the Middle Fork road, historic mining practices and some limited timber harvesting and grazing in the area. In addition, non-specified metals have been identified as a pollutant of concern.

Mores Creek and Grimes Creek: Mores Creek and its tributary Grimes Creek also do not presently support salmonid spawning due to sedimentation of habitat. The sediment here is also believed to come from a combination of sources including historic mining practices, timber harvesting, road construction and maintenance and limited grazing (IDHW, 1988).

Kirby Dam Failure and Impact on Water Quality

Currently, there are no toxic impacted segments listed by DEQ in the basin. However, when the Kirby Dam failed on May 26, 1991, sediments containing toxic chemicals from Atlanta's historic mining days were released into the Middle Fork Boise River. In a DEQ study, McIntyre (1991) reported that 90,000 cubic yards washed down when the dam failed, leaving behind 160-210,000 cubic yards. During the follow-up study, water samples taken 0.5 mile below the dam, two days after the failure, contained levels above EPA Drinking Water Standards for arsenic (Table 20). The dam has been stabilized by the State of Idaho and the U.S. Forest Service (completed April, 1992) and the sediments remaining will be prevented from further contaminating the Middle Fork Boise River. It is still to early to determine the full impact on the river and its fishery. Currently, arsenic and mercury concentrations in the water column and sediments are within an acceptable range. Mercury concentrations found in fish tissue have prompted health officials to recommend a limit of one meal of fish from the Middle Fork Boise River per week.

Table 20. Levels of Arsenic (As) and Mercury (Hg) in Samples Collected from the Middle Fork Boise River, After the Kirby Dam Failure (McIntyre, 1991).

Location	Sample Date	As (μg/l)*	Hg (μg/l)*
1/2 mile below Kirby Dam	5-26-91 5-27-91	0.260 - 5250 0.140 - 0.410	0.013 0.006
Swanholm Creek	5-27-91	0.060	less than .0005
Slide Gulch	5-27-91	0.058	less than .0005

*EPA Water Quality Criteria: Arsenic = .050 μg/l; Mercury = 0.050 μg/l.

Fish, Wildlife, and Biological Communities

The high biological diversity of the basin is in large part due to the fact that there is a wide array of communities represented, which include the following dominant vegetation types:

Sagebrush--around the two reservoirs and along the north side of the Middle Fork Boise River (elev. 2500-8500').

Ponderosa pine--open woodlands, sometimes mixed with Douglas fir on north-facing slopes (elev. 2500-7000').

Douglas fir--closed and open canopied forests mixed with quaking aspen and patches of sagebrush on north-facing slopes and at higher elevations (elev. 5000-9500').

Lodgepole pine--dense canopied forests with sparse understory in upper reaches of both North and Middle Forks Boise River and Crooked River (elev. 6000-8000').

Subalpine fir--closed and open canopied forests at higher elevations, primarily in Sawtooth Wilderness Area (elev. 5000-9500').

Riparian types--along the rivers and creeks above the reservoirs exist floodplain vegetation dominated by cottonwoods, willows, alder and even lodgepole pine at certain specific locations (elev.3280-6562' Sawtooth Wilderness Area boundary).

Special Species and Habitats

Even though the biological diversity of the basin is relatively high, the population status of several species is of concern (Moseley and Groves, 1992; Table 22). These are listed with the U.S. Fish & Wildlife Service and Idaho Department of Fish & Game.

The USFWS provides protection for those species of plants and animals that are listed as threatened or endangered (T&E species). Species can also be classed as candidate species, and can fall into one of several candidate categories, depending on their status. The species of plants and animals that are found within the upper Boise River basin identified by USFWS as endangered candidates are listed in Table 21.

Table 21. Threatened and Endangered Wildlife and Plants Found Within Upper Boise River Basin (Moseley and Groves, 1992).

Candidates	Listed Endangered
Bull trout (Dolly Varden) Wolverine Goshawk Silvery whitlow-grass Idaho goldenweed Wilcox's primrose	Bald eagle Gray wolf

The Natural Heritage Programs and Conservation Data Centers (CDC) around the county, have developed their own ranking system which represents their assessment of the global and state status of each species. The CDC in Idaho is affiliated with the IDFG. The ranking is on a 1 to 5 scale for plants, animals, and natural communities and is applied separately at global rangewide and state levels (Table 22). The rank is primarily based on the number of known occurrences, but other factors such as habitat quality, narrowness of range, and population trends are taken into consideration (Moseley and Groves, 1992). The USFWS and CDC ranking systems are used in the screening process for fish, wildlife, and plants. In addition, the USFS, Region 4, lists five plant species, the native rainbow trout, bull trout, westslope cutthroat trout, wolverine, flammulated owl, goshawk and fisher as sensitive species. Goshawks are known to nest in the basin; one has already been located in the Logging Gulch area.

The IDFG recognizes that recent gray wolf (1979-88 in the North Fork Boise River vicinity and Pete Creek) are probable sightings, and are not confirmed. Wolverine sitings have been confirmed in the Atlanta area (Stephens, 1991). A few of the wolf and wolverine occurrences are within six miles of the river. A fisher was trapped in 1978 in upper Devil's Creek, and bald eagles commonly winter along the Middle Fork (Stephens, 1991).

Because of the relative pristineness and species diversity of the basin, the Boise National Forest has proposed two Research Natural Areas (RNA) in addition to the already established Bannock Creek RNA, for protection (USDA, 1990a; Plate 8). One is on the North Fork Boise River (874 acres), 5-6 miles above the confluence with the Middle Fork Boise River, and the other on the Roaring River 4-6 miles above the Middle Fork Boise River (423 acres). The proposed North Fork Boise River RNA contains a relatively uncommon species of false yarrow and the Roaring River RNA contains the

Idaho goldenweed, a candidate for federal listing (USDA, 1990a). The existing 445-acre Bannock Creek RNA, east of Idaho City, which contains a high diversity of biological communities from sagebrush to Douglas fir. The BLM officially established the Boise Front Area of Critical Environmental Concern (ACEC) which covers 12,000 acres of the Boise Mountains to protect the winter range for approximately 4000 mule deer (USDI, 1987; Plate 8). Although not indicated on Plate 8, the headwaters of Grimes Creek are considered an important elk calving and deer fawning area (Minter, 1992).

Table 22. Global and State Ranks for Sensitive Species in Upper Boise River Basin (Moseley and Groves, 1992).

Species	Global Rank	State Rank
Fisher (Martes pennanti)	5	1
Wolverine (Gulo gulo)	4	2
Fringed myotis bat (Myotis thysanodes)	5	1
River otter (Lutra canadensis)	5	4
Gray wolf (Canis lupus)	4	1
Bald eagle (Haliaeetus leucocephalus)	3	3
White-headed woodpecker (Picoides albolarvatus)	5	1
Goshawk (Accipiter gentilis)	4	4
Flammulated owl (Otus flammeolus)	4	3
Westslope Cutthroat trout (Oncorhynchus clarki lewisi)	5	2
Bull trout (Salvelinus confluentus)	4	2
Tiehm's rush (Juneus tiehmii)	5	2
Tall swamp onion (Alium validum)	4	1
Wilcox's primrose (Primula wilcoxiana)	2	2
Silvery whitlow grass (Draba argyraea)	3	3
Idaho goldenweed (Haplopappus aberrans)	3	3
Giant helleborine (Epipactis gigantea)	4	3
Idaho douglasia (Douglasia idahoensis)	2	2

1 = critically imperiled because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction
2 = imperiled because of rarity or because of other factors demonstrably making it very vulnerable to extinction
3 = either very rare and local throughout its range or found locally in a restricted range or because of other factors making it vulnerable to extinction
4 = apparently secure, though it may be quite rare in parts of its range, especially at the periphery
5 = demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery

The North and Middle Forks Boise River are listed as Protected Areas by the Northwest Power Planning Council because of the wild rainbow trout and deer and elk wintering range (NWPPC, 1990). The forks and adjacent plateaus serve as major mule deer migratory routes from the high elevations to lower elevations, south-facing slopes and the Boise Front Wildlife Management Area (WMA), just outside Boise (Harris, 1991). The canyon of the North Fork Boise River above the Middle Fork Boise River confluence is roadless and contains rugged terrain, is reputed to be an important refuge for elk during hunting season. During winter, the elk migrate from the Trinity Mountains to the north side (south-facing slope) of the Middle Fork Boise River (Harris, 1991).

Fisheries

Lucky Peak and Arrowrock Reservoirs: Fisheries in the two reservoirs on the Main Boise River, Lucky Peak and Arrowrock, are classified by IDFG as mixed (contain cold and warm water species) fisheries and contain populations of smallmouth bass, perch, rainbow trout, kokanee, bull trout, and whitefish (IDFG, 1990a). The fisheries in both reservoirs vary in quality and quantity because of fluctuating water levels (Rohrer, 1989). A fish kill occurred at Arrowrock in 1966 due to drawdown, and in 1988 it was completely drained for irrigation purposes (Rohrer, 1989). The 1988 Army Corps of Engineers Operations Manual for the Boise River System recommends that both Lucky Peak and Arrowrock each have a minimum conservation pool of about 28,700 AF. But in the recent dry years, the minimum pool has dropped below the recommended level (Reid, 1991).

The IDFG plan for Arrowrock is to stock annually with fingerling rainbow. The intention for Lucky Peak is to improve the kokanee (landlocked sockeye) fishery. Kokanee probably need to be stocked annually in the reservoir to maintain a population. In the early 1970s, kokanee spawned in Mores Creek, but didn't establish (Rohrer, 1989). IDFG also plans to study the feasibility of stocking fingerling rainbow and continue to stock catchable rainbow in Lucky Peak.

Main Boise, North and Middle Forks Boise River: Upstream from the reservoirs, the Main, North, and Middle Forks Boise River contain excellent populations of wild rainbow trout, mountain whitefish and bull trout (IDFG, 1990a). The highest densities in the basin of both the bull and wild trout are in the roadless portion of the North Fork, the reach between the confluence at Troutdale and Rabbit Creek.

Because of heavy fishing pressure, hatchery-reared rainbow trout are released by IDFG to supplement the wild populations. Currently, 75% of the Middle Fork and 64% of the North Fork are managed as native trout fisheries, while the remaining 25%/36% are managed for hatchery-reared trout (Allen, 1991). The management direction proposed by IDFG for the early 90s varies for different reaches of the river (IDFG, 1990a). Prior to the Kirby Dam failure in the spring of 1991, the IDFG had planned to stock the Middle Fork from Arrowrock to the North Fork confluence with catchable rainbow trout following the high water period (usually mid-July) until Labor Day. Their intention had been to manage for high catch rates of wild fish from the North Fork confluence to Kirby Dam. The IDFG also planned to stock with rainbows above Kirby Dam to Sawtooth Wilderness prior to the failure of Kirby Dam. However, the IDFG Middle Fork management plan has been put on hold until the impact from the Kirby failure can be assessed (Reid, 1991). According to the IDFG, the North Fork currently does not receive the angling pressure that the Middle Fork gets and will be managed for high catch rates (3 fish/hour) and low angler density.

Boise River Tributaries: While the main rivers of the basin serve for both spawning and rearing, the tributaries serve mainly for spawning. Natural populations of brook trout, wild rainbow trout, and westslope cutthroat trout occur in some tributary streams. Sheep Creek, a tributary of the Middle Fork, has the highest density of juvenile wild trout and is an important spawning stream (Rohrer, 1989). Table 23 provides wild rainbow trout densities for sections of the North and Middle Forks and several of their important tributaries (Rohrer, 1989 and 1990). In addition to Sheep Creek, other important spawning tributaries in the basin include Roaring River, Yuba River, Rabbit Creek, and Johnson Creek.

Table 23. Boise River Wild Rainbow Trout Densities (Rohrer, 1989, 1990).

Stream Sections Studied	Density (fish/100 m^2)
Mainstem and Middle Fork Boise	
Section 1 (Willow Cr. C.G. to confluence)	.39
Section 2 (confluence to Alexander Cr.)	.69
Section 3 (Alexander Cr. to Dutch Cr.)	.57
Section 4 Dutch Cr. to Kirby Dam)	.89
Section average	.65
Middle Fork Tributaries:	
Sheep Creek	12.01
Roaring River	8.59
Queens River	2.90
Yuba River	4.43
North Fork Boise	
Section 1 (confluence to Rabbit Cr.)	.98
Section 2 (Rabbit Cr. to Crooked R.)	.21
Section 3 (Crooked R. to Deer Park)	1.00
Section 4 (Deer Park to Graham C.G.)	1.20
North Fork Tributaries:	
Rabbit Creek	4.50
Crooked River	2.90
Bear River	1.60
Johnson Creek	8.60

Aesthetic Values

The objective of data collection for the upper Boise River basin aesthetic study was to identify landscape scenic values, viewer characteristics and special management designations. Most of the upper Boise River basin is under the jurisdiction of the Boise National Forest with a few scattered parcels managed by the Cascade and Bruneau resource areas within the Boise District Bureau of Land Management (BLM). The Forest Service and BLM inventory and manage their lands for aesthetic

resources during land management planning as required in organic statutes and other federal regulations. Consequently, the majority of aesthetic data necessary for the Upper Boise Plan were available from these two agencies.

Visual Management Systems

Guidance for conducting visual inventories on Forest Service lands is contained in *National Forest Landscape Management, Volume 2 - Chapter 1, The Visual Management System* (USDA, 1974). This process, known as the Visual Management System (VMS), provides a framework for inventory and management of the visual resource (USDA, 1974). Guidance for inventorying BLM lands for visual resource values is found in the *Visual Resource Management Inventory and Contrast Rating Manual - 8400 Series* (VRM manual) (USDI, 1986), originally published in 1980 with revisions in 1984 and 1986.

Visual inventory data collected during evaluation of Forest Service and BLM lands provide information on landscape scenic values and viewer characteristics. The Boise National Forest inventoried and mapped visual resource data at a scale of 1:24,000 from 1979 to 1981. The Cascade and Bruneau resource areas within the Boise BLM District conducted visual resource inventories in 1984. Inventory data were mapped at a scale of 1/2 inch = 1 mile.

Landscape Scenic Values

Landscape scenic values are a measure of the aesthetic quality of a landscape from a regional perspective. This value is based on the degree of variety a landscape possesses. All landscapes are considered to have some scenic worth, but landscapes with greater variety are rated higher (USDA, 1974; USDI, 1986). The Forest Service system terms these values variety classes which are determined by evaluation of variety found in characteristic landform, rock form, vegetation, and water forms (USDA, 1974). The BLM relies on a numeric rating system to derive scenic quality classes. This system assesses the degree of visual variety and harmonious composition of seven criteria: landform, vegetation, water, color, adjacent scenery, scarcity and cultural modifications (USDI, 1986). Both agencies categorize landscape scenic values using one of three classes: class A - outstanding; class B - common; or class C - minimal.

Landscape scenic values for the basin were identified in Forest Service and BLM visual resource inventories as class A, B or C and reviewed for use in the Upper Boise aesthetic analysis. The most outstanding or scenic landscapes in the basin were those landscapes rated as variety class A by the Forest Service or scenic quality class A by the BLM. Class B landscapes, although aesthetically appealing locally, possess characteristics common to the region. Class C landscapes have minimal

variety in landscape features. Plate 10 depicts the scenic values assessed for landscapes in the basin. The most outstanding scenic landscapes are described in Table 24.

Table 24. Outstanding Scenic Landscapes in the Upper Boise River Basin* (USDA, 1979-81; USDI, 1984a; and USDI, 1984b).

Grays Creek drainage	Browns Creek drainage
Middle Fork Boise	Portion of Black Warrior Creek drainage
Slopes adjacent to Sawtooth Wilderness	Johnson Creek drainage
Right Creek drainage	Headwaters of Phifer Creek
Browns Creek drainage	Headwaters of Hot Creek
Little Queens River drainage	Headwaters of Lake Creek
Cub Creek drainage	Steel Mountain Summit area
Ridge along Cayuse Point to Bald Mountain Summit	Elk Creek drainage
Headwaters of Yuba River	Boiler Creek drainage
East Fork Yuba River drainage	Grade Creek drainage
Corbus Lake	Grouse Creek drainage
Jennie Lake	Grouse Lakes
Wolf Mountain	Decker Creek Drainage
Headwaters of Bear Creek	Upper end of Devils Creek
Little Trinity Lakes area	Upper end of Sheep Creek drainage
Upper Roaring River area	Upper end of Rattlesnake Creek
Middle Fork of the Roaring River	Warrior Lakes area
East Warrior Peak and northern slope	Blue Jay Lake area
East Bank of North Fork of Boise River	Swanholm Peak area
Easy Slope of Graham Peak area	Lodgepole Creek drainage
Cub, Taylor and McNutt Creek drainages	Lodgepole Lake area
Tyee Mountain	Goat Mountain
Northside of Little Silver Creek	Shephard Peak
Bear River	Graham Peak
	Silver Mountain
	South side of Lucky Peak

* Landscapes inventoried as variety class A or scenic quality class A by the Boise National Forest or Boise District BLM

Viewer Characteristics

Viewer characteristics include the sensitivity of viewers to changes in the visual landscape and the visible landscape as seen by the viewer. Sensitivity levels are a measure of public concern for the scenic values of the landscape. This is accomplished by first identifying key viewpoints (roads, use areas and water bodies) which provide an opportunity for a person to view the landscape. Several criteria are then considered to determine the sensitivity of the viewer located at this viewing area. Criteria evaluated include viewer activity, use volume, use duration, and national or local importance. Three levels of viewer sensitivity are used to describe viewer concern for the visual landscape: level 1 or high, level 2 or moderate, and level 3 or low.

Viewpoint inventory data for the basin were available for Boise National Forest lands, but not for BLM lands. Sensitive viewpoints identified in the Forest Service visual inventory were reviewed for accuracy and currency. It was discovered that levels of use, types of users, and other indicators of

visual sensitivity had changed for some key viewpoints subsequent to the original sensitivity analysis conducted ten years ago by the Forest Service. Accordingly, sensitivity levels were updated through review with Forest Service staff familiar with the VMS system and use patterns on the forest. Final sensitivity levels for high and moderate viewpoints used in the Upper Boise aesthetic analysis are summarized in Table 25.

Distance zones define the viewshed or the visible landscape as seen from a sensitive viewpoint. The viewshed is differentiated into the following categories defining specific distances from the viewpoint: foreground (0 to 1/4-1/2 mile), middleground (1/4-1/2 to 3-5 miles), background (3-5 miles to 15 miles), and seldom seen (unseen or beyond 5 miles). Visibility and clarity of detail are dependent on distance; consequently, these delineations define different levels of viewer perception. The foreground describes the area where detail is readily perceived. The middleground defines the distance where texture is perceived. Background describes the distance where texture becomes difficult to discern but forms or masses are perceived (USDA, 1974). Distance from a viewer is an important determinant in mitigating visual impacts.

The sensitivity of the viewshed is determined by the sensitivity of the viewpoint. Viewshed data were available for Forest Service lands only. Viewsheds for high and moderate sensitivity viewpoints listed in Table 25 were calculated by the Boise National Forest through use of a computer mapping program called VIEWIT using terrain data at a scale of 1:250,000. Viewsheds were divided into foreground, middleground, background or unseen distance zones. Maps depicting these viewsheds are located in IDWR files.

Agency Visual Resource Management

The Forest Service and BLM overlay landscape scenic value classes, viewer sensitivity and viewshed mapping to arrive at agency management objectives. These define the management direction for the visual resource, or degree of acceptable visual change allowed in a particular landscape. The Forest Service derives visual quality objectives (VQOs). The BLM derives visual resource management classes (VRM classes). Table 26 summarizes management direction for VQOS and VRMs.

Table 25. Key Viewpoints and Sensitivity Levels for the Upper Boise River Basin.

Roads	Trails	Water Bodies/Streams	Use Areas
Sensitivity Level 1 or High			
Middle Fork Boise 268	Pogue National Recreation Trail 122	North Fork Boise	Black Rock Campground
North Fork Boise 327	Crooked River 158	Sheep Creek	Nunamker homesite
State Highway 21	Little Queens River 054	Middle Fork Boise River	Ninemeyer Hot Springs
Fall Creek - Rocky Bar 129	Johnson Creek 059	Little Queens River	Trinity Look Out
Queens River 206	Black Warrior 053	Little Trinity Lake	Edna Creek Campground
Grayback 374A	Trinity Mountain Rd. 129	Rainbow Lake Area	Power Site
Roaring River 255	Middle Fork Boise River 060	Big Roaring River Lake	Queens River Trailhead
	Roaring River 45	Queens River	Little Roaring River Campground
	Cottonwood 189	Little Roaring River Lake	Big Roaring River Campground
		Big Trinity Lake	Power Plant Campground
		Cottonwood Creek	Grayback Gulch Campground
		Jennie Lake	Hayfork Campground
		Roaring River	Bad Bear Campground
		Yuba River	Ten Mile Campground
Sensitivity Level 2 or Moderate			
Middle Fork Boise 268	Devils Creek 128	Arrowrock Reservoir	Willow Creek Campground
Thorn Creek to Cottonwood 377	Snowslide 123	Lucky Peak Reservoir	Ninemeyer campground
North Fork Boise 327	Rattlesnake 127	Grimes Creek	Willow Creek campground
Little Owl 384	Clear Creek 145	Clear Creek	Irish Point dispersed site
Grimes Creek 364	Link 148	Pescado Lake	Badger Creek Campground
Robie Creek 261	Warm Springs 147	Grouse Lakes	Troutdale Guard Station
South Fork Robie Creek 260	Kirkham Ridge 144	James Creek	Arrowrock boat ramp
Roaring River 255 (paralleling Lost Man Creek)	Grouse Creek 066	Mores Creek	Graham Bridge Campground
Fall Creek to Rocky Bar 129			Johnson Creek Campground
James Creek 126			Clear Creek subdivision
Flint Creek to Decker Creek 289			Robie Creek subdivision
China Basin 205			Karney subdivision
Private Road in Atlanta area			Macks Creek Picnic Area & Boat Ramp
Idaho City to Horseshoe Bend 307			Arrowrock Dam
Alder Creek 615			Spring Shores Marina
			Dutch Creek Administrative Site
			Weatherby Landing Field
			Riverside Campground
			Atlanta Townsite
			Rocky Bar Historical Area
			Atlanta Airstrip
			Atlanta Guard Station

The Basin includes lands managed for all five VQO's, i.e, preservation, retention, partial retention, modification and maximum modification. A detailed map is available in the Department's files or the Boise National Forest Supervisor's office. VRM class delineations for BLM parcels are presented in Table 27. These lands are managed under VRM classes II and III within the basin. Specific geographic delineations of VRM class boundaries are available in BLM and Department files.

Table 26. Visual Management Direction for Forest Service and BLM Lands (USDA, 1974; USDI, 1986).

VQO (Forest Service)	VRM Class (BLM)	Management Direction
Preservation	VRM Class I	Ecological changes only.
Retention	VRM Class II	Retain existing visual character of the landscape. Allows activities which are not visually evident. Visual change should be low.
Partial Retention	VRM Class III	Partially retain visual character of the landscape. Visual change should be moderate.
Modification	VRM Class IV	Allows major modifications to the existing landscape character. Management activities may visually dominate the landscape. Level of change can be high.
Maximum Modification		

Table 27. VRM Classes for BLM Lands in the Upper Boise River Basin (USDI, 1984a and USDI, 1984b).

VRM Class	Land Area
II	Boise Front Lucky Peak area
III	Idaho City area Quartzburg area Placerville area Centerville area

Additional Visual Resource Data Collected

In addition to evaluating the Forest Service and BLM visual inventory data, the aesthetic study involved a review of other agency programs to identify resources and/or viewpoints managed to preserve or promote aesthetic qualities. Public input was also considered to identify resources which are highly valued for scenic or aesthetic attributes. Many of the resources identified through these procedures were already considered in the Forest Service's and BLM's visual resource inventories. Recreational facilities operated by the USACE, Bureau of Reclamation, and IDPR, were considered in the sensitivity analysis conducted by the Forest Service. Other agency designations which recognize aesthetic resource values include wilderness, national trail, and federal Wild and Scenic River designations. The federal agencies considered wilderness and national trail designations during its visual inventory processes. The BLM designates areas of critical environmental concern (ACECs) and special recreation management areas (SRMAs) which were also considered during its visual inventory.

Four additional agency management designations with the purpose of protecting aesthetic values apply in the basin. Three of these programs identify scenic values viewed from travel routes. They include Idaho's State Scenic Route program, the U.S. Department of Transportation's National Scenic Byway program and the Forest Service's Scenic Byway program. A fourth recognizes outstanding aesthetic values of river corridors -- federal wild and scenic river designations.

Scenic Routes and Byways Program

The Idaho Transportation Department (ITD) has a program which identifies certain state highways as state scenic routes. This designation characterizes highways with unquestionable scenic quality (ITD, 1977). Additionally, many of these are eligible for national scenic byway status (USDT, 1988).

The Forest Service has a program similar to the state's in identifying national forest scenic byways. The objectives of the scenic byway program in Idaho include: 1) highlighting outstanding Forest Service scenery; 2) increasing public comprehension of Forest Service management activities including its provision of recreational opportunities; 3) meeting demand for the recreational pursuit of pleasure driving; 4) promoting use of the national forest by non-traditional users; and 5) contributing to the national scenic byways effort (Cook, 1989). In Idaho, the Forest Service scenic byway program complements the ITD program (Cook, 1991). Those highways which are designated state scenic routes and traverse national forest lands are proposed as national forest scenic byways.

In the upper Boise River basin, State Highway 21 is designated as the Ponderosa State Scenic Route from Boise to Stanley by the ITD (ITD, 1977). It is also eligible for national scenic byway designation (USDT, 1988). Additionally, the Boise National Forest has nominated State Highway 21 from Idaho City to Lowman as a national forest scenic byway in its Land and Resource Management Plan (USDA, 1990a).

National Wild and Scenic Rivers

The objective of the Wild and Scenic Rivers Act is to keep river corridors which possess outstandingly remarkable scenery, recreational, geologic, fish & wildlife, historic, cultural, or other similar values . . . free-flowing (Section 1[b]). One of three designations may occur reflecting the type of access and intensity of development in the river corridor -- wild, scenic or recreational (USDA, 1990a).

No wild and scenic rivers are designated within the basin. However, the Forest Service has conducted eligibility studies to identify free-flowing rivers possessing at least one outstandingly remarkable values. These river segments were found eligible for detailed suitability analysis for possible inclusion in the National Wild and Scenic River system (USDA, 1990a).

Wild

- North Fork Boise - Johnson Creek to Hunter Creek
- North Fork Boise - Rabbit Creek to Middle Fork Boise
- Yuba River - Headwaters to Trails Creek
- Bear River - Headwaters to North Fork Boise
- Roaring River - Headwaters to crossing of Forest Service Road 255
- Crooked River - Whoop Um Up Creek to North Fork Boise

Recreational

- North Fork Boise - Wilderness boundary to Johnson Creek - recreational
- North Fork Boise - Hunter Creek to Rabbit Creek
- Middle Fork Boise - Forest boundary to Willow Creek
- Yuba River - Trail Creek to Middle Fork Boise
- Roaring River - Crossing of Forest Service Road 255 to Middle Fork Boise

Other Scenic Designations

Additional special management designations by the Forest Service which are related to aesthetic resource management or protection include the Sawtooth Wilderness and the adjacent recommended Ten Mile Wilderness located in the northeast corner of the basin. Additionally, the BLM manages the Boise Front as an ACEC and SRMA, noting its function as a scenic backdrop for the City of Boise (USDI, 1987).

Cultural Features

The National Register is an official list compiled by the National Park Service since 1966 of archaeological, historic, and architectural properties of national, state and local significance worthy of preservation. Register sites located on private lands include Idaho City and the Atlanta Historic District (USDA, 1990b). Register sites on BLM lands include the Placerville Historical District. The BLM proposes nominating three other sites including Quartzburg, Centerville, and Pioneerville (USDI, 1987). National Register sites on the Boise National Forest include Alturas City, Yuba City, some mill sites, several cabins, historic graves, and Arrowrock Dam (USDA, 1991d; USDA, 1990b). Kirby Dam was formerly listed, but is no longer eligible because of its rehabilitation in 1990 and subsequent collapse in the spring of 1991.

Numerous sites are eligible for listing, and others may be eligible although an evaluation has not been completed (USDA, 1990b). Eligible sites include a number of Forest Service administrative sites, historic mining and logging sites, particularly Chinese mining sites. Administrative sites eligible for nomination include the Atlanta and Cottonwood ranger stations; Barber Flat, Deer Park, Graham and Troutdale guard stations; Beaver Creek and Dutch Creek work stations; and the Idaho City work compound (USDA, 1991d).

The discovery of gold around Idaho City launched gold fever in the Boise basin in 1862 (Alt and Hyndman, 1989). By 1869, the rush was over, but limited mining continued until about 1952. Prospectors found gold near Atlanta, on the Middle Fork Boise River, in 1863, but the glory was short-lived (Alt and Hyndman, 1989). In 1932, however, a mill was erected that utilized a new process extracting both gold and silver which made Atlanta the top gold producer in the state until 1936. The Monarch Mine, the most renowned of Atlanta district mines, produced over $2 million between 1865 and 1936 (Anderson, 1939). In 1908, Kirby Dam was completed just below Atlanta, to supply 600 hp of power to Monarch (Bell, 1906).

Throughout the basin is the evidence of the mining activity. After the independents hand-worked the gravels, mining companies hydraulically worked the hillsides, to be followed in 1898 by the dredges, which turned the floodplains upside down and resulted in the gravel piles that litter the valley floors. The Boise basin was the most productive gold mining district in Idaho. The Idaho City area is important for understanding the local mining history and Chinese populations.

During the gold rush, prospectors followed the 50 mile Goodrich Trail that ran between Idaho City and Rocky Bar (Idaho Historical Society, 1972). The trail was named after the Goodrich Brothers who owned a ranch at Alexander Flats on the Middle Fork Boise River, where they established a hotel for miners called the 24 Mile House or Middle Boise Hotel. The hotel and trail were maintained by the brothers for several years until miners began to use other routes to Idaho City and Boise, such as by way of Banner or directly down the Middle Fork Boise River.

Recreation

Methods

The objectives of the recreation study for the Upper Boise Plan were to identify (a) the types and diversity of recreational opportunities within the basin; (b) agency recreational management direction and designations; and (c) current use and future capacity of these recreational activities. This information was obtained from a number of sources. Predominately, data were acquired from contacts with various agencies and review of their land management plans including the Boise National Forest Land and Resource Management Plan (USDA, 1990a), the Idaho Outdoor Recreation Plan (SCORP) (IDPR, 1989), the Bureau of Land Management (BLM) Cascade Resource Area Management Plan (USDI, 1987), and the Lucky Peak Master Plan (USACE, 1988a).

In addition to the agency contacts described above, data were obtained from literature review and contacts with private organizations regarding trail and boating use. Specific information with respect to trail use were lacking for the basin. Consequently, the Department contacted specific trail

users to identify the type of trail use, location of trails used, and issues and concerns with respect to the river planning process. Numerous publications were also examined which summarize trails located within the basin. Individual boaters were contacted and boating guides reviewed to obtain information on put-in and take-outs, whitewater classifications, and boating activity in the river corridors.

The IDPR and IDWR contracted a recreation study through Boise State University which provided information regarding types of river recreation activity and degree of use in certain geographic areas along the mainstem, North and Middle Forks of the Boise river. This survey was conducted from May to September 1991, and focused on recreational use in roaded areas for the early spring and summer seasons.

Overview

According to the 1987 Idaho Leisure Travel and Recreation Study, Region 3 ranked second in the state as a major recreation destination, receiving 16% of all leisure travelers in the state. (Region 3 encompasses Adams, Canyon, Gem, Owyhee, Payette, Valley and Washington counties, in addition to Ada, Boise and Elmore counties). Destination travellers consisted of 52.4% Idaho residents, with most non-resident visitors coming from California, Oregon, Washington, Utah and Montana (Tynon et al., 1988). A 1991 study concluded Region 3 received 28.5% of all tourists, ranking it first along with Region 1 located in the Panhandle (IDC, 1991). Regionally, at least 35% of residents and non-residents engage in hunting, pleasure driving, nature study, hiking, walking, picnicking or sightseeing. Recreation patterns within the planning area generally reflect regional trends (Table 28).

Secondary suppliers of recreational opportunities include BLM in the vicinity of Lucky Peak and the area surrounding Placerville, Quartzburg, Centerville, Pioneerville and Idaho City. These opportunities accounted for approximately 2370 recreation visits in 1991. Recreation primarily consisted of motorized and non-motorized trail uses, and winter sports in the Idaho City area (Farrow, 1991). The IDFG Boise River Wildlife Management Area (WMA) accounted for another 8275 recreation visits, the most popular uses being wildlife observation, nature study and hunting (Table 28).

Table 28. Estimated Recreation Activity Participation for Region 3 and the Upper Boise River Basin (IDPR, 1989; USDA, 1991a; Schiepan, 1992; USDI, 1992; Farrow, 1992; Scholten, 1992; Budolfson, 1992; USACE, 1992 and Carter, 1992).

	1987 REGION 3 PARTICIPATION		BOISE NATIONAL FOREST (including Arrowrock)	BLM	BOISE WMA	LUCKY PEAK (excludes Spring Shores State Park)	IDPR (Spring Shores State Park)	ARROWROCK FACILITIES
Activity	**Resident Travelers**	**Non-resident Travelers**	**1991 RVDs[1] (% of total)**	**1991 RVs[2] (% of total)**	**1991 RVs (% of total)**	**1991 RVs (% of total)**	**1991 RVs (% of total)**	**1990 RVs**
Fishing	15.7%	13.3%	7500 (2.3)			47,768 (7.6)	10,704 (6.1)	
Boating						157,184 (25.2)	66,789 (37.8)	
Power boat	2.4%	0.2	5000 (1.5)					
Jet boat	3.5%	1.8%	-					
Canoe	6.3%	0	500 (0.15)					
Sail	0	1.1%	1000 (0.3)					
Kayak	0	0.8%	1900 (0.6)					
Raft	0.4%	2.3%	-					
Swimming								
Pools	23.4%	3.2%	-					
Reservoir/lake	1.5%	0.3%	-			48,181 (7.8)	21,853 (2.3)	
River/streams	1.8%	0.4%	3300 (1.0)					
Diving	0	0	500 (0.15)					
Water ski	0.3%	0	3000 (0.9)			43,249 (7.0)	18,966 (10.7)	
Beach	15.4%	2.4%	-					
Non-motorized				250 (10.5)				
Hiking/walking	37.1%	24.5%	3900 (1.2)					
Horseback	2.1%	1.9%	18,000 (5.4)					
Biking	0	5.4%	6500 (2.0)		450 (5.4)			
Off road vehicle	3.0%	5.7%	19,900 (6.0)	240 (10.1)	300 (3.6)			
Camping								
Developed	18.8%	9.9%	49,800 (15.0)	-				
Dispersed	2.5%	2.0%	63,300 (19.0)	150 (6.3)		3265 (0.5)	4678 (2.6)	
Recreational cabin	-	-	3500 (1.1)	-				
Hunting				300 (12.6)		2367 (0.3)		
Big game	1.0%	2.6%	25,200 (7.6)		1150 (9.0)			
Upland game/birds	0.6%	0.6%	4700 (1.4)		700 (8.5)			
Nature study/wildlife observation	42.0%	56.2%	3350 (1.0)		5000 (60.4)			
Winter recreation				800 (33.8)	400 (4.8)			
Snowplay/sled	0.6%	0	4000 (1.2)					
Snowmobiling	4.5%	0	9000 (2.7)					
Cross country ski	5.8%	0	10,500 (3.1)					
Other land-based								
Picnicking	36.7%	19.6%	12,500 (3.7)	180 (7.6)		151,623 (24.3)	11,704 (6.6)	
Pleasure driving	46.1%	31.3%	37,450 (11.3)	450 (18.9)				
Sightseeing	34.5%	70.1%	2000 (0.6)			77,395 (12.4)	5323 (3.0)	
Gathering forest products	-	-	8700 (2.6)					
Guided tours	0.5%	1.9%	13,400 (4.0)					
Sports	30.7%	19.9%	1400 (0.4)					
Miscellaneous			12,400(3.7)		275 (3.3)	90,579 (14.6)	36,882 (20.8)	
TOTALS			**332,100 RVDs**	**2370 RVs**	**8275 RVs**	**305,748 RVs**	**88,863 RVs**	**15,000 RVs**

[1] Recreation visitor day (RVD) equals one person for twelve hours.

[2] Recreation visit (RV) equals one person for one visit regardless of length of visit. RVs for activities do not necessarily add up to the total RVs for an area as a person may participate in more than one activity on a visit.

Table 29. Number and Percent of Recreation Activities and Number of Visitors Observed on Segments of the Main, North and Middle Forks Boise River (Long, 1991*).

	MAIN STEM BOISE	NORTH FORK BOISE				MIDDLE FORK BOISE		
	Confluence to Arrowrock	Deer Park	Deer Park to Little Owl Creek	Little Owl Creek to Barber Flat	Barber Flat to Rabbit Creek	Jackalyn Creek to Swanholm Creek	Swanholm Creek to Alexander Flats	Alexander Flats to Confluence
Activity								
Fishing	482 (25.7%)	82 (33.4%)	153 (37.2%)	459 (27.8%)	658 (22.0%)	43 (22.9%)	63 (18.5%)	80 (14.8%)
Nap/Relax	478 (25.6%)	78 (31.8%)	111 (27.0%)	332 (20.1%)	462 (15.4%)	52 (27.7%)	88 (25.8%)	132 (24.4%)
Swim	351 (18.7%)	11 (4.4%)	34 (8.3%)	406 (24.5%)	450 (15.0%)	11 (5.9%)	59 (17.3%)	54 (10.0%)
Camp	252 (13.4%)	39 (15.9%)	77 (18.7%)	260 (15.7%)	566 (18.9%)	35 (18.6%)	23 (6.7%)	115 (21.3%)
Motor bike	52 (2.7%)	11 (4.4%)	6 (1.5%)	47 (2.8%)	260 (8.7%)	11 (5.9%)	13 (3.8%)	4 (0.7%)
Floating	72 (3.8%)	0	0	46 (2.7%)	61 (2.0%)	0	0	48 (8.8%)
Picnicking	44 (2.4%)	0	11 (2.7%)	26 (1.6%)	63 (2.1%)	19 (10.1%)	6 (1.8%)	22 (4.1%)
Sightseeing	44 (2.4%)	3 (1.2%)	8 (1.9%)	10 (0.6%)	95 (3.2%)	9 (4.7%)	14 (4.1%)	6 (1.1%)
Hiking	37 (2.0%)	2 (0.8%)	3 (0.7%)	2 (0.1%)	80 (2.7%)	0	0	5 (0.9%)
Mountain biking	45 (2.4%)	8 (3.3%)	2 (0.4%)	24 (1.5%)	25 (0.8%)	0	7 (2.1%)	6 (1.1%)
Hot Springs	6 (0.3%)	0	0	0	0	0	49 (14.3%)	58 (10.7%)
Horseback Riding	2 (0.1%)	6 (2.4%)	0	28 (1.7%)	41 (1.4%)	0	2 (0.5%)	0
Gathering Firewood	0	3 (1.2%)	4 (1.0%)	8 (0.4%)	18 (0.6%)	0	0	4 (0.7%)
Hunting	2 (0.1%)	1 (0.4%)	0	2 (0.1%)	7 (0.2%)	6 (3.2%)	1 (0.3%)	2 (0.4%)
Reading	0	1 (0.4%)	1 (0.2%)	4 (0.2%)	4 (0.1%)	1 (0.5%)	0	4 (0.7%)
Other	2 (0.1%)	0	1 (0.2%)	0	198 (6.6%)	12 (6.3%)	16 (4.7%)	0
Total Activities by Segment	1869	245	411	1654	2988	199	341	540
TOTAL ACTIVITIES BY RIVER CORRIDOR	1869	5298				1080		
Total Visitors by Segment	1279	195	327	1117	2180	150	259	417
TOTAL VISITORS BY RIVER CORRIDOR	1279	3819				826		

Note: Some visitors engaged in multiple activities.
* Bob Long's survey ran for a total period of 41 days from May 18, 1991 to September 1, 1991.

Recreation Opportunity Spectrum

The Boise National Forest inventoried lands for recreational opportunities using the recreation opportunity spectrum (ROS) classifications. This inventory provides general information regarding the range or spectrum of recreational opportunities available on the inventoried lands. Five ROS classes are used which indicate outdoor recreation settings, activities and experience opportunities (USDA, 1986). Since the majority of recreational use in the basin occurs on Forest Service lands and much of this use constitutes dispersed recreation, ROS classes provide a good overview of the range of recreation activities possible within the basin.

Most of the river corridors are classified as roaded natural indicating the landscape is natural appearing with areas of substantial modification. Motorized use is possible. Exceptions include portions of the North Fork downstream from Rabbit Creek and between Johnson and Hunter Creeks; Cottonwood Creek; and the upstream portions of the Yuba River, Bear River and Crooked River which are categorized as semi-primitive motorized. This indicates a landscape which is predominately unmodified and natural appearing where motorized use may occur. River corridors within the Sawtooth Wilderness are classified as primitive, representing natural landscapes, where motorized use is prohibited.

Developed Recreation Facilities

Numerous developed recreational facilities are located in the basin providing opportunities to engage in camping, picnicking, fishing, hunting, swimming, boating and winter recreational endeavors. These facilities are summarized in Table 30 and located in Plate 11.

Developed recreation facilities within the basin are mainly associated with the USACE's Lucky Peak Reservoir or Boise National Forest campgrounds and concentrated adjacent to water bodies. Facilities at Lucky Peak attract 62% of all attendance at lakes and reservoirs within a 50 mile radius of Boise (USACE, 1988a). Recreational use at Lucky Peak is predicted to increase 45% in the next 20 years to an estimated 612,318 visitors annually (USACE, 1988a). Increased use is predicted to be the result of an increased population rather than increased activity participation rates per individual (USACE, 1988a). Currently, use has decreased since 1987. This may be related to the drought which has resulted in lower water levels and/or shortened boating season on the reservoir (USACE, 1992). Developed recreational facilities located on the Boise National Forest are primarily campgrounds, but include trailheads, parking areas and a visitor center.

Camping

A study conducted by the Idaho Department of Commerce in 1991 concluded 28.5% of all tourists camped while traveling in Idaho (IDC, 1991). Regionally, recreation participation surveys conducted in 1987 estimated 55.5% of resident and 25.9% of non-resident destination travellers camped. The regions's public campgrounds were cited as one of its most positive assets (Tynon et al., 1988). The Boise National Forest estimates 19% of the total RVDs on the Boise and Idaho City ranger districts engaged in dispersed camping compared to 15% of the RVD total using developed facilities (Table 28).

According to a 1991 recreation study conducted in the basin, 75% of recreationists camped (Long, 1991). Camping activity was concentrated on the North Fork Boise River from Little Owl Creek to Rabbit Creek, and on the mainstem from the confluence of the North and Middle Forks to Arrowrock backwaters. These segments received 78% of camping use occurring in surveyed areas (Long, 1991).

A total of 163 developed public camping sites exist within the upper Boise River basin (Table 31 and Plate 11). The majority of developed and dispersed camping opportunities are available on the Boise National Forest. Developed camping facilities are limited at Lucky Peak, with ten sites at Spring Shores State Park. Primitive camping occurs at Barclay Bay, Charcoal Creek and Deer Flat, the latter two are accessible by boat only (USACE, 1988a and 1992). There are no developed camping facilities at Arrowrock Reservoir, although dispersed use does occur.

Table 30. Developed Recreational Sites Within the Upper Boise River Basin (USDA, 1987; USACE, 1988a; and USACE, 1992).

Recreation Facility	Activities	Estimated Use*
Forest Service		
Arrowrock	boat ramp, water skiing	15,000 (1990)
Atlanta	trailhead, stock loading facilities, recreational cabin	
Bad Bear	camping	
Badger Creek	camping	
Bald Mountain	camping	
Banner Ridge	trailhead, cross country skiing	
Barber Flats	recreational cabin, camping	
Big Roaring	camping	
Black Rock	camping	
Cottonwood	camping, recreational cabin	
Deer Park	recreational cabin	
Dutch Creek	recreational cabin	
Edna Creek	camping	
Gold Fork	trailhead, cross country ski trails	
Graham Bridge	camping	
Granite Creek	trailhead	
Grayback Gulch	camping	
Hayfork	camping	
Idaho City Visitor Center	information	
Johnson Creek	camping	
Little Roaring	camping	
Mores Creek Summit	trailhead	
Ninemeyer	camping	
Power Plant	camping	
Riverside	camping	
Ten Mile	camping	
Troutdale	camping	
Willow Creek (north)	camping	
Willow Creek (south)	camping	
Whoop Um Up	trailhead, cross country ski trails	
LUCKY PEAK FACILITIES		
Army Corp of Engineers		
Barclay Bay	picnicking, boat ramp, swimming, fishing	109,166
Birch Creek	picnicking, boat docks	
Browns Gulch	picnicking, boat docks	
Charcoal Creek	picnicking, swimming, fishing	8,015 (1987)
Chimney Rock	picnicking, swimming, fishing	7,875 (1987)
Dead Dog Creek	picnicking, boat dock	
Deer Flat	picnicking, swimming, fishing	7,975 (1987)
Lucky Peak Overlook	picnicking, fishing	102,571 (1987)
Goose Neck Bay	picnicking, boat docks	
Mack's Creek Landing	boat ramp, picnicking, swimming, fishing	11,203
More's Creek	picnicking, fishing, swimming	14,040 (1987)
Pipeline Gulch	picnicking, boat docks	
Placer Point	picnicking, swimming, fishing	5,760 (1987)
Robie Creek Park	picnicking, boat launch,swimming, fishing	42,310
Sheep Creek	picnicking, boat docks	11,889 (1987)
South Robie Creek	picnicking, boat docks	
Turnaround Point	picnicking, boat docks	
Turner Gulch	picnicking, boat launch, swimming, fishing	
IDPR		
Spring Shores State Park	picnicking, food service, marina, boat launch, swimming, fishing, RV camping	88,863

* Based on 1991 fiscal year attendance tabulation at Lucky Peak, unless noted otherwise.
U.S. Forest Service estimated use in RVDs; Lucky Peak estimated use in RVs.

Table 31. Upper Boise River Basin Developed Public Campgrounds, and Number of Sites (USDA, 1987b; and USACE, 1988a).

	No. of Developed Sites
Boise National Forest	
Bad Bear	8
Badger Creek	5
Bald Mountain	4
Big Roaring River	10
Black Rock	11
Cottonwood	3
Edna Creek	9
Graham Bridge	4
Grayback Gulch	14
Hayfork	6
Johnson Creek	3
Little Roaring River	4
Ninemeyer	8
Power Plant	25
Riverside	7
Ten Mile	14
Troutdale	4
Willow Creek (north)	4
Willow Creek (south)	10
IDPR	
Spring Shores State Park	10
TOTAL	163

Although nineteen developed campgrounds are managed by the Forest within the Upper Boise basin, the Forest Service estimates most camping occurs in dispersed areas (USDA, 1991b). Most developed campgrounds are located adjacent to rivers or streams providing easy access to the water. Dispersed camping is also concentrated in river corridors. Three campgrounds located along the North Fork Boise were closed because of threats to the water quality from the restroom facilities. However, camping near streams and rivers is popular, and despite closure, these and other areas located along the mainstem, North Fork and Middle Fork, and tributaries receive heavy dispersed use. The Forest Service plans to provide developed facilities at some of these dispersed use areas in the future (Herrity, 1992). Estimated use at the developed USFS campgrounds in the basin was 49,800 RVD's (USDA, 1991a).

Swimming and Water Skiing

Recreation participation surveys indicate most swimming occurring within Region 3 is concentrated at pools (Table 28, p. C-29). An estimated 15.4% of residents and 2.4% of non-residents visit beaches. An estimated 1.5% and 1.8% of residents and non-residents respectively swim in reservoirs or rivers (Table 28).

Most of the swimming activity on the Boise River occurs at Sandy Point located below Lucky Peak Dam and outside of the basin. In 1991, 37% of all swimming activity at Lucky Peak occurred at Sandy Point. Barclay Bay, Spring Shores and Robie Creek were also major providers of

swimming opportunities (USACE, 1992). Remaining use occurs at boat and vehicle access sites around the reservoir. Swimming capacity at Lucky Peak's facilities, based on density of swimmers per water surface area, currently exceeds use at both Spring Shores and Robie Creek developed areas. This is largely a function of parking facility limitations (USACE, 1988a).

Swimming activity was observed throughout the Boise River corridors during a recreational survey in 1991. Use was concentrated on the mainstem and North Fork from Little Owl Creek to Rabbit Creek (Table 29). Several hot springs on the mainstem, Middle Fork and Queens River also attracted visitors. Additional swimming opportunities are provided at the Warm Springs Resort's natural warm water pool near Idaho City.

Water-skiing occurs on Lucky Peak and participation levels are projected to nearly double over the next 20 years (USACE, 1988a). Areas of the reservoir receiving concentrated use are the Mores Creek arm, Barclay Bay, Spring Shores State Park and Turnaround Point. This has resulted in congestion and complaints of near misses (Hoedt, 1992). Future zoning may be required to resolve these conflicts (USACE, 1988a).

Picnicking

Developed picnic areas are concentrated in the Lucky Peak area. Additional opportunities are available at Forest Service campgrounds. Dispersed use is possible throughout the upper Boise River basin with use concentrated along river corridors with easier access.

Picnicking was engaged in by 3.2% of visitors observed in Boise River segments in a 1991 survey (Long, 1991). The most popular picnicking spots were on the North Fork from Barber Flat to Rabbit Creek and on the mainstem Boise (Table 29). Facilities at Lucky Peak are most heavily used by virtue of its close proximity to Boise and provision of developed sites. Most picnicking use occurs at Spring Shores, Barclay Bay and Robie Creek (USACE, 1992).

Boating/Floating

A diversity of boating opportunities are available in the study basin including canoeing, kayaking, rafting, power boating and sailing. Recreation on Lucky Peak and Arrowrock reservoirs is limited by water level fluctuations. Water from Arrowrock and Anderson Reservoirs is released into Lucky Peak to maintain recreation levels. Lucky Peak Reservoir receives heavier boating use than Arrowrock because of maintained water levels, accessibility, and the number and variety of facilities including boat launches, ramps and a marina. The boating experience is enhanced by picnicking, fishing and primitive camping facilities accessible only by boat at several sites around the reservoir.

In normal water years, water levels in Lucky Peak are maintained at a level useable for recreation from mid-June through Labor Day weekend. However, in low water years Lucky Peak is drawn down sooner to meet irrigation demands, shortening the recreation season. This situation is evidenced in the recreation estimates for Lucky Peak over the last years which show a decrease in use coinciding with the drought.

In addition to the low-water constraints, boating capacity on the reservoir is limited by a shortage of parking, launching and moorage facilities. Estimated capacity is 463 boats at one time, or 980 boats a day (USACE, 1988a). Current boating use is at 60% of estimated capacity (280 boats at one time) comprised of 60% high power (jet boats, power boats pulling water skiers) and 40% low power boats (sail boats, canoes) (USACE, 1988a). The Lucky Peak Master Plan proposes expanding parking and boating facilities in several key areas to accommodate increased boating access to the reservoir. However, development is not proposed to accommodate the full estimated capacity of the reservoir (USACE, 1988a).

Use is concentrated in areas on the reservoir resulting in boating densities which exceed safety considerations. Low water years result in less available water surface area to accommodate the estimated carrying capacity. The IDPR had eight reported accidents and numerous reports of near misses in 1991 (Beale, 1992). Past experience indicates only 3-5% of accidents are reported. In 1991, 10,887 registered boaters designated Ada and Boise counties as one of their primary use areas. This is a 32% increase from 1989 (Hoedt, 1992).

The mainstem, North and Middle Forks of the Boise, Mores Creek and Grimes Creek provide a variety of whitewater boating experiences for different skill levels and water craft. The Boise River system has been canoed, pole-canoed, kayaked, tubed, and rafted since at least the 1960s, but use has increased in recent years (Lucachick, 1992). No commercial outfitters are licensed by the Idaho State Board of Outfitters and Guides on these stretches (Sangrey, 1991).

The Middle Fork is considered an excellent river for beginning and intermediate canoeists and kayakers (Rosentreter, 1991). This area is often used for instructing boaters through Boise State University's Outdoor Education Program. A roadless stretch of the North Fork canyon, above the confluence with the Middle Fork, provides continuous class IV whitewater for advanced boaters (Amaral, 1990; Moore and McClaran, 1989). The whitewater season on these stretches generally occurs from April through June when spring run-off provides sufficient water for boating.

Whitewater boating opportunities are also available on Mores and Grimes creeks in the early spring during the peak run-off. These are intermediate runs which may require portaging around bridges and fences (Amaral, 1990). Table 32 provides information regarding the more popular runs

in the basin. Plate 11 locates put-ins and take-outs. Boating is also reported to occur above Barber Flats on the North Fork and on the Crooked River (Rosentreter, 1991; Herrity, 1992).

Table 32. Upper Boise Whitewater Segments (Amaral, 1990; Moore and McClaran, 1989; and Rosentreter, 1991).

Segment	Put-in/Take-out	Flow Range (cfs)	Skill Level	Craft
Main Boise	Troutdale/Willow Creek	500-1500 > 1500	Beginner - Class II Intermediate - Class II-III	Kayak, canoe, raft
North Fork Boise	Barber Flat/Black Rock	600-2000	Beginner to Intermediate - Class II-III	Kayak, canoe, raft
North Fork Boise	Black Rock/Troutdale	600-1000 1000-2000	Intermediate - Class III-IV Advanced - Class IV	Kayak, raft
Middle Fork Boise	Ninemeyer/Troutdale		Beginner - Class II+	Kayak, canoe, raft
Mores Creek	Big Gulch/Grimes Creek confluence	600-1300	Intermediate - Class II-III	Kayak, canoe
Mores Creek	Grimes Creek confluence/Robie Creek confluence	600-1300	Intermediate - Class II-III	Kayak, canoe
Grimes Creek	Pine Creek/Mores Creek confluence	400-1000	Intermediate - Class II-III	Kayak, canoe

A recreation survey conducted on the mainstem, North and Middle Forks from May to September, 1991, documented the boating activity occurring on these rivers (Table 33). Boating accounted for 2.7% of all recreation activity on the Boise River system engaged in by 3.8% of visitors (Table 29, p. C-30). Use was concentrated on the mainstem and North Fork from Barber Flat to Rabbit Creek. Additional boating use occurred on the Middle Fork from Alexander Flats to the confluence, and on the North Fork from Little Owl Creek to Barber Flat (Table 29). Rafting comprised 35% of total boating use, tubing 42%, kayaking 13%, and canoeing 10% (Table 33).

Table 33. Boating Activity Observed on the Boise River System (Long, 1991).

	Rafts	Float Tubes	Kayak	Canoe	Total
North Fork Deer Park to Rabbit Creek	19	53	22	13	98
Main & Middle Fork Jackalyn Cr. to Arrowrock backwaters	51	34	6	7	107
TOTALS	70	87	28	20	205

Differences in boating craft were observed on the Middle and North Forks. Rafting and tubing were sighted more frequently on the mainstem and Middle Fork. About half of all boating craft observed were rafts. By comparison, tubing comprised half of all boating observed on the North Fork with all the tubing occurring along the roaded reach. The remaining half was equally distributed between rafts, canoes and kayaks (Table 33).

Wildlife Observation

The upper Boise River basin has numerous opportunities for wildlife observation. Extensive areas of mule deer and elk winter and summer range occur in the basin and along river corridors. Bald eagles forage along the Middle Fork Boise in the winter. An area noted in the *Idaho Wildlife Viewing Guide* is the Boise River WMA which includes the area surrounding Lucky Peak Reservoir (Carpenter, 1990). The area provides winter range for more than 6000 mule deer and opportunities to observe bald and golden eagles. The optimum period to make wildlife observations is from December through March.

Additional wildlife opportunities are afforded by sportsman's access areas managed by the IDFG. Acquired to provide access for hunters and fishermen, they also provide wildlife observation opportunities.

Fishing

Fishing license sales have been relatively stable over the years increasing by 4% from 1977 to 1987. For this same period a 14% increase in angler use has occurred (Reid, 1989). In 1990, 20% of fishing licenses were purchased in Ada, Boise, Canyon and Elmore counties (IDFG, 1991). The majority of people recreating in the basin reside in these counties (USACE, 1988a; Long, 1991). Although all purchasers may not reside or fish in the vicinity of license purchase, there likely is some relationship.

Two of the ten most frequently fished waters cited by anglers in a 1987 angler survey were located in the basin -- the Boise River and Lucky Peak Reservoir (Reid, 1989). A total of 77.4% of Idaho anglers preferred cold-water fishing for trout on rivers and streams (Reid, 1989). The Upper Boise Basin provides ample opportunity to engage in this preferred fishing activity.

Management by IDFG varies on the mainstem, North and Middle Forks Boise River. Sport fish species occurring widely throughout the Boise drainage are rainbow and bull trout, and whitefish. Cutthroat and brook trout are found on the Middle Fork (IDFG, 1990a). The mainstem, Middle Fork from the Sawtooth Wilderness boundary to Kirby Dam, and North Fork from Deer Park to Rabbit

Creek are managed as put-and-take rainbow trout fisheries (IDFG, 1990a). Management emphasis is on wild rainbow trout for the North Fork from Rabbit Creek to the confluence and above Deer Park, and for the Middle Fork within the Sawtooth Wilderness. The Middle Fork from Kirby Dam to the confluence is managed as a quality wild trout fishery for bull and rainbow trout. This management involves size and catch number restrictions to increase catch rates for larger fish (IDFG, 1990a). Arrowrock and Lucky Peak are managed as mixed fisheries with smallmouth bass, yellow perch, bull trout, whitefish and rainbow trout. The IDFG is also attempting to establish a kokanee fishery in Lucky Peak (IDFG, 1990a).

Table 34 summarizes creel surveys conducted on reservoirs, rivers and streams located in the upper Boise River basin since 1986. The data mainly represent angler hours and catch rates for a specific day derived from spot creel checks. Underlined data for 1988 and 1989 estimate angler hours for the time period indicated. It is difficult to make comparisons between river segments as survey periods do not coincide.

A 1991 recreation survey provides the best information for comparing fishing activity between river segments (Long, 1991). This survey found that fishing was the most popular recreational activity in the river corridors. Fishing comprised 24% of all observed recreational activities and was engaged in by at least one-third of visitors to the basin (Long, 1991). Fishing occurred throughout the basin, but was concentrated most heavily on the North Fork downstream from Barber Flat to Rabbit Creek. According to the Forest Service, fishing has increased on the North Fork since implementation of fishing restrictions by the IDFG on the Middle Fork in 1990 (Herrity, 1992). This increase may also be partly attributable to the Kirby Dam failure in May 1991. Substantial use also occurred upstream of Barber Flats to the confluence of Little Owl Creek and on the mainstem Boise (Long, 1991) (Table 29, p. C-30).

Hunting

The Upper Boise planning area encompasses all of IDFG management unit 39. The area supports predominately deer and elk hunting, but is also open for black bear, mountain lion, upland game and birds. In 1990, Unit 39 ranked first in the state for numbers of hunters, fourth for hunter days and second for harvest numbers for deer hunting. Elk hunting ranked first in hunter numbers, third in hunter days, and second for harvest (Nelson, 1986-1990). Popularity is attributed to proximity to Boise, excellent deer and elk populations, good success rates, and ease of access, combined with an opportunity to hunt in remote areas (Nelson, 1992).

Table 35 summarizes the estimated hunter days for deer, elk, black bear, mountain lion, upland birds, and upland game hunting from 1986 to 1990. Deer hunting has increased by 1% and

elk by 42% during the 5-year period. Black bear and mountain lion hunting has increased substantially, by 99.6% and 319% respectively, but overall hunter days remain low.

Table 34. Estimated Angler Hours and Catch Rates (fish/hour) in the Upper Boise River Basin* (Reid and Mabbott, 1987; Mabbott and Holubetz, 1989, 1990a, and 1990b; Rohrer, 1989 and 1990).

	1986 Angler Hours	Catch Rate	1987 Angler Hours	Catch Rate	1988 Angler Hours	Catch Rate	1989 Angler Hours	Catch Rate
Boise River								
Confluence - Willow Creek	-	-	-	-	5450[1]	0.70[1]	5749[2]	0.95[2]
North Fork Boise	28	1.24	228	0.77	209	0.82	183	0.57
Deer Park - Crooked River	-	-	-	-	-	-	1143[3]	1.31[3]
Crooked River - Rabbit Creek	-	-	-	-	-	-	2013[4]	1.38[4]
Middle Fork Boise	764	0.63	658	0.52	482	0.82	315	0.59
Alexander Creek - Confluence	-	-	-	-	3299[1]	1.48[1]	1863[2]	0.73[2]
Mores Creek	90	0.51	137	0.50	61	0.85	94.5	0.69
Grimes Creek	103	0.76	129	0.81	108	0.47	14	0.29
Crooked River	-	-	80	0.39	47	0.74	16	0.5
Roaring River					24	0.83	-	-
Queens River	-	-	17	0.41	13	1.15	20	0.95
Rabbit Creek	33	0.67	29	1.07	-	-	-	-
Arrowrock Reservoir	772	0.39	1019	0.62	121	0.68	1720	1.47
Lucky Peak Reservoir	1964	0.42	10,618	0.78	2050	0.82	5029.5	0.64

* All data represent spot creel checks except for underlined data which represent season statistics for the period noted.
[1]May 28 - Oct. 28, 1988 [2]May 27 - Sept. 29, 1989 [3]Sept. 26 - Oct. 13, 1989 [4]Aug. 26 - Oct. 13, 1989

Table 35. **Hunter Days for Mule Deer, Elk, Black Bear, Mountain Lion, Upland Game and Upland Birds (Nelson, 1986-90; IDFG, 1986-1990).**

	1986	1987	1988	1989	1990
Deer Unit 39	44,828	50,060	47,386	41,772	45,032
Elk Unit 39	13,935	16,918	17,697	18,679	24,134
Black Bear Unit 39	2396	1796	3944	3731	4784
Mountain Lion Unit 39	48	436	206	265	201
**Upland Game*		5539	3447	5229	8,772
**Upland Birds*			39,460		40,601

* Hunter days for Ada, Boise, and Elmore counties.

Trails

The upper Boise River basin contains an extensive trail network providing opportunities for motorized and non-motorized use (Plate 11). The large number of trails in the basin makes it difficult to map them. Consequently, effort was focused on designated trails identified in the Boise National Forest Travel Plan and trail inventory; priority trails identified by organizations representing trail bike, equestrian and mountain bike users; and trails cited in hiking guides. IDPR provided additional information with respect to winter trail use, i.e., snowmobile and cross country ski trails. A detailed table listing the Forest Service or other identification number, motorized or non-motorized use, and special designations is located in the Department's files.

The Boise National Forest as a whole manages 969 miles of trails (USDA, 1990a). Through this planning process, 358 miles of trails were inventoried with 115 miles of these being non-motorized. Motorized use includes trail bikes, all terrain vehicles and snowmobiles. Non-motorized use is limited to trails in the Sawtooth Wilderness, and trails parallelling Cottonwood Creek, North Fork Rabbit Creek, Bear Creek, Bear River, and Johnson Creek. The William Pogue trail, parallelling Sheep Creek, is a designated national recreation trail providing for motorized and non-motorized use.

Access to the lesser used western portion of the Sawtooth Wilderness occurs from trails located in the eastern portion of the basin. Developed trailhead facilities accessible by vehicle are located on the Middle Fork east of Atlanta and the Queens River.

Substantial snowmobile use occurs in the Idaho City area which provides designated parking areas for trailers and groomed trails. A number of marked and groomed cross country ski trails are also found in the upper Boise River basin (see Winter Recreation section below).

Although the basin provides extensive trails for all users, many of these are poorly signed or require maintenance. All user groups interviewed during the trail inventory cited this as a major concern. Additionally, terrain constraints often restrict trail location to river and stream canyons, resulting in potential water resource impacts.

Winter Recreation

The upper Boise River basin receives winter recreation use particularly in the vicinity of Idaho City. Snowmobilers use a number of Forest Service roads in the area and along the North Fork, Granite, Rabbit, Swanholm, Phifer, Willow, Little Owl, and Bannock creeks (Wells, 1991). Several popular snowmobile areas are Granite Creek Snow Park, Pilot Peak, Summit Flats and Rabbit Creek. A notable trail is the Highway to Heaven, a 150 mile snowmobile trail from Boise to Stanley via Idaho City and Lowman.

Cross country skiing is also popular. Almost thirty five miles of marked trails affiliated with the IDPR Park N' Ski program are provided fifteen to twenty miles above Idaho City adjacent to State Highway 21. These include Whoop Um Up, a national recreation trail; Banner Ridge; and Gold Fork with parking areas, restrooms and groomed trails. Skiing also occurs in the Idaho City area and at Mores Creek Summit.

Additional winter recreation activities include snowplay, sledding and ice skating in the vicinity of Idaho City and to the north.

Recreational Dredge Mining

Recreational dredging is restricted to intake nozzle diameters of five inches or less, and to a season extending from July 1 to October 31. The North Fork and its tributaries from the confluence with the Middle Fork to Bay Horse Creek is a one-stop permit area, which means that applications do not have to specify their location. The Middle Fork Boise River from Roaring River to the Sawtooth Wilderness boundary is also a one-stop permit segment [6-8 permits issued for the reach in 1990 (Ballou, 1991)]. The Middle Fork and main Boise River from Lucky Peak to Roaring River is closed all year to mining. However, the Idaho Gold Prospectors have requested opening this segment to recreational mining. In 1989, there were two applications to mine outside the one-stop areas in the basin (Ballou, 1991).

Sightseeing

Sightseeing and pleasure driving were cited as one of the more popular recreation activities in the region (IDPR, 1989) (Table 29, p. C-30). Access in the study basin is amenable to pleasure driving in the river corridors as numerous improved and unimproved roads are adjacent to the Middle and North Forks, Grimes Creek, Mores Creek, and other tributaries.

Sightseeing opportunities include travel on State Highway 21, designated the Ponderosa State Scenic Route and eligible as a national scenic byway (ITD, 1977; USDT, 1988). The route parallels Mores Creek for most of its length, accessing Forest Service recreation sites, trailheads and winter play areas. Travellers pass through Idaho City, an historic mining town with museums, lodging, food and other tourist services.

In the northwestern corner of the basin are additional historic mining towns including the townsites of Placerville, Quartzburg, Centerville and Pioneerville. Atlanta, another historic townsite, is located at the edge of the Sawtooth Wilderness on the Middle Fork. Some recreational visitation occurs to these mining areas. Opportunities exist to enhance recreational experiences through provision of interpretative facilities. The Boise District BLM proposes future development of historic interpretation, cross country ski trails and snowmobile trails in the Pioneerville, Placerville, and Quartzburg areas (USDI, 1989). The Forest Service also plans to provide historic interpretation of sites on its lands (USDA, 1990a).

Additional Recreation Opportunities

Several special management designations are found in the basin which have recreational implications. These include the southern portion of the Boise Front situated on the northern edge of Lucky Peak Reservoir designated by the BLM as an area of critical environmental concern (ACEC) and special recreation management area (SRMA) (USDI, 1987; Plate 11). The Boise Front is the site of substantial dispersed recreation use including off road vehicle use, hiking, mountain biking, hunting, horseback riding and nature study. The area is designated an ACEC because of potential impacts to fragile soils and watersheds from heavy recreational demands (USDI, 1989). The area has mixed ownership resulting in access conflicts (Farrow, 1991). Trail use is significant, but lack of signs and maintenance result in erosion impacts.

The basin contains the western edge of the Sawtooth Wilderness. In addition, the Forest Service has recommended the Ten Mile area, 78,785 acres along the North Fork and adjacent to the Sawtooth Wilderness, for wilderness designation (USDA, 1990a). Non-motorized trails and other

forms of non-motorized recreation are available in these areas. Numerous alpine lakes are found in the Sawtooth Wilderness.

Very few private cabins or homes are found along the Middle and North Forks, with the exception of Atlanta, because very little patented land exists. A few private cabins or homes are located at Twin Springs, Alexander Flats, Deer Park and Dutch Creek. Tributaries, such as Mores, Robie, Daggett, and Grimes creeks, are parallelled by large areas of private land and homes. In addition, rental cabins are available at Idaho City, Atlanta and Twin Springs. Several Forest Service guard stations and lookouts are available to the public on a rental basis (USDA, 1991a).

Agriculture: Irrigation/Livestock Watering

The occurrence of irrigation and livestock watering in the upper Boise River basin from either ground or surface water is limited. Most of the surface water from the watershed goes into the two storage reservoirs within the lower end of the basin, Lucky Peak and Arrowrock. Arrowrock was constructed specifically to provide storage for the irrigation of the Boise Valley, while Lucky Peak's primary role was for flood control. Secondarily, Lucky Peak has stored water for irrigation and recreation purposes. In all, about 327,000 acres of land are irrigated in the Boise Valley by Boise River water, with an additional 82,500 acres irrigated by water transported from the lower Payette River.

Implementation of this plan will have no effect on existing water rights for irrigation and other beneficial uses.

Current Agriculture Water Use Within the Basin

The Stewart Decree of 1906 and the Bryan Decree of 1929 have governed how most Boise River water is managed. Court decrees typically finalize the water right process. Early decrees commonly address natural flow rights rather than storage rights. In the Boise basin, all irrigation storage rights and permits are held by the BOR, who then contracts with the various irrigation districts and canal companies for the use of the stored water. The Snake River Basin Adjudication is the current effort to update the water right records for the basin.

Currently, above Lucky Peak dam, the IDWR Water Allocation Bureau indicates that there have been 172 water rights issued for irrigation or irrigation storage and 85 for stock watering, accounting for a total of 304,915 AF/annum. Of this total 303,601 AF are allocated for irrigation storage in the two reservoirs. The total Boise River reservoir system irrigates about 327,000 acres in the Boise Valley between Lucky Peak Dam and the mouth of the Boise River. There are several

isolated irrigated pastures in the Mores Creek drainage but they account for a very small percentage of the total lands irrigated in the Boise River basin.

Future Irrigation Development Within the Basin

Within the upper Boise River basin, no Class 1, 2, or 3 potentially irrigable lands have been identified (Pacific NW River Basin Comm., 1971; IWRB, 1970). Land ownership is an additional barrier to future irrigation development since the vast majority of the land is managed either by the Forest Service or the State of Idaho.

The upper Boise River basin has limited irrigation potential, but the lower Boise River basin (below Lucky Peak) still has potentially arable lands that could be irrigated by Boise River water. However, several studies have suggested a trend toward declining irrigated acreage in the lower basin over the last thirty years (Table 36). IWRB data indicated the irrigated acreage in Ada and Canyon counties exceeded 425,000 acres (in 1967) (IWRB, 1968). By 1989, IDWR studies showed that the irrigated acreage in the two counties was over 289,000 (IDWR, 1991). Because of high urban growth explosion in the basin, farm land has been converted into subdivisions. Since a peak during the 1950's into the 1960's, the total water diverted from the Boise River for agricultural use has steadily declined.

Livestock Watering

Within the basin there are currently 23 active cattle and sheep grazing allotments on Forest Service property and two in BLM Cascade Resource Area (Ririe, 1991; Boltz, 1991) (Plate 4). Of those 23 USFS allotments, four are on the periphery of the basin and extend into adjacent basins (Grouse Cr., Rock Cr., Rattlesnake Cr., and Jerusalem Assn. allotments); the remainder are contained within the basin. The total allotment acreage, animal-unit-months (AUM), and grazing density (AUMs/acre) are provided in Table 37. AUM is the amount of forage it takes to feed one adult cow plus unweaned calf for one month; five sheep units equal one cow unit. The grazing density in the basin ranges widely because it is dependent on several factors including, soil, vegetation cover, and slope, all of which vary considerably. An additional 200 AUMs need to be included to the basin total to account for animals trailed through inactive allotments (Ririe, 1992).

Allotments that exist on the main streams may impact the riparian communities and water quality (Plate 4). Because of the sheep grazing threat to the water quality of Elk Creek, Idaho City's municipal water source, Boise National Forest temporarily removed the sheep (827 AUMs) from the Elk Creek allotment after the 1988 season pending a NEPA Environmental Assessment (Swearinger,

1991). Other areas that BNF is concerned about the potential grazing impact on water quality are around Thorn Creek Butte and upper Roaring River (Ririe, 1992).

Table 36. Total Irrigated Acreages for the Lower Boise River Basin (Morse, 1991; IWRB, 1968; Boltz, 1991).

Year	Ada County		Canyon County	
	Dept. Commerce	IDWR/IWRB	Dept. Commerce	IDWR/IWRB
1967		109,440		315,790
1969	84,428		217,240	
1970		109,500		315,800
1974	80,297		219,653	
1978	97,801		235,589	
1982	91,736		229,066	
1987	85,928	104,200	213,013	248,000
1988		67,612		214,209
1989		85,343		203,790

Table 37. Active Cattle and Sheep Allotments in Upper Boise River Basin.

Active Allotments	Total Suitable Acres[1]	Partial Suitable Acres (% within basin)	Total AUMs	Partial AUMs (in basin)	Grazing Density (AUMs/S. acre)
Boise N.F.					
Bald Mt.	4881		540		11.1
Black A	7627		2086		27.4
Circle Bar	9321		1490		16.0
Cold Springs	4620		90		1.9
Dead Horse	3727		248		6.7
Deer Cr.	3562		600		5.9
Granite Cr. *	4773	3723 (78%)	165	129	3.5
Grimes Cr.	7454		786		10.5
Grouse Cr.*	13,262	6498 (49%)	1783	874	13.5
Jerusalem *	24,485	2448 (10%)	3484	35	1.4
Lazy H *	30,819	27,737 (90%)	76	68	0.2
Little Beaver *	10,036	7025 (70%)	600	420	6.0
Lostman	12,453		1380		11.1
Mores Cr.	2639		824		31.2
Ophir Cr.	9388		1100		8.5
Porter Cr. *	1579	173 (11%)	198	22	12.7
Rattlesnake Cr.*	8000	2720 (34%)	1639	557	20.5
Rock Cr.*	12,758	5358 (42%)	540	227	4.2
Smith Cr.	6708		784		11.7
Summit Flats *	4969	4770 (96%)	932	895	18.8
Sunset	9865		540		5.5
Two Bar	15,736		1393		8.8
Yuba R.	4000		1200		30.0
BLM					
Quartzburg	2179		200		10.9
Pioneerville	5		5		1.0

*Partial acreages are given only for those allotments that are not totally within the basin.
[1]Suitable acres are those acres within an allotment that are suitable for grazing.

Domestic, Commercial, Municipal and Industrial Uses

Mores Creek Drainage

Within the Mores Creek watershed, several small communities utilize both ground and surface water. Idaho City, from 1980 to 1986 grew by 70 people. In addition, several new subdivisions have been developed along Mores Creek (DuQuette Pines, Wilderness Ranch, and Mores Creek Rim Ranches) that have groundwater rights. Most domestic wells pump small volumes from fractures or decomposed granites. A few wells produce from shallow alluvial systems that overlay the granites in small mountain valleys (Neely, 1992).

The Idaho City water supply comes from gravity flow, collecting the water from sandy alluvium beneath Elk Creek (Reed, 1992). The water is run through a treatment facility in Idaho City at an average rate of 175,000 gal./day (100,000 to 300,000 gal./day). Idaho City has a water right to divert up to 5.9 cfs (Reed, M., 1992). The water is treated with ozone gas to prevent the occurrence of giardiasis.

Boise North and Middle Forks Drainage

Atlanta is the only community along the Middle Fork that utilizes basin water for municipal use. The community of 30-50 permanent residents, maintains a gravity collection system on the East Fork Montezuma Creek. The community has a domestic water right to divert 0.11 cfs and 60 AF/annum. There are only four well driller's logs available for the Middle Fork from Arrowrock Reservoir to Atlanta (Neeley, 1992). Two of these wells produce domestic water from fractured granite and two from alluvium.

Geothermal Resources

Numerous geothermal springs exist in the basin with temperatures ranging from 41°C to 76°C. Some have been developed for commercial and recreational uses. An example is a fish farm at Twin Springs, on the Middle Fork, that used hot spring water to raise Tilapia (type of sunfish). The farm operated for several years but is no longer active (Parrish, 1991).

Summary of Water Rights Within the Basin

In early 1992, the total quantity of water appropriated within the upper Boise River basin both ground and surface water was 16,023 cfs and an annual volume of 303,008 AF per year (Table 38).

These numbers include the storage in Lucky Peak Reservoir and reflect the totals found in the water rights files of IDWR. Water right applications for an additional 5,479 cfs and 1,200 AF/annum have been submitted to the Department for approval.

Uses by stream reach are shown in Table 38. Water rights in the basin are summarized above 10 cfs flow rate or 25 AF volume. Appropriated water includes licenses, decrees, claims and permits, but does not include applications. Irrigation and storage irrigation, mining and power are the largest uses by flow and volume. Most of the irrigation water is appropriated for storage in Lucky Peak and Arrowrock reservoirs and subsequent use in the Boise Valley below the planning area. The communities of Idaho City, Atlanta, and Placerville have appropriated surface water for municipal and domestic use. Only a small percentage of the appropriated water is from groundwater and springs.

Table 38. Water Rights by Use (decrees, licenses, permits, and claims--not including applications) and by Stream Reach for the Upper Boise River Basin.*

Water Use	Number of Rights	Flow Rate (CFS)	Volume (AF/annum)
Irrigation	168	144.065	1289.70
Irrigation Storage	4	15000.000	303601.80
Stockwater	84	2.720	23.80
Stockwater Storage	1	0.000	0.10
Industrial	7	45.500	0.00
Commercial	2	0.180	5.40
Mining	83	595.750	903.64
Fish Propogation	1	2.000	0.00
Heating	3	0.420	173.70
Cooling	1	2.000	0.00
Power	4	271.520	1100.40
Municipal	1	4.000	0.00
Domestic	198	12.162	502.64
Recreation	5	1.780	0.00
Fire Protection	13	3.180	5.60
Fire Protection Storage	3	0.040	11.24
TOTAL	578	16085.317	307618.02
Reach Name			
Birch Creek	1	10.000	0.00
Boise River	3	15001.000	303600.00
Boise River, Middle Fork	10	474.520	72.40
Browns Creek	4	16.560	0.00
Canyon Creek	2	20.600	0.00
Charcoal Creek	2	12.000	0.00
Clear Creek	9	23.820	1.20
Elk Creek	20	86.880	8.20
Granite Creek	11	9.200	336.40
Grimes Creek	9	47.510	0.00
Hot Creek	1	25.000	0.00
Macks Creek	8	3.820	1109.20
Mores Creek	20	43.760	545.60
Phifer Creek	1	25.000	0.00
Robie Creek	12	6.700	0.24
Sawmill Creek	4	28.020	0.73
Thorn Creek	5	16.630	10.40
West Fork Creek	2	37.000	0.00
Other Tributaries	151	163.979	1183.40
Springs	213	24.475	347.48
Groundwater	90	8.843	402.77
TOTAL	578	16085.317	307618.02

*The water rights that are included are only those that were for a minimum of 10 cfs or 25 AF. If a water right was for more than one use, only the dominant use is listed.

Minerals and Mining[1]

The upper Boise River basin contains 20 mining districts. Most important are the placer and lode gold mines in the Mores Creek, Idaho City, Pioneerville, Grimes Pass, Banner, Summit Flat, Gambrinus, Quartzburg, and Centerville districts and gold/silver mines in the Yuba district (Plate 5). Much of the area has a high mineral potential, especially for precious metals and molybdenum.

History of Mining in the Basin

The Mores Creek and Middle and North Forks of the Boise River basins include some of the most mineralized land in the state of Idaho (Gillerman, 1991). According to Smith (1983) gold was discovered on Grimes Creek in the Boise Basin on August 2, 1862. Hundreds of mines have operated at various times in the basin and at one point, Idaho City was Idaho's most populous city. Gold mining continued in the basin (particularly at Atlanta) into the 1950's. Initially, gold was recovered from placer deposits (free gold in stream gravels that eroded from the source veins) and later lode mines were developed (usually underground mines in the original vein deposits). Mines in the Boise basin collectively produced about 3 million ounces of gold, making it historically the largest gold-producing area in the state.

The majority of mineral production from the basin has been precious metals. Gold has been the primary metal of interest, but silver, lead, zinc, and occasionally copper are often mixed in the gold-bearing ore. Other minerals mined or known to exist in quantity in the district include antimony (Swanholm Creek), molybdenum (upper Grimes Creek), and bismuth (upper Grimes Creek). Non-economic mineral occurrences include: beryllium, niobium, arsenic, zirconium, thorium, uranium, rare earths, garnet (industrial grade), and iron. The lack of development of mining properties containing some of these minerals like molybdenum or antimony, is often dictated by a ready supply of these materials from other sources. However, these occurrences may become marketable with changes in world supply and demand.

Recent Mining Activity in the Basins

There are thousands of mining claims throughout the North and Middle Fork basins. Although the majority of the mines on Plate 5 are no longer in production, the mineral wealth of the Boise basin and other mining districts is clearly indicated by the large number of mines and prospects (Mitchell et al., 1991).

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[1] We would like to thank Earl Bennett of the Idaho Geological Survey for writing the majority of this section.

Many of the mines ceased production due to fluctuations in the metal markets rather than a lack of minable resources. Another reason was federal government action. All gold mines in the United States were closed in 1942 under War Production Board Act L-208 and many never reopened after the war. The recent introduction of low-cost heap-leach and open-pit mine technology has made some of the old mine sites attractive exploration targets. Idaho experienced a modern gold rush in the 1980's, comparable to the boom of the 1930's (brought on by the depression). By 1990, 10,300 mining claims had been registered on federal land in the Boise National Forest (USDA, 1990a).

Currently, there are two mining districts in the Basin that are getting considerable attention from exploration companies. In December 1990, Atlanta Gold signed an agreement with Newmont Exploration to explore its 3,100 acre property in the Yuba district (Bennett and Gillerman, 1991). Atlanta Gold estimates near-surface minable reserves at 974,000 ounces of gold and 558,000 ounces of silver (compared to the estimated 400,000 ounces of gold mined from the district between 1865 and 1952; (Kiilsgaard, 1989). Several companies, including Freeport, Goldpost Resources, Westmin Resources Cominco, and Pegasus Gold, have been exploring between Grimes Creek and Quartzburg and around Elk Creek (Bennett et al., 1990; Gillerman, 1992).

Additional metals of interest in the basin include molybdenum, beryllium, and uranium. The Cumo molybdenum prospect located above Grimes Creek was extensively explored by AMAX in the early 1980's. This is a significant deposit that was not developed because of the current oversupply of molybdenum in North America. The Sheep Creek pluton (formerly called the Twin Springs pluton) also contains molybdenum mineralization (prospects in the Roaring River district) and is anomalous in beryllium and uranium (Bennett and Knowles, 1983; Bennett, 1980). Almost the entire Sheep Creek pluton was staked by Inspiration Resources in 1981 based on geochemical anomalies. However, the current oversupply of molybdenum will preclude serious exploration in this area for some time.

Mines in the Neal district, located south of Lucky Peak Reservoir, have produced about 30,000 ounces of gold (Plate 5). Recently, Centennial Mining Company completed a 200-drill hole exploration program in this area. A gold resource of about 27,000 ounces was identified but this is not large enough to warrant mining at current gold prices.

Geochemical anomalies were reported by the U.S. Geological Survey near the Cottonwood Ranger Station, Dutch Creek Ranger Station, and Sheep Creek (Smith, 1989). These anomalies are in areas with no known mines and prospects, and may contain deposits of low grade precious metals and rare earth minerals.

Current Laws That Regulate Mining

As two thirds of Idaho is federal land, mining has been historically controlled by federal laws and regulations. These laws are enforced by the USFS and the BLM. The General Mining Law of 1872 gives U.S. citizens the right to enter public lands, locate (stake) claims, and remove valuable minerals. The law also allows for patenting claims (i.e., buying the land) from the federal government if a minable mineral deposit exists on the claim(s). Currently, a number of changes in the 1872 law are being considered by Congress. The Organic Act of 1897 specifies that mining laws and regulations apply to all federal lands. The 1955 Surface Resource Act attempts to minimize adverse environmental impacts to surface resources from mining.

Several state laws apply to all mines in Idaho, including those on federal lands. The Idaho Dredge and Placer Mining Protection Act of 1955 requires reclamation of disturbed areas and adherence to water quality standards for placer mines. The Idaho Surface Mining Act of 1971 provides measures to reclaim the lands disturbed by surface mining operations. The IDL administers these two laws under direction from the State Land Board. IDL has signed an MOU with the USFS that coordinates state/federal requirements for mine operating plans and bonding on federal lands. The DEQ administers water quality laws on state and federal lands (USDA, 1990a). All minerals on state lands are leasable in contrast to locatable minerals on federal lands.

Mineral Potential

Non-metallic commodities that may be of economic interest in the basins include sand and gravel deposits. There is no potential for oil and gas in the basin.

There are a number of sand and gravel pits in the Boise basin, mostly in the lower basin, which are a source of local construction materials. There is no market for transporting this high-bulk, low-value commodity over long distances. State, County, and private sand and gravel operations are located on Mores Creek, below Idaho City and along Grimes Creek. None of these operate in active stream channels but crush old dredge and placer piles to make aggregate (Murray, 1991).

Given the right economic climate, most of the Middle and North Fork basins of the Boise River have significant mineral potential. As noted, the basins have recently been the site of a number of exploration projects. A study by the USGS to determine the mineral potential of the Hailey 2° quadrangle, which includes the North and Middle Forks of the Boise River, classified most of the area basins having a high mineral potential.

There are areas with mineral resource potential in the Basin (Table 39) that have recently been considered for inclusion in the federal wilderness system (Plate 5). The mineral potential of these areas has been studied by the Bureau of Mines as required by the 1964 Wilderness Act and RARE II program. The U.S. Geological Survey has also looked at the Ten Mile and Black Warrior areas (Johnson and Worl, 1991). The report notes that both areas have the potential for several types of ore deposits.

Any state designation, such as a natural or recreational waterway, would not preclude mining activity and exploration unless it directly impacted the stream channel, such as a sand and gravel operation or an access road. Currently, there is a moratorium on granting any further water rights above Lucky Peak Dam.

Placer and Dredge Mining

Today, placer mines typically are not located in the active stream itself, but on the shore, in older river gravel deposits. Historically, placer gold has been mined in the Boise basin and on the Middle Fork of the Boise River downstream from Atlanta and at Twin Springs. One of the larger placer gold operations is the ABC mining operation on Buckskin Creek near Idaho City, though there are several other producing placers in the basin. An active placer mine is currently operating on bench gravels at Twin Springs (Fink, 1992).

In the 1980's, recreational dredging or using suction dredges to mine small amounts of placer gold became a popular pastime. The use of these small dredges (5 in. or less diameter nozzle), which requires a one-stop permit from the Department of Water Resources, is allowed on many waterways in Idaho, unless specifically closed. No site-specific records of recreational dredging activity are kept. Various state and federal officials who happen to be in remote areas check for possible permit violations.

A number of stream segments in the Boise River system are closed to dredge mining, or have seasonal limitations (Table 40). The Boise River from Lucky Peak Dam to the confluence of Roaring River, the North Fork Boise River, the Queens River, and Grimes Creek are closed the entire year.

Table 39. Mineral Resource Investigation Studies Conducted in the Upper Boise River Basin, Their Minerals, and Potential Yield Summaries (Plate 5).

Mineral Study and Reference	Minerals With Potential	Summary of Mineral Potential
Atlanta Gold (Atlanta Gold Corporation 1990 Annual Report)	gold, silver	*Annual report: 1,024,000 oz. gold; 2,516,000 ozs. silver estimated to be profitable at $400/oz. for gold
Black Warrior Basin (Gabby, 1992. Bureau of Mines Report MLA 3-92)	gold, silver, copper, lead, and zinc	*No identified resources *Seven properties show strong evidence of disseminated gold with silver, copper, lead, zinc byproducts *Confluence of Queens-Little Queens rivers may have significant gold-bearing gravels
Trinities Basin (Benjamin and Federspeil, 1991. Bureau of Mines Report MLA 10-91)	gold, silver, bismuth, molybdenum, and beryllium	*5 localities and 28 individual sites may warrant additional exploration *28 sites contain anomalous concentrations of one or more of gold, silver, bismuth, molybdenum, and beryllium
Ten Mile West RARE II Area (Benham and Avery, 1983. Bureau of Mines Report MLA 63-83)	gold, silver, lead, and zinc	*Potential for placer and lode gold in basin (assays indicated that 4 groups of lode workings and 4 gravel sites showed potential for gold, silver, lead and zinc) *low lode potential at one group for silver-zinc and moderate gold-silver resources at the other three *Samples of gravel indicated that no site could be mined at profit but lower alluvial deposits may yield better gold, particularly near Johnson Cr. C.G.

Timber Resources

Forests cover approximately 90% of the upper Boise River basin; the remaining 10% is a mixture of sagebrush, grasslands, and open water. The dominant timber species of the forest are Ponderosa pine and Douglas fir, with Lodgepole pine Subalpine fir, and Whitebark pine being of lesser abundance. The vast majority of the forested land in the basin is administered by the Boise National Forest (BNF). Approximately 85% of the BNF is forested and of that about 65% is suited for timber management (USDA, 1990a). Other agencies that manage commercial timber stands in the basin are the Bureau of Land Management (BLM) and Idaho Department of Lands (IDL). Some additional harvesting is done on private lands in the basin.

Table 40. Recreational Dredge Mining Status in the Upper Boise River Basin (IDWR, 1991).

Boise River Basin Reach	Open	Closed
-Boise River Star Bridge to Arrowrock Dam		Entire Year
-North Fork Boise River and tributaries		Entire Year
-Boise River and Middle Fork Boise River from Arrowrock Dam to Roaring River		Entire Year
-Middle Fork Boise River from the confluence with Roaring River to Sawtooth Wilderness Area boundary below Leggitt Creek	July 1-Oct. 31	
-Middle Fork Boise River and all tributaries from Sawtooth Wilderness Area boundary upstream		Entire Year
-Queens River and all tributaries		Entire Year
-Middle Fork Boise River tributaries (mouth to Sawtooth Wilderness Area boundary below Leggitt Creek)	July 1-Oct. 31	
-Mores Creek From Lucky Peak Reservoir to Idaho City & tributaries	July 1-Sep. 30	
EXCEPT Grimes Creek & tributaries	Entire Year	
EXCEPT Elk Creek drainage upstream from Eldorado Gulch	Entire Year	
EXCEPT Elk Creek and tributaries downstream from Eldorado Gulch		Entire Year
-Mores Creek & tributaries above Idaho City	Entire Year	

Timber Harvests

During fiscal year 1989, the BNF offered 86.5 million board feet (MMBF) for sale and sold a total of 85.4 MMBF valued at $2,650,000 (USDA, 1990a). Over the past decade, an average of 74.5 MMBF has been sold annually on the BNF. A forest-wide harvest of 127 MMBF would occur if timber harvest were maximized (USDA, 1990a). The allowable sale quantity (ASQ) is 850 MMBF for the decade (85 MMBF average annual ASQ).

The BNF has 30 timber sales scheduled through 1999 (Table 41; USDA, 1990c). The total board footage cut in the next five year period is 92.3 MMBF (ave. per year = 18.46 MMBF), with an additional 24.0 MMBF sold in 1994 and 1995. All harvesting will directly impact streams in varying degrees, depending on the harvesting technique use.

Table 41. BNF Timber Sale Program in the Upper Boise River Basin through 1999 (Idaho City and Boise Ranger Districts Timber Sale Programs; USDA, 1990c).

Sale Name	Volume (MMBF)	Area (Acres)	Drainage	Cut Year
Roaring R.	2.5	463	Roaring R.	1991
Hermada	7.1	1466	Swanholm	1991
Corral	3.9	1620	Meadow Cr.	1991
Alex-Brown	5.8	558	Alexander	1991
Big Tree	11.4	1600	Big Owl	1991,92,93
Mineral Mt.	13.2	1303	Ophir Cr.	1991,92,93
Hungarian	6.7	1435	Hungarian	1991
Ski Cr.	5.7	617	Crooked R.	1992
Hoodoo	5.0	800	Hoodoo	1991,92
California Gulch	3.0	284	Cal Gulch	1991
Mack-Pine	8.0	1600	Macks Cr.	1993,94
Fourth Cr.	10.0	1345	Fourth Cr.	1993,94,95
Jackson-Smith	5.0	630	Smith Cr.	1994,95
Hot Cr.	5.0	580	Hot Cr.	1994,95
Horse Heaven	4.0	440	Trail Cr.	--
Logging Gulch	7.0	1000	French Cr.	--
South Rabbit	8.0	1770	Rabbit Cr.	--
Warm Springs	5.0	900	Warm Sprs.	--
Bear Run	1.2	200	Mores Cr.	1992
Jack-Wil	8.0	1000	Grimes Cr.	1992
Sunset	4.0	500	Mores Cr.	1998
Granite	2.0	300	Mores Cr.	1993
Black Rock	9.0	1,500	Boise N.F.	1997
Crooked-Pike	6.0	800	Crooked R.	1992
Bears	2.0	300	Bear R.	1993
Brown-Wren	6.0	800	Boise N.F.	1993
Hot Horse	6.0	800	N.F./M.F. Boise	1992
Atlanta	4.0	900	M.F. Boise	1998
Lostman	4.5	1800	M.F. Boise	1993
Buck Creek			M.F. Boise	1994

State lands that are managed for timber harvest in the basin are found exclusively in the Mores Creek drainage (Horn, 1991). Over the past seven years (1983-1990), 39.2 MMBF were cut and sold on state lands in the Boise basin (Table 42; Hill, 1991). The Boise basin occupies approximately 40% of the IDL's Southwestern Area (Area 6). The normal annual harvest in this area is 10 MMBF, but it was increased to 20 MMBF in 1989 in order to salvage insect killed timber. It is scheduled to drop back to 10 MMBF in 1993.

BLM lands are found in the Mores Creek watershed and around Lucky Peak Reservoir, where there is little or no timber (Plate 1). Historically, limited logging has occurred since the early 1960s on BLM property in the Mores Creek watershed. Currently logging activity is limited to selective cutting to control pine bark beetle infestations. The BLM has an active timber salvage sale west of Idaho City that involves less than 0.2 MMBF. Its expansion will depend on beetle activity. The extent of future logging on BLM lands around Quartzburg, Placerville, Centerville, and Pioneerville will also depend on the level of insect activity. Small salvage sales are planned for 1991-1993 around Placerville (Jones, 1991).

Table 42. Timber Harvested On State Lands in the Upper Boise River Basin in the Past Seven Years (1983-90) (Hill, 1991).

Year	Amount Cut (MMBF)
1984	7.57
1985	6.04
1986	0
1987	1.71
1988	15.87
1989	1.10
1990	6.91
TOTAL	39.2

MMBF=Million board feet

Timber harvested in the North and Middle Fork and Mores Creek watersheds in recent years has gone to mills primarily in western Idaho or occasionally eastern Oregon (Table 43). Several other mills from eastern Oregon that have been successful bidding in the Payette basin and Boise South Fork, have also bid on sales in this basin.

Table 43. Mills Relying on Harvested Timber From Upper Boise River Basin (Morelan, 1991).

Mill	Location
Croman Corporation	Boise
Producer's Lumber Co.	Boise
Boise Cascade	Horseshoe Bend
Emmett Plywood Mill	Emmett
Ellingson	Baker, Oregon

It is not the intent of the Idaho Water Resource Board that this plan affect harvest of timber or log hauling in the upper Boise River basin. The Idaho Forest Practices Act and Water Quality regulations afford protection regarding these activities.

Riparian Forests

Riparian forests exists along virtually all major streams and their tributaries in the basin. The BNF estimates that 7% of the forest consists of riparian vegetation typically dominated by cottonwoods, willows and alders. All vegetation is critical in slope stability, minimizing erosion and maintenance of water quality, but riparian vegetation is critical because it serves to stabilize stream channels and to provide wildlife and fish habitat. While riparian communities represent less than 1% of the area in the Western U.S. they typically provide critical habitat for the majority of terrestrial

species (Chaney et al., 1990). Overgrazing and detrimental logging practices impair both the biological integrity and aesthetic quality of a river canyon riparian community.

Power Development and Energy Conservation

According to the Northwest Power Planning Council's 1991 Conservation and Power Plan, the Pacific Northwest region gets 62 percent (12,500 megawatts) of its energy from the region's network of hydropower dams (the percent that hydropower contributes can vary up to 75 percent of the total production, depending on annual precipitation conditions). The remaining power is generated by coal (16%), nuclear (7%), imports (11%), oil/gas (2%), and miscellaneous (2%).

Existing Hydropower Facilities

Hydropower generation on the North and Middle Forks of the Boise River is currently secondary in importance behind flood control, irrigation water supply and maintenance of minimum stream flows. Power is generated as releases are made for these primary purposes and to balance storage distribution within the Boise basin reservoir system.

Within the upper Boise River basin, there are three active hydropower generating plants in operation (Table 44). Anderson Ranch Dam, while not in the basin per se, is operated as part of the Boise River system and is included in the discussion.

Table 44. Power Generating Facilities Within the Upper Boise River Basin.

Dam	Installed Capacity
Lucky Peak Dam	101.500 MW
Kirby Dam *	0.158 MW
Macks Creek Dam	0.010 MW
TOTAL CAPACITY	106.510 MW

* Kirby Dam, below Atlanta, collapsed May 26, 1991, but has been reconstructed in 1992.

Lucky Peak Dam (at the downstream boundary of the basin): The 101.5 MW powerplant at Lucky Peak Dam which began operating on October 1, 1988, is owned by the Boise-Kuna, Nampa-Meridian, Wilder, New York, and Big Bend irrigation districts (the districts). It has contracted with Seattle City Light to purchase the power generated and to operate the Lucky Peak power facility. The energy from the plant ties into the Idaho Power company grid and is wheeled through the IPC intertie into the Northwest power grid. Seattle City Light then draws equivalent power from the Northwest power grid as needed, or markets it to other utilities in the system. The Idaho Power Company occasionally purchases power from Lucky Peak.

Kirby Dam: Kirby Dam was an isolated facility serving the community of Atlanta until May 26, 1991 when the dam collapsed. The original Kirby Dam was a log crib built on the Middle Fork Boise River and completed in 1908 to provide electricity for the Monarch gold mine. In 1984 a lightening fire destroyed the powerhouse which was later rebuilt. In 1990, the log crib construction was judged unstable by IDWR and reinforced using large boulders on the face of the dam. The reinforcement failed during spring runoff. Recently, the dam was rebuilt/stabilized and upstream diversion constructed to provide water to the Kirby Hydropower plant.

The Kirby power system is owned by the Atlanta Power Company Inc. The owners have speculated that the system could be expanded from its current .16 MW capacity to 1.09 MW, almost a 7-fold increase to accommodate a river flow rate of 350 cfs. The mean annual flow below Atlanta is estimated at 190 cfs (Warnick, 1981).

Macks Creek: Macks Creek is a tiny (.01 MW) facility (FERC No. 06631-03) located on a small tributary to Grimes Creek that serves private homes.

Anderson Ranch: This project was completed in 1945 by the Bureau of Reclamation. It is located on the South Fork Boise River and consequently not in the study basin, but it is operated cooperatively with the other dams in the Boise system. Anderson Ranch was designed for a total of three generating units, but presently only two units are installed, each with a 20 MW capacity, providing a total of 40 MW of power. Future plans are to install a third unit.

Existing Facilities Without Power

Arrowrock Dam is the only facility in the basin that currently does not have power. It is owned by U.S. Bureau of Reclamation, built in 1915, and has an active storage capacity of 286,600 AF. It is located about 12 river miles above Lucky Peak Dam on the main Boise River. Currently, Arrowrock has no power generation, but it's design allows for the installation of 3 units. Recently, the districts applied for and received a FERC license (License No. 4646-002) to construct and operate a 60 MW powerplant at Arrowrock.

Hydropower Potential

The attributes that are used to assess the hydropower potential include stream gradients/discharge data, access to transmission system, drainage (sq. mi.), head, acre-foot storage capacity, installed kW capacity, and estimated MW annual generation. With the exception of Twin Springs Project (Boise-Kuna Irrigation Dist. et. al, 1990) and the Alva Green Project (FERC Docket

No. EL90-50-0000), most of these data have not been determined or are not available for other sites in the basin.

In 1980, a report done by the Idaho Water Resources Research Institute, evaluated eleven stream sites in the basin in regards to their theoretical hydroelectric potential (Heitz et al., 1980). Three sites were identified on Mores and Grimes creeks, one site on the Boise River, three on the North Fork Boise River, three on the Middle Fork Boise River, and one on the Queens River. The report did not actually rate the sites nor did it provide information on their economic feasibility.

FERC Filings: In addition to the Arrowrock FERC license, there is currently only one other active FERC application for hydropower/storage facilities within the upper Boise River basin (USACE, 1991). A Declaration of Intention (DI) was filed for the Alva Green project on September 11, 1990 (FERC Docket No. EL90-50-0000). The facility would be located above Atlanta on Boise National Forest land (T5N, R11E, Sect. 35) on the Middle Fork Boise River and would consist of a three foot high diversion dam, 1300 ft. diversion canal, an offstream reservoir with an 8 acre-foot capacity, a 12 ft. high dam, a 1500 foot penstock, and a powerhouse with a projected capacity of 60 kW (storage structure and portion of diversion canal would be on private property; the remainder on public land).

Inactive FERC Filings/Identified Sites: Since the inception of FERC, there have been 37 separate filings in the basin. This list includes, everything from operational sites, such as Lucky Peak, to inactive license applications. Of those 37 most have received only study permits to evaluate feasibility for hydropower potential. Table 45 lists filings that have inactive status. Some of these filings may be for almost the same site, as is the case with the Twin Springs site.

The Twin Springs reservoir and damsite (T4N, R7E, Sect.18), 3.3 miles downstream confluence of North and Middle Forks Boise River, has been studied since the early 20th century by Bureau of Reclamation, USGS, and Army Corps of Engineers. Most recently, the irrigation districts producing power at Lucky Peak were issued a preliminary permit by FERC to study the feasibility of the project. The districts preliminary permit application was initially based on a 1968 Corps study which recommended a 470-foot high rockfill dam, 600,000 acre-foot reservoir and 103.5 MW powerhouse. Further study by MK resulted in a modified design that included a 420-foot high roller compacted concrete (RCC) dam that would impound 400,00 acre-foot of water. The damsite and powerplant would be 3.3 miles downstream from the confluence of the Middle and North Forks of the Boise. At full pool, the reservoir would inundate 3700 acres, flooding 11.6 miles of Boise River and Middle Fork and 6.7 miles of North Fork. Recently, Morrison-Knudsen Engineering concluded that Twin Springs was not currently economically feasible, and on July 30, 1990 the districts voluntarily surrendered their preliminary permit to FERC (Olowinski, 1991).

Table 45. Inactive Filings on Study Sites and FERC Applications in the Upper Boise River Basin.

Ferc No.	Project Name	Stream Name	Power Potential (MW)
Study Sites			
V63	Graham	N. F. Boise R.	
T73	Trail Creek	N. F. Boise R.	
T74	Big Owl	N. F. Boise R.	
V62	Lost Creek	N. F. Boise R.	
V65	Yuba Dam/Reservoir	M. F. Boise R.	
V24	Atlanta	M. F. Boise R.	
T62	Barber Flats	N. F. Boise R.	
T72	King	M. F. Boise R.	
V64	Alexander Flats	M. F. Boise R.	
T60	Slide Gulch	Boise River	
T71	Bald Mountain	M. F. Boise R.	
FERC Applications			
7950-00	Boise R. North Fork	Boise River, N. Fk.	10.00
9819-01	N. Fork Boise R.	Boise River, N. Fk.	6.35
9675-00	N. Fork Boise R.	Boise River, N. Fk.	10.00
	Twin Springs	Boise River	75-87.5

Energy Supply and Conservation

Current Energy Supply: Being almost exclusively a rural basin, virtually all the energy demands in the basin go toward residential and municipal uses. Electric power is supplied to Idaho City by Idaho Power, but Atlanta has it's own power supply in Kirby Dam. In the basin, heat is the greater consumer of energy followed by hot water needs (Hoebelheinrich, 1992). Major sources of heat are wood, electric, oil, and possibly propane. Hot water energy is almost totally electric.

Energy Conservation: The Northwest Power Planning Council 1991 Conservation and Electric Power Plan has projected that 75% of the energy needed for the region over the next 20 years can be provided by conservation resources. The remaining 25% will come from low-cost hydropower and cogeneration.

In this basin, energy efficiencies would be most effectively improved by weatherization and adding insulation to existing residential and municipal structures and meeting national standards for new buildings. Given the probability that wood stoves are prevalent in the basin, energy could be saved and air quality improved if residents were encouraged to buy catalytic converted and wood pellet stoves.

Over the past few years, there have been a number of federal and state programs to encourage conservation. The Good Cents and Design In Excellence programs, funded by Idaho Power, are promoted for new commercial and residential construction. Existing facilities are eligible for conservation upgrading through grants and loans sponsored by state and federal agencies and the

public utilities. These programs promote conservation upgrades by providing low-interest loans or funding a percentage of the installation costs.

Navigation

The basis of Idaho's title to the streambeds of navigable waters is stated specifically in the Idaho Admission Bill of 1890 and the Idaho Constitution. State title applies to the entire Boise mainstem, Boise North Fork through T5N, R7E (above Black Rock C.G.), and the Boise Middle Fork through T5N, R8E (confluence with Roaring River) (IDL, 1986). State title does not apply to Mores Creek and its tributaries.

No commercial navigation occurs in the basin. Recreational boating occurs on the Middle and North Forks of the Boise, particularly during the spring runoff period (May, June), but currently there are no outfitters licensed to guide on any stretch of the Boise River (Sangrey, 1991).

APPENDIX D: MANAGEMENT ALTERNATIVES

Draft Alternative A

The No Action alternative would continue present management policies and practices and serves as a baseline for analyzing all other alternatives. Resource use levels for this alternative were established by examining current use levels. The present level of management on public and private lands would not be affected. No river segments are proposed for state protection or minimum stream flows. The only recommendation is to continue present management practices.

Boise National Forest manages 81% of the planning area, with 12% of that being managed as wilderness. Recreation within the area, largely takes place on Forest Service property or on the two reservoirs. The recreation facilities on Lucky Peak are managed by the Army Corps of Engineers, while those on Arrowrock (Bureau of Reclamation facility) are managed by the Forest Service. Without state river protection in the basin, there would probably be little impact on short-term recreation patterns, but long-term recreation patterns may be impacted. Demand for river-related recreation, such as whitewater rafting, is increasing rapidly in Idaho. Without additional protection of the rivers in the basin, development such as diversions and mining activities could impair the primitive and scenic character of several of the river reaches in the basin.

Given the fact that the majority of the land in the basin is in the public domain, the likelihood of major developments is not great. But any development or significant increase in recreation that directly impacts the waterways in the basin could have harmful consequences on the river fishery, the riparian wildlife, and the water quality. Without state protection of river segments, the Federal Energy Regulatory Commission would be less likely to constrain hydropower development.

The absence of state river protection would have little if any impact on current and future water uses and water development because for the critical summer season the basin is considered to be fully appropriated. Even though several hydropower sites have been identified in the basin, only two could possibly go ahead in the next few years--Alva Green Project near Atlanta and the Arrowrock retrofit. Twin Springs Hydropower Project is not considered feasible at this time.

Draft Alternative B

The objective of this alternative is to provide state protection for reaches in the basin which possess a combination of the following: a) outstanding fish and wildlife resources; b) current excellent water quality conditions in which those conditions need to be protected, such as the water supply for

Idaho City and Atlanta; and c) reaches which have current and projected high recreational use and diversity, such as the Middle and North Forks Boise River. Minimum stream flows are recommended as actions for specific streams where water supply is critical. These would be determined in cooperation with IDFG and IDPR.

The waterways in the basin that would be protected with this alternative include:

- Boise River (from Arrowrock Reservoir backwaters to confluence of North and Middle Forks Boise River)
- Sheep Creek (mouth to headwaters and tributaries)
- Middle Fork Boise (from confluence North Fork Boise to Roaring River)
- Montezuma Creek (mouth to headwaters and tributaries)
- North Fork Boise (from confluence Middle Fork Boise to Rabbit Creek)
- Elk Creek (from Deer Creek to headwaters and tributaries).

Under this alternative the IWRB would make applications for minimum stream flows on:

- Sheep Creek (mouth)
- Middle Fork Boise (at Roaring River)
- Roaring River (at mouth)
- Yuba River (at mouth)
- Montezuma Creek (at Atlanta well site)
- North Fork Boise River (at Rabbit Creek)
- Rabbit Creek (at mouth)
- Johnson Creek (at mouth)
- Elk Creek (at Idaho City well site)

This alternative addresses several of the basin objectives and issues. The fishery and wildlife habitat, particularly along the Boise River and the Middle and North Forks would be protected from any further degradation. Sheep Creek, which would be provided both protection and minimum stream flow, has been one of the most important spawning tributaries in the basin. This alternative also provides for establishing minimum stream flows on tributaries that wouldn't be protected, such as Roaring River, Yuba River, Rabbit Creek, and Johnson Creek that are highly regarded as native trout spawning streams.

This alternative addresses the basin objective of maintaining high quality recreation associated with free-flowing rivers. One of the main issues raised by the public was recreational over-use. This alternative would prohibit development on those reaches that currently receive high recreational use,

such as the Boise River, Middle and North Forks, thereby maintaining much of the existing recreational opportunity. Development opportunities are not addressed by this alternative, but are not precluded on those reaches left unprotected.

Draft Alternative C

The Idaho Code states that pre-existing activities, such as mineral leases, grazing, and timber harvesting would not be affected by a state protection designation, but it is still possible that protection serves as an impediment to future development. Consequently, the development alternative provides for state protection for only those outstanding reaches that do not conflict with any of the following: a) Twin Springs hydropower damsite and storage reservoir; b) current and future mineral exploration in the area where Atlanta Gold Corporation has demonstrated mineral potential; c) current grazing practices; and d) suitable timber land and planned salvage and green sales. The minimum stream flows necessary to maintain biological communities, aesthetics, and recreational activities would be determined in cooperation with the IDFG and IDPR.

Actions

The waterways in the basin that would be protected with this alternative include:

- Boise River (from Arrowrock Reservoir backwaters to Twin Springs damsite)
- Sheep Creek (above Devils Creek to headwaters and tributaries)
- Middle Fork Boise River (Alexandar Flats to Roaring River; above Atlanta to Sawtooth Wilderness boundary)
- Roaring River (East and Middle Fork confluence to headwaters and tributaries)
- Hot Creek (upper portion)
- Black Warrior (mouth to Sawtooth Wilderness boundary)
- Queens River (mouth to Sawtooth Wilderness boundary)
- North Fork Boise River (Crooked River to Bear River; Hunter Creek to Sawtooth Wilderness boundary)
- Crooked River (from FS road 348 to headwaters and tributaries)
- Bear River (upper portion and tributaries)
- Johnson Creek (mouth to headwaters and tributaries)

Under this alternative the IWRB would make applications for minimum stream flows on:

- Boise River (below Twin Springs damsite)
- Sheep Creek (at Devils Creek)
- Middle Fork Boise River (at Alexander Flats)

- North Fork Boise River (at Rabbit Creek)

This alternative addresses the development opportunities in the basin. One of the stated basin objectives is that potential hydropower sites, such as Twin Springs, be protected from uses and threats that may compromise that potential. This alternative would prevent possible upstream diversions on the North and Middle Forks that may divert water from the stream by establishing minimum stream flows on the North Fork at Rabbit Creek, on the Middle Fork at Alexander Flats, and on Sheep Creek at Devils Creek. One of the major issues raised by the public is the threat of dams and diversions. A minimum stream flow established below the Twin Springs damsite would mitigate that to some degree by insuring sufficient water for instream uses below the project.

This alternative also addresses the possible need for road-building and stream channel alteration for mineral exploration and development by the Atlanta Gold Corporation in Yuba River-Decker Creek watershed. It also allows for the possibility of road building along reaches that have a high probability of timber harvest in the future. Those outstanding reaches that are not directly affected by Twin Springs Hydropower, Atlanta Gold mining, or extensive grazing and logging practices were provided protection.

Draft Alternative D

This draft alternative is at the opposite end of the continuum from the "no action" alternative in providing protection for all reaches in the basin that were outstanding in at least one of the screening areas (biological, aesthetics, and recreation). In this alternative, no consideration is given for current land use practices, such as grazing and logging, or potential hydropower or mineral development.

The waterways in the basin that would be protected with this alternative include:

- Boise River (Lucky Peak Dam to confluence of North and Middle Forks)
- Sheep Creek (mouth to headwaters and tributaries)
- Middle Fork Boise River (from confluence with North Fork to Roaring River; Gray's Creek to Sawtooth Wilderness boundary)
- Roaring River (from confluence of East and Middle Forks to headwaters and tributaries)
- Hot Creek (upper portion and tributaries)
- Phifer Creek (upper portion and tributaries)
- Black Warrior Creek (mouth to headwaters and tributaries)
- Queens River (mouth to Sawtooth Wilderness boundary and tributaries)

- Yuba River (mouth to headwaters and tributaries)
- Decker Creek (mouth to headwaters and tributaries)
- North Fork Boise River (from confluence with Middle Fork to Little Owl Creek; from Hunter Creek to Sawtooth Wilderness Area)
- Crooked River (lower segment: mouth to FS road 384; upper segment: from FS road 348 to headwaters and tributaries)
- Beaver Creek (east fork and tributaries)
- Edna Creek (upper portion)
- Bear River (mouth to headwaters and tributaries)
- Bear Creek (mouth to headwaters and tributaries)
- Johnson Creek (mouth to Sawtooth Wilderness boundary and tributaries)
- Elk Creek (from Deer Creek to headwaters and tributaries)

This alternative addresses several basin objectives that deal with protecting the *status quo* and attempting to preserve for posterity the free-flowing and unpolluted rivers, and the primitive character of the basin. The major threats to the basin, as perceived by the public, are habitat deterioration from development, recreational abuse, dams, and poor land stewardship practices. This alternative would go the farthest of the four alternatives to preserve the outstanding waterways in the basin. This alternative would not address any potential for development on the protected reaches but would not preclude development on those unprotected reaches.

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Plate 1

LAND OWNERSHIP

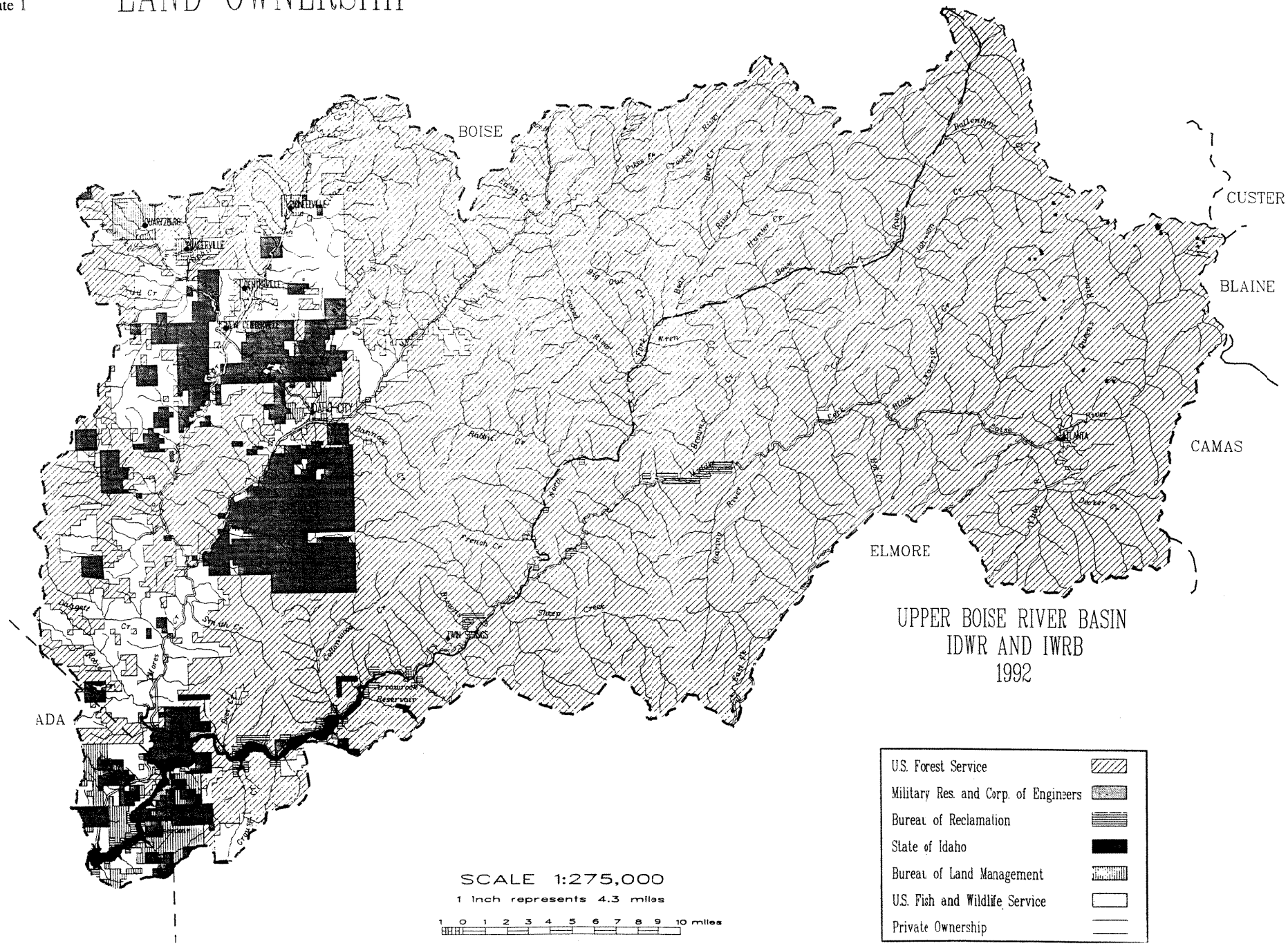
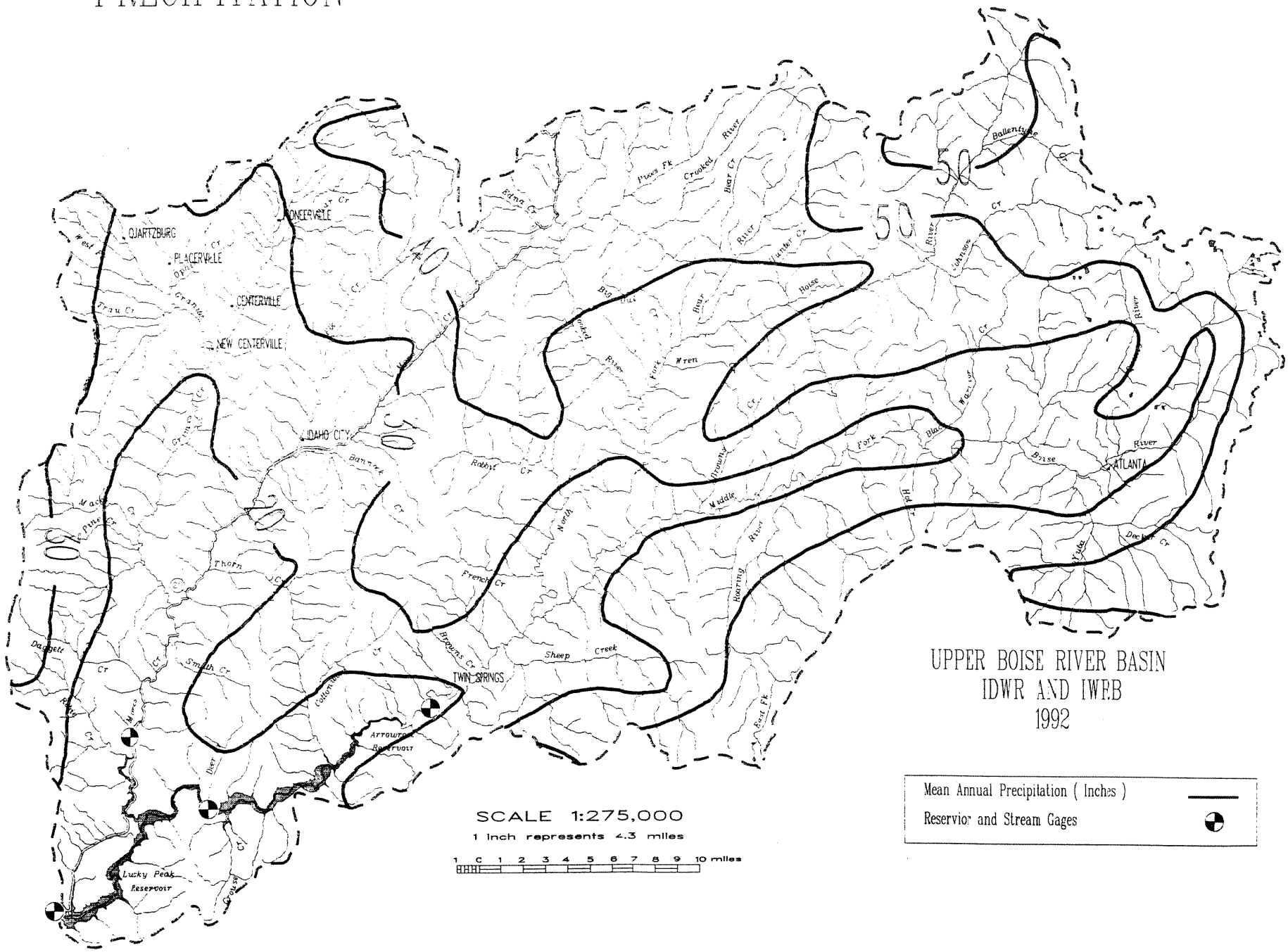


Plate 2

PRECIPITATION



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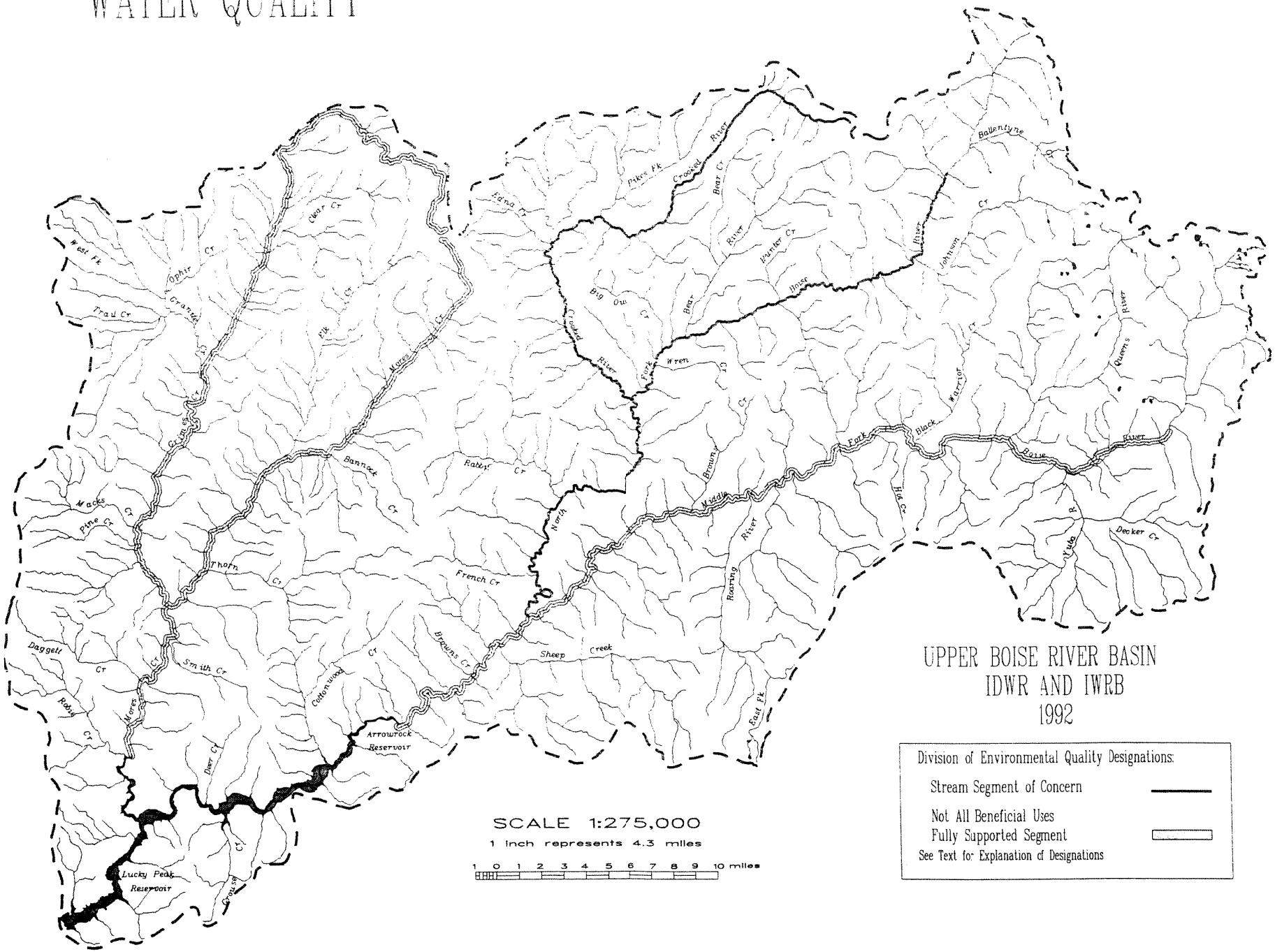

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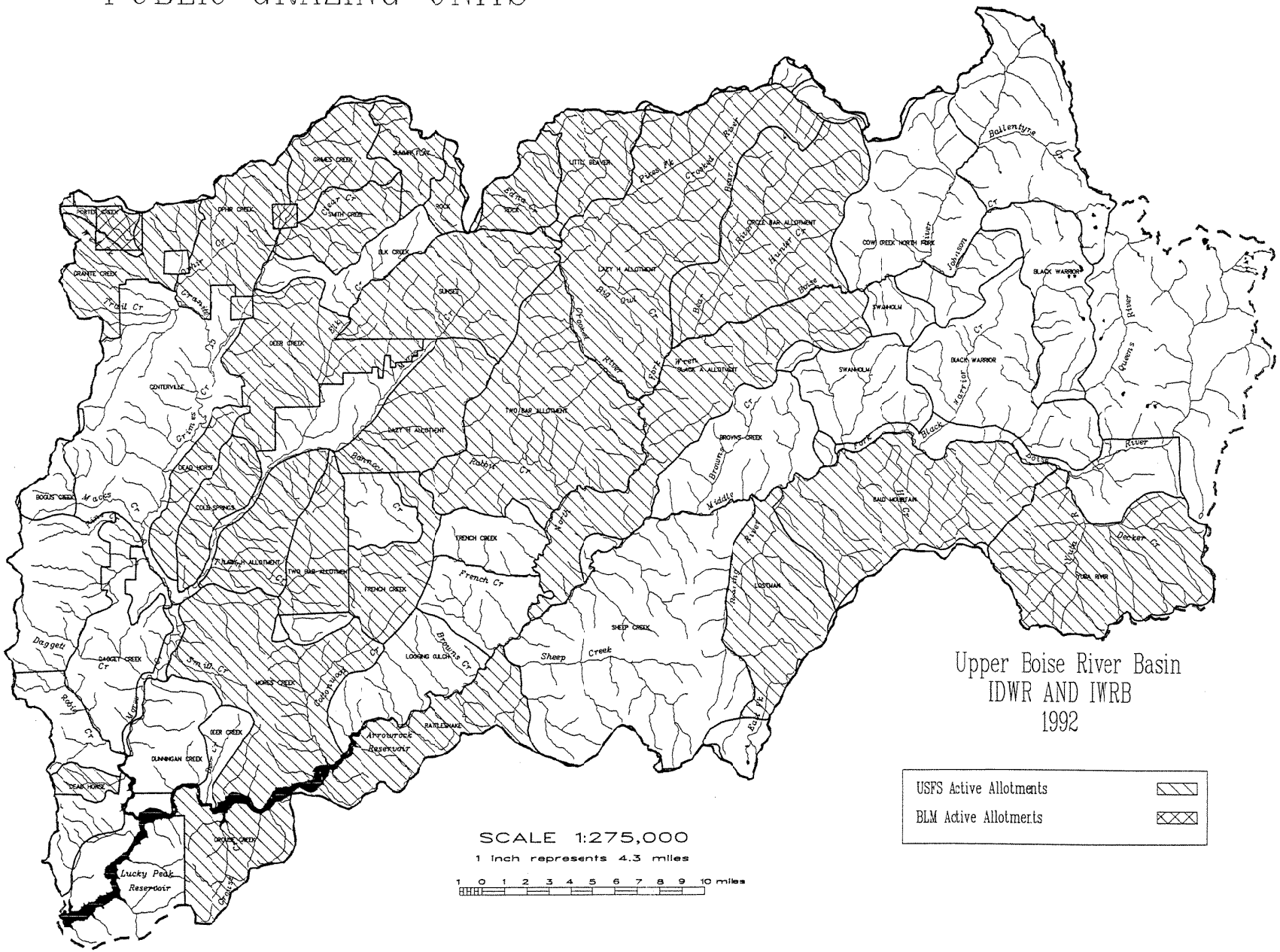

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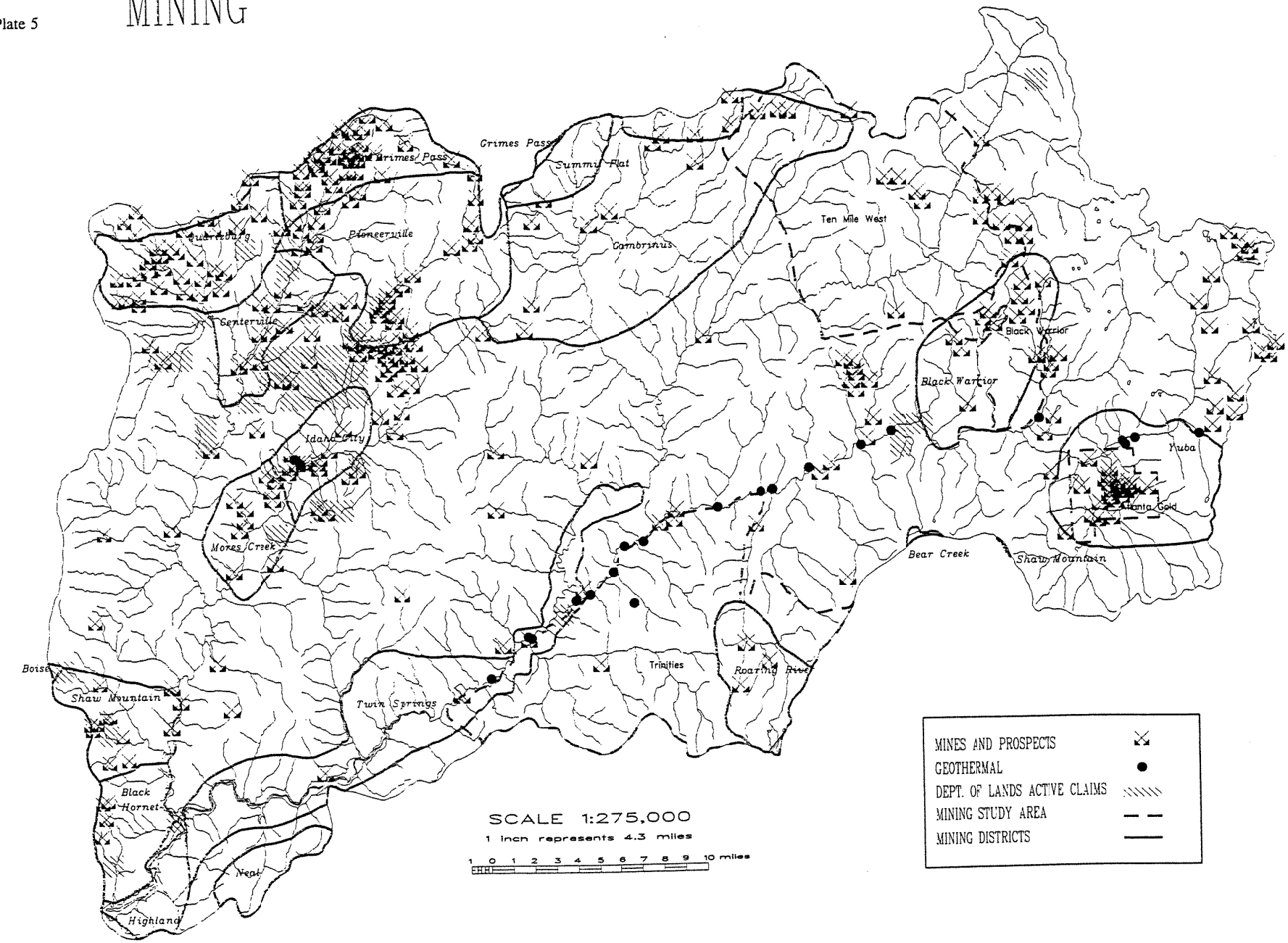
MINING



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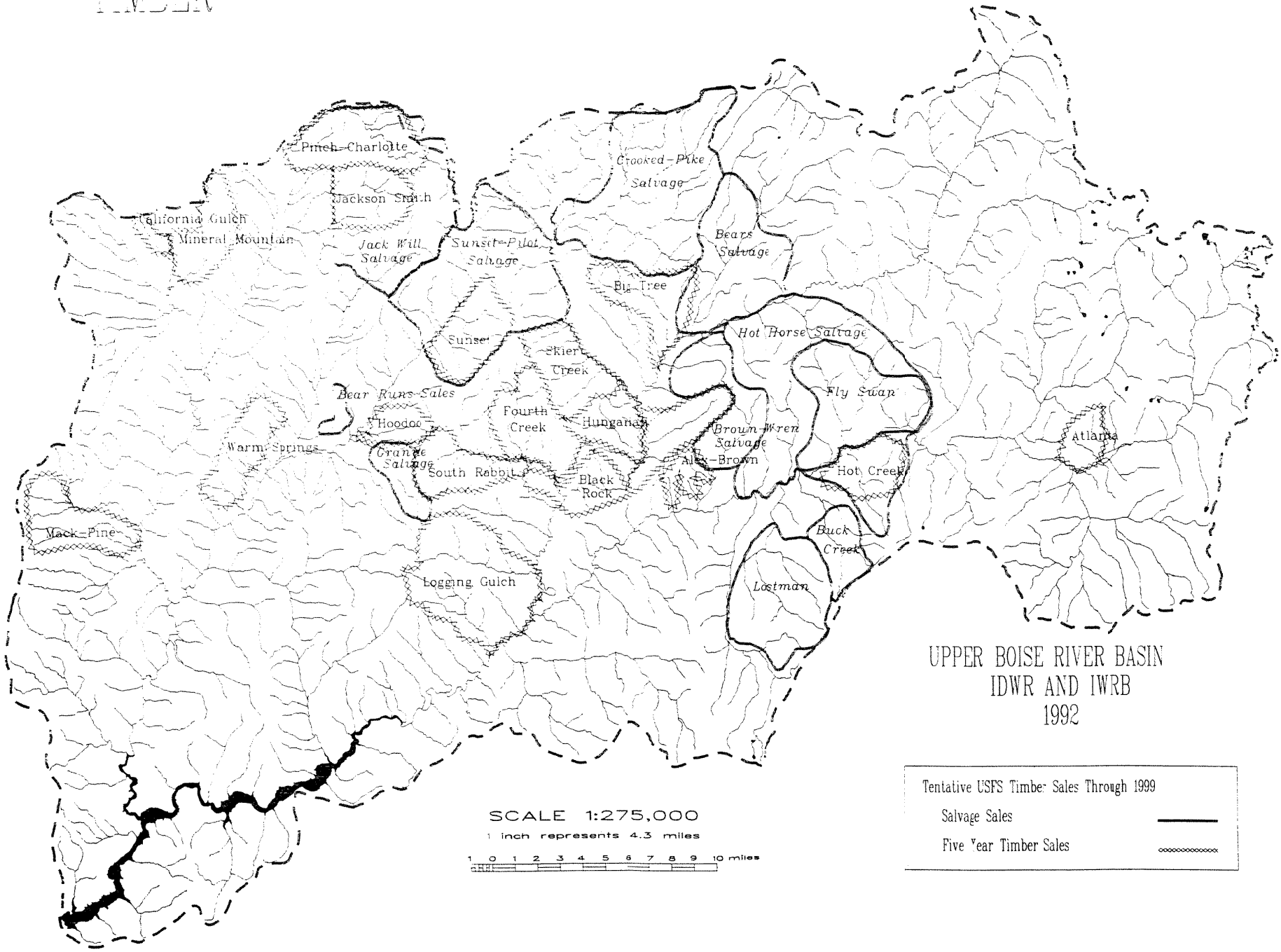
TIMBER



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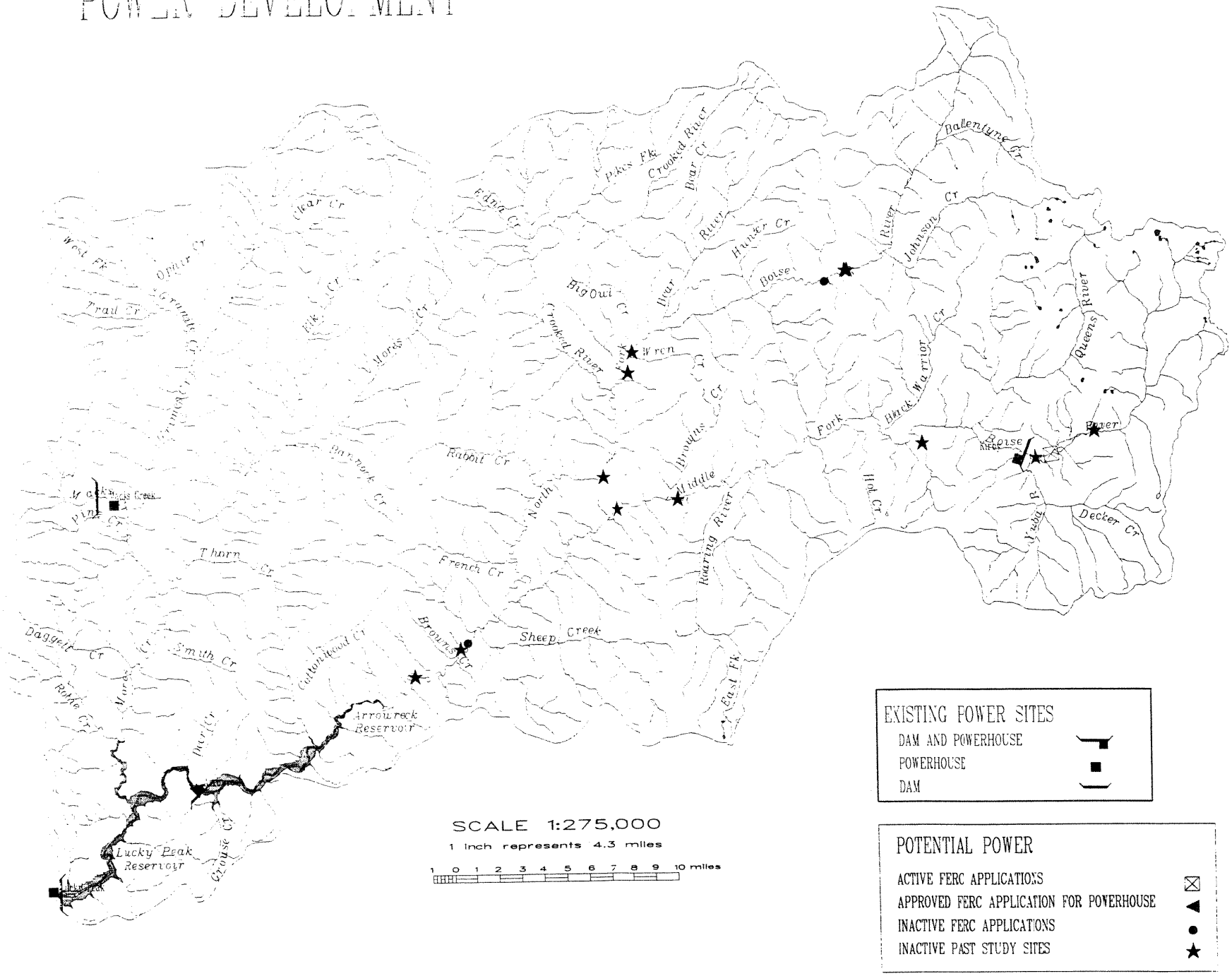

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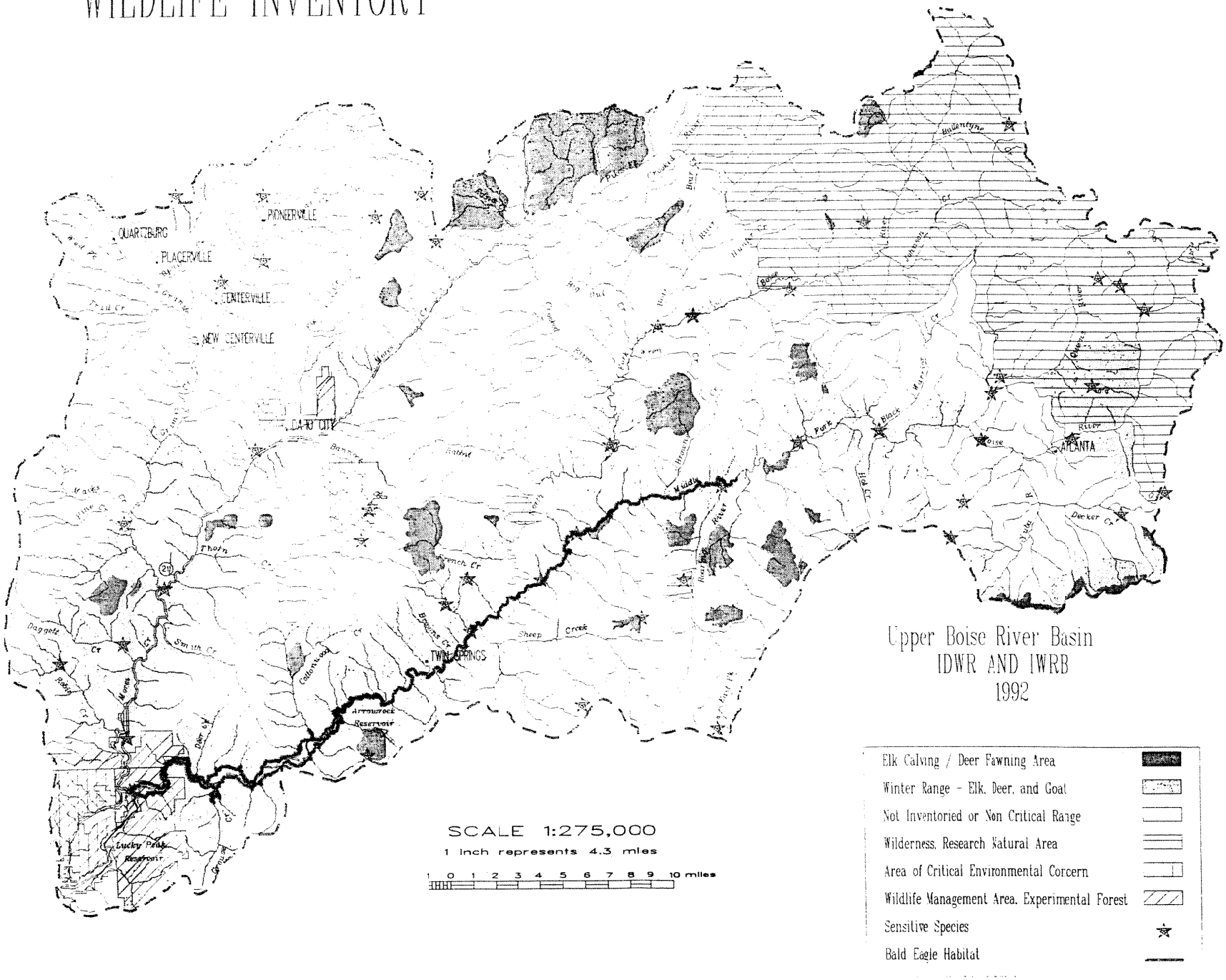
WILDLIFE INVENTORY



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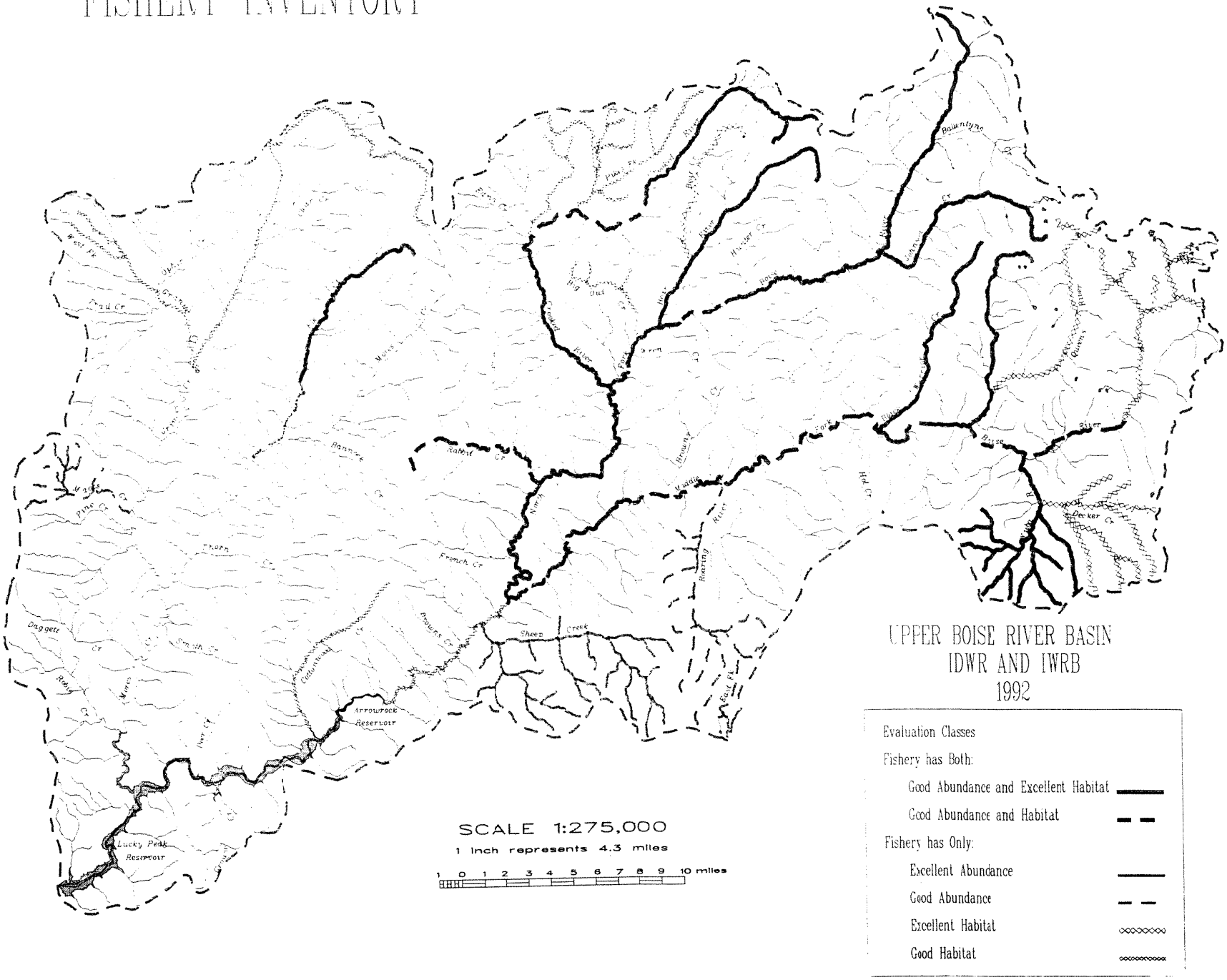

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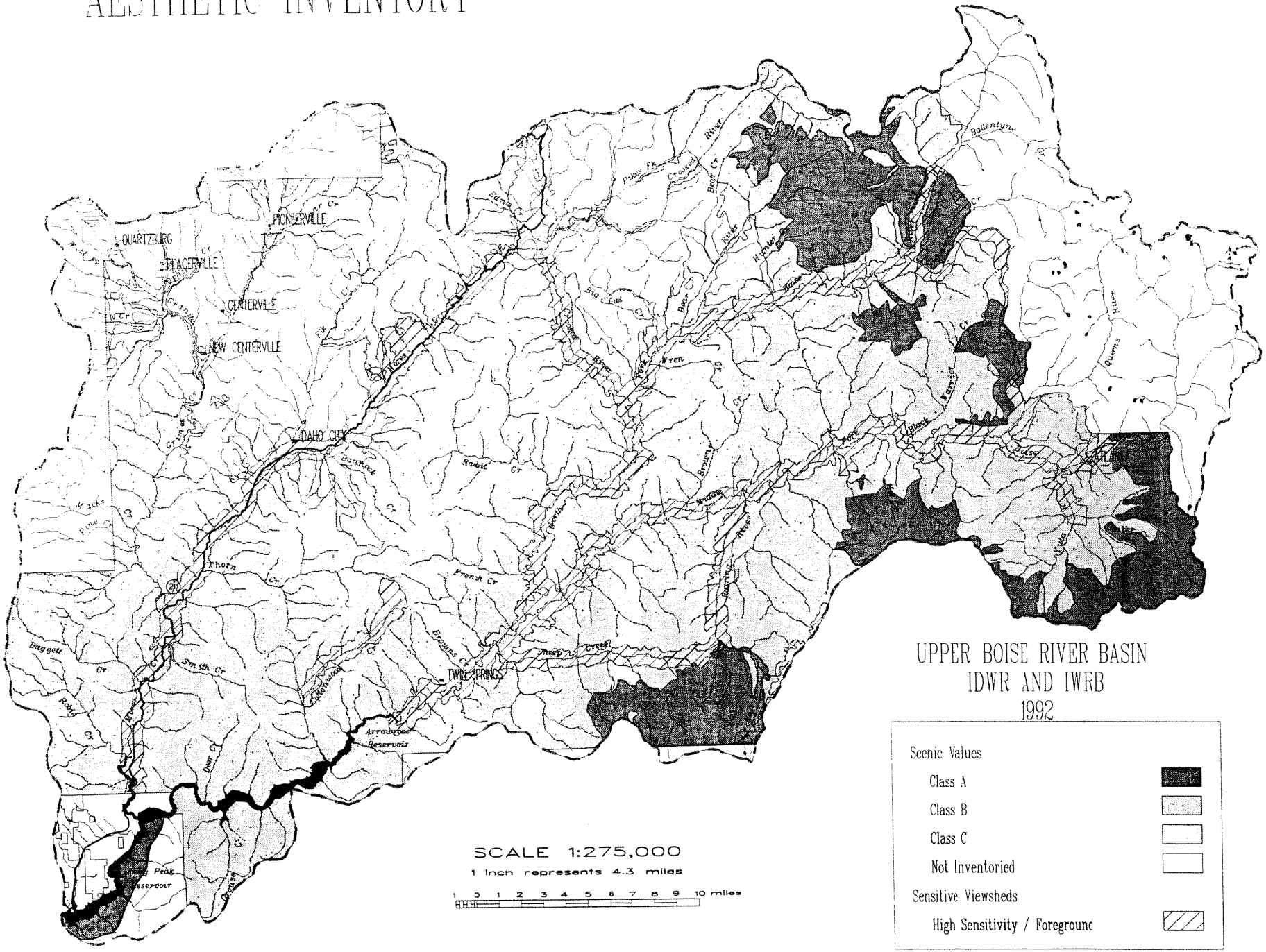
AESTHETIC INVENTORY



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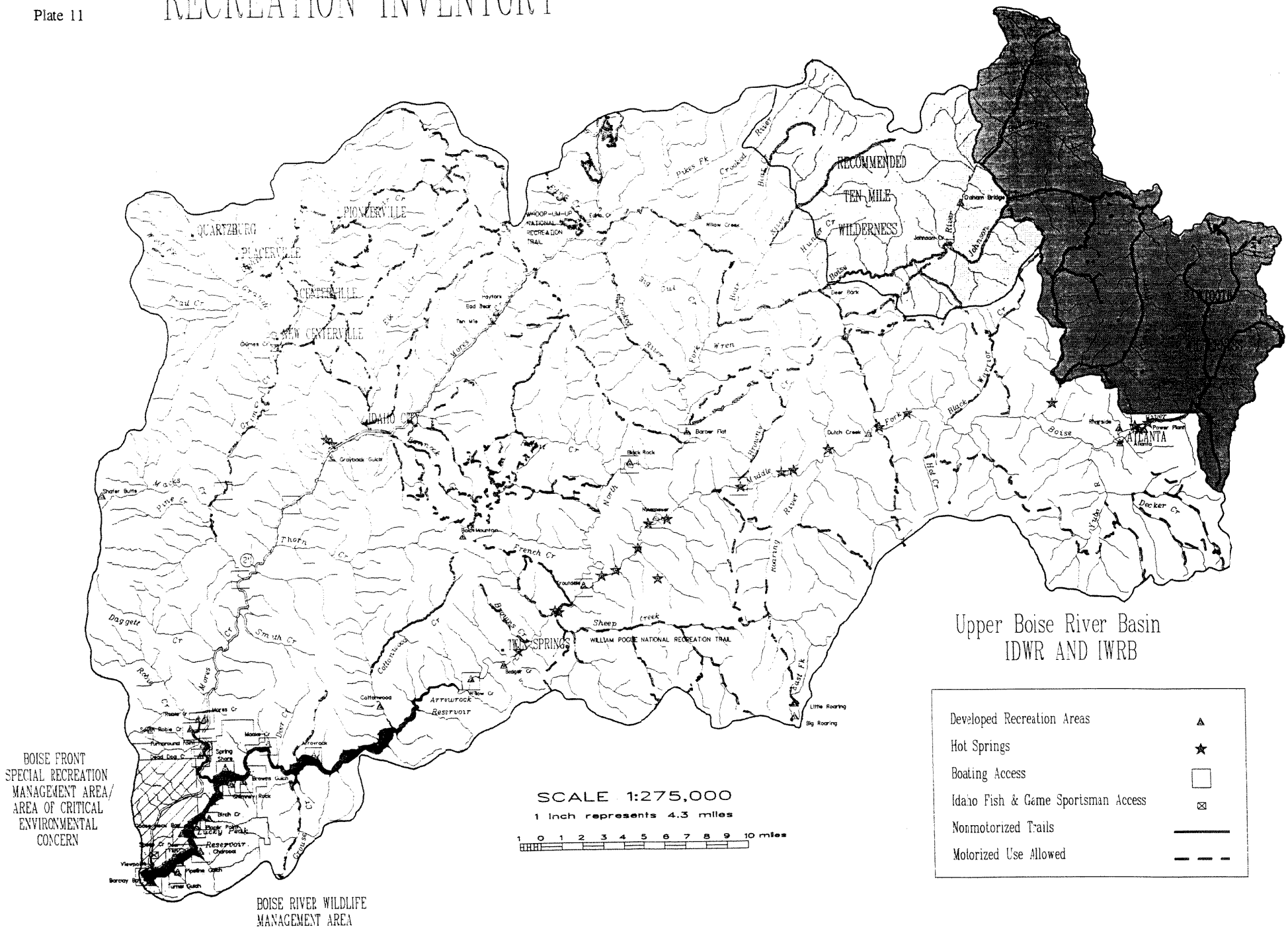
RECREATION INVENTORY



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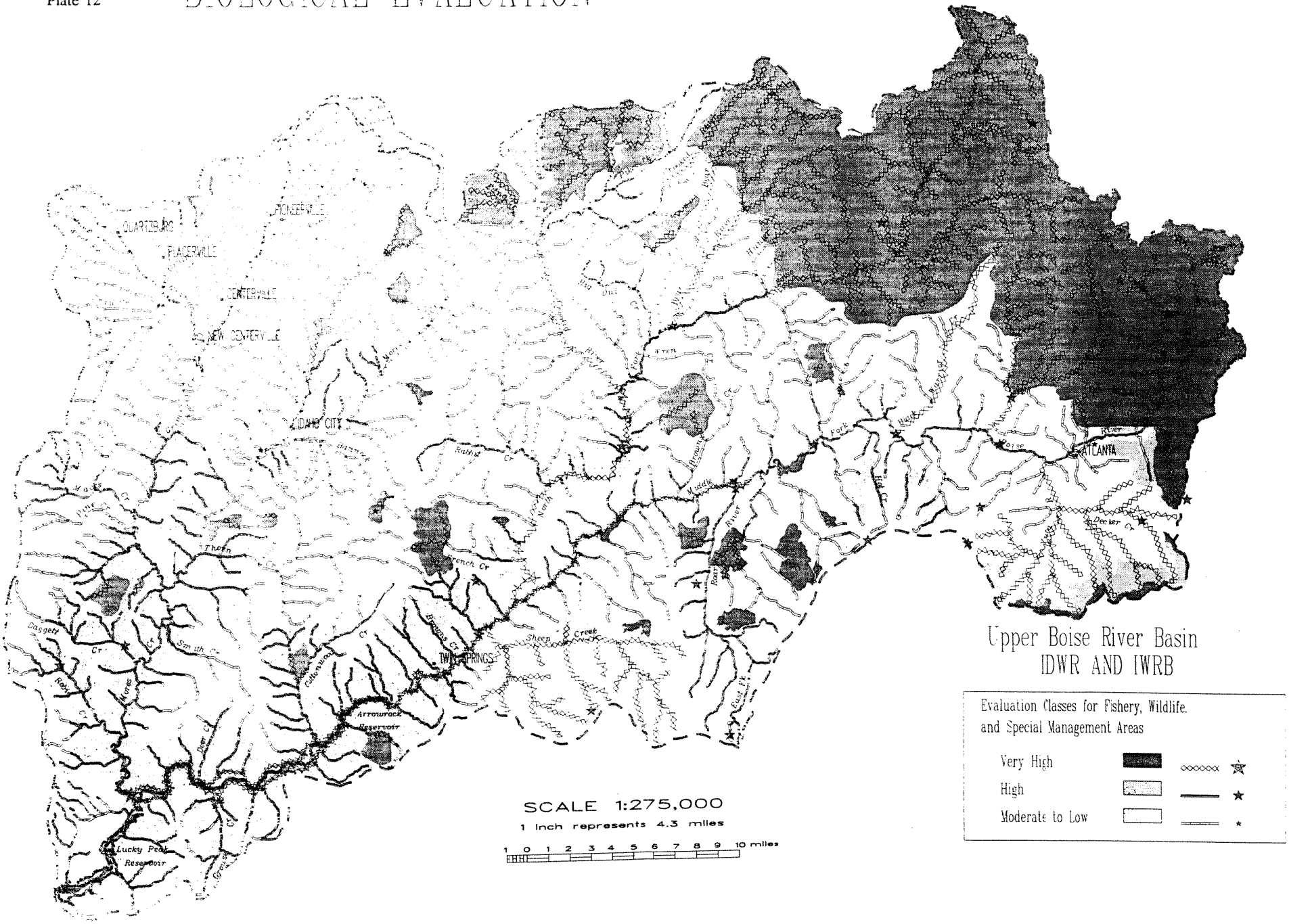

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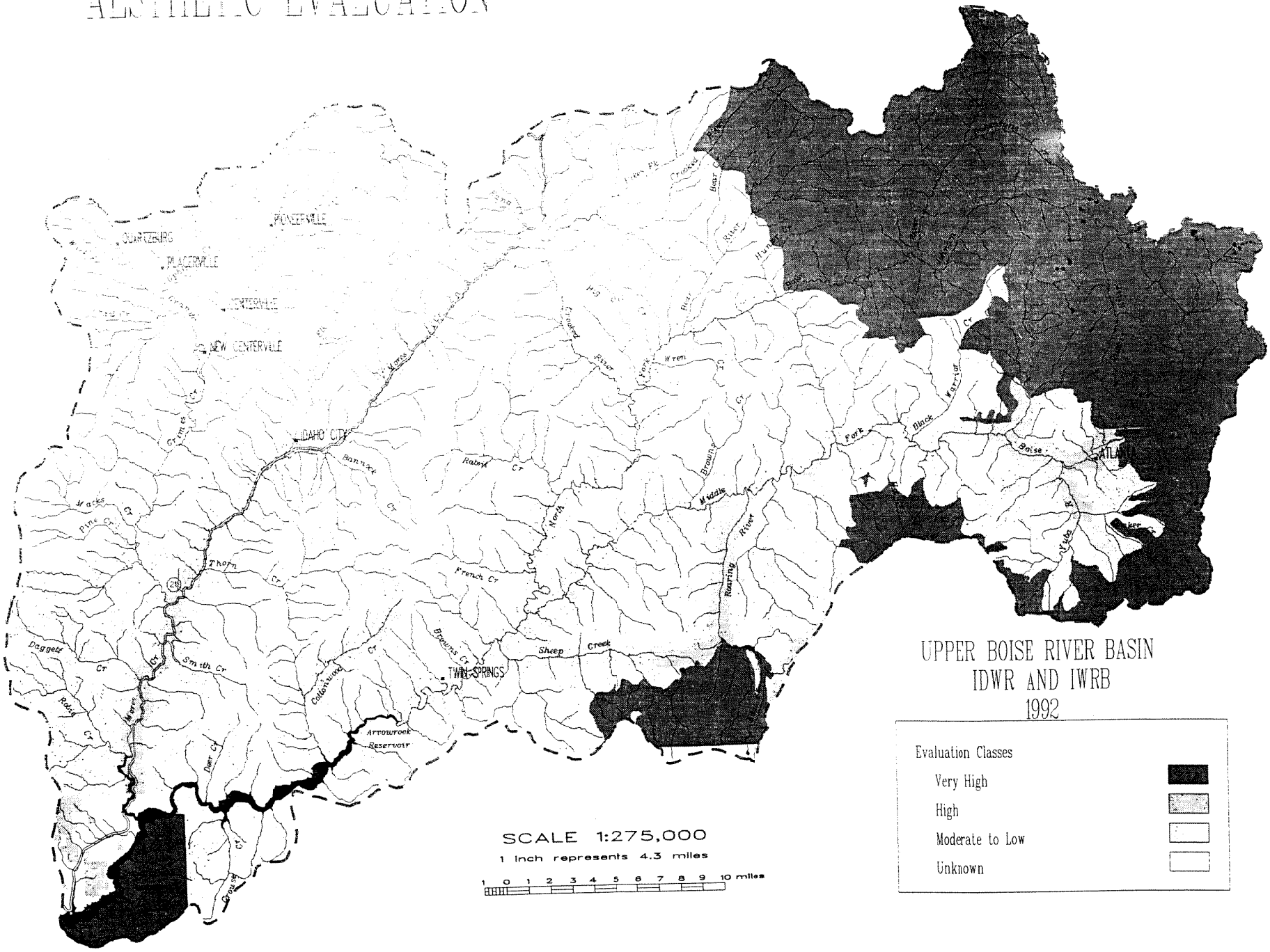

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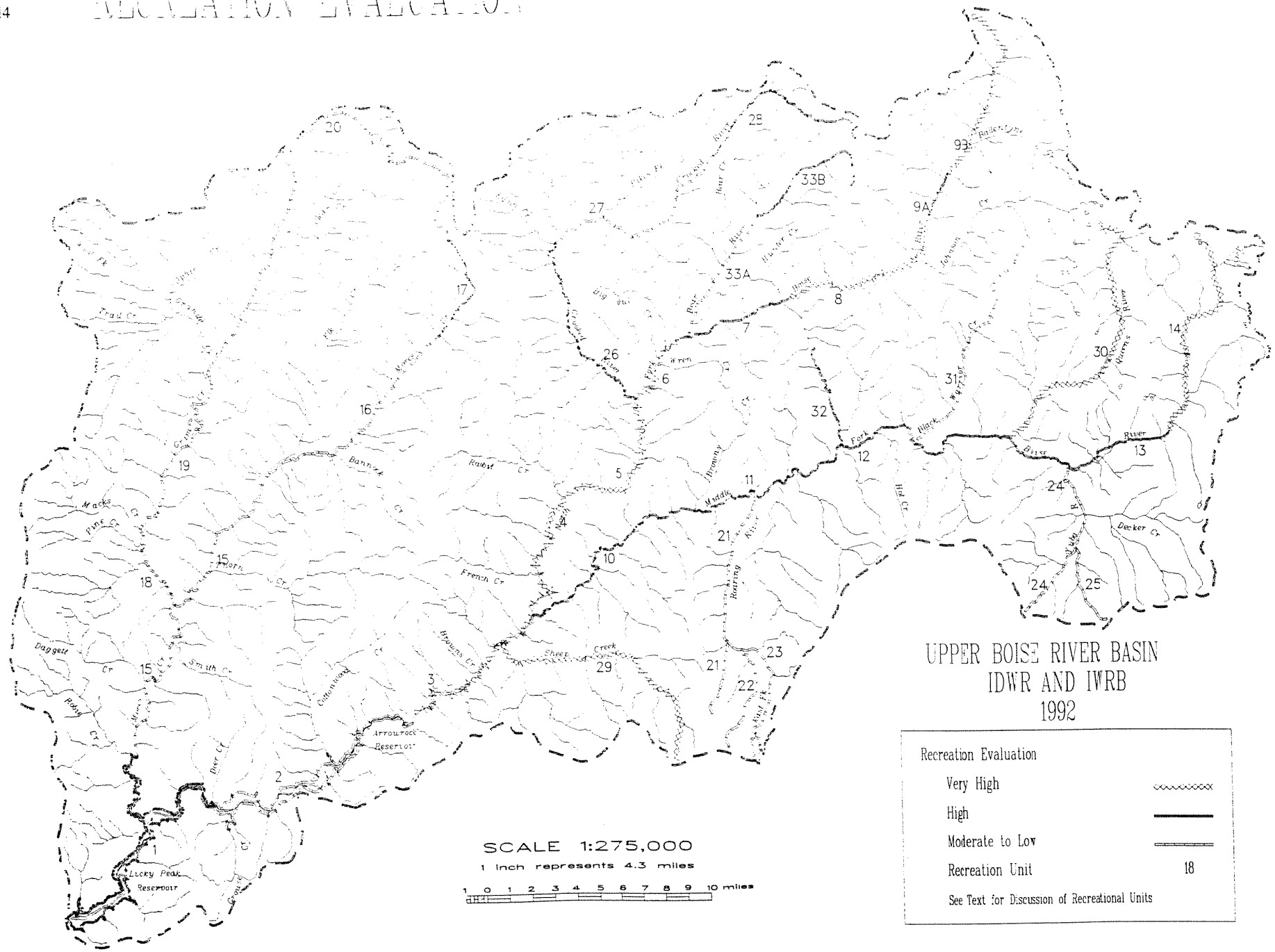

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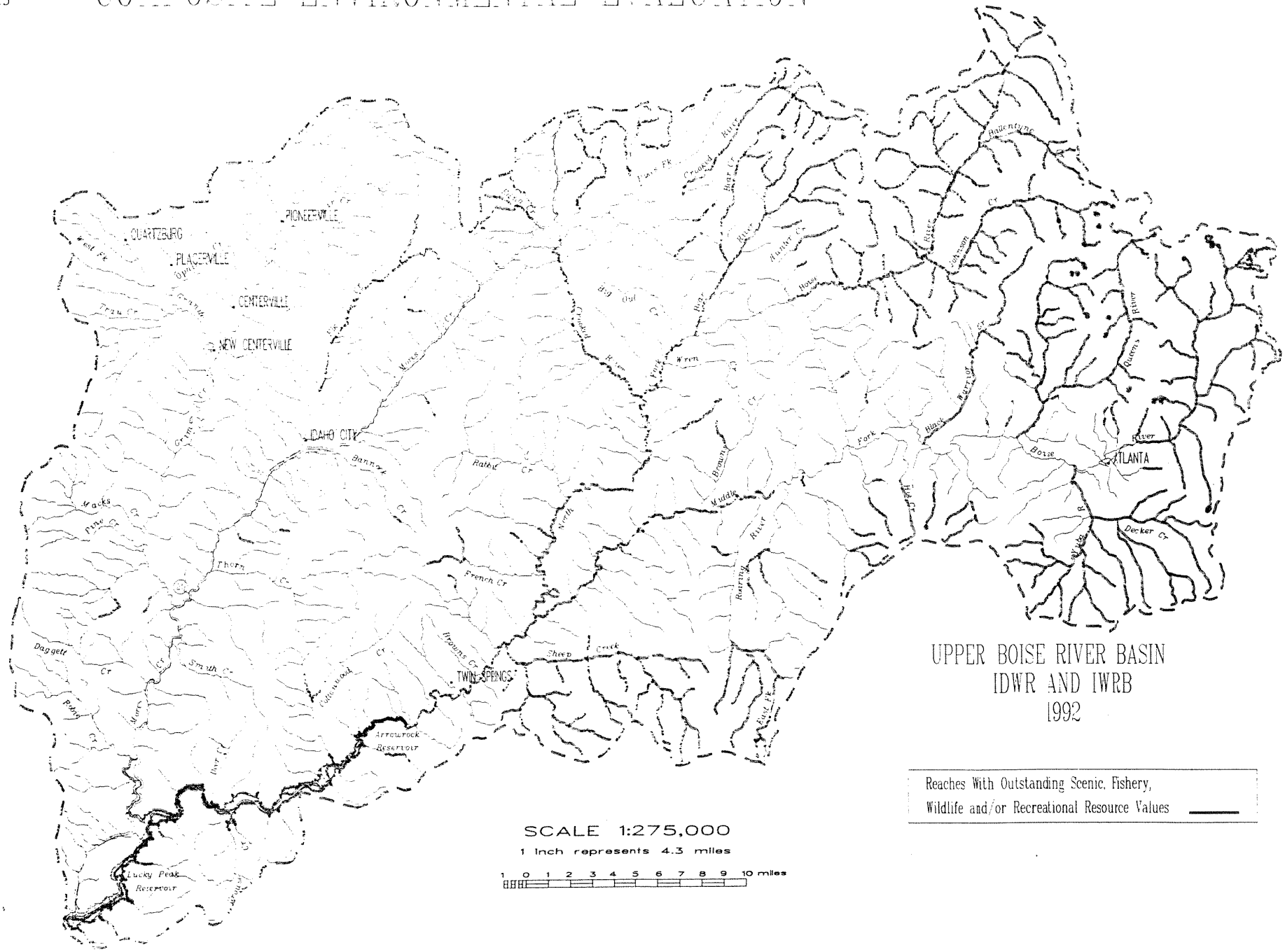

Comprehensive
STATE WATER PLAN

Henrys Fork Basin

Idaho Water Resource Board
1992

COMPREHENSIVE STATE WATER PLAN: HENRYS FORK BASIN

IDAHO WATER RESOURCE BOARD

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December 1992

Buffalo Springs on the Buffalo River, Henrys Fork Basin.

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Executive Summary

This component of the Comprehensive State Water Plan is prepared by the Idaho Water Resource Board in keeping with their constitutional and legislative charge to formulate and implement a state water plan. This portion of the water plan is prepared for the entire part of the Henrys Fork basin in Idaho including the Falls River and Teton River drainage basins. The basin extends from the Idaho border to the Henrys Fork junction with the South Fork Snake River north of Idaho Falls.

In 1988 the Idaho Legislature directed that the main stem Henrys Fork be studied from its origin at Henrys Lake to Ashton Reservoir. The study was expanded to include the tributary streams and lower river area because of the requirement to adopt a comprehensive water plan for the state and the provision for that plan to be based on geographic areas.

Each river or basin plan, which is a component of the state water plan, may identify rivers which are designated as state protected rivers. This plan has no direct impact on existing irrigation rights and uses, timber harvest, stockwater use, or other vested rights. In river reaches designated for protection, the purpose of the plan is to protect the streambed from disturbances that are not in the public interest. It is not intended that this plan be used to justify federal wild, scenic or recreational river designations of any of the Henrys Fork basin waterways.

This plan is the result of much thought, study, research and public input. The local advisory group was of great value in developing the plan. It was a team effort with many participants.

The Henrys Fork plan describes and evaluates the water resources and related economic, cultural, and natural resources of the basin. The planning process is outlined and constraints identified. The goals and recommendations of the Water Resource Board are presented relative to improving, developing and conserving the water resource uses of the Henrys Fork basin. Each resource element has been addressed in the plan. The goals of the plan seek to ensure future water resource use that will complement and supplement State goals directed toward maintaining Idaho's high "quality of life."

The Henrys Fork is a major tributary of the Snake River draining about 2,700 square miles in Idaho plus 500 square miles of Wyoming. Over 50 percent of the basin is public land. The average estimated amount of water entering the basin each year as precipitation is nearly 4,100,000 acre-feet. The amount leaving the basin as the annual flow for the Henrys Fork is 1,400,000 acre-feet. An additional 700,000 acre-feet leave the basin as ground-water outflow. 500,000 acre-feet of surface water and 200,000 acre-feet of ground water are consumptively used within the basin. The remaining 1,300,000 acre-feet is consumed through natural evapotranspiration. These averages are adequate to meet current beneficial uses, and to support some economic growth. There, however, are problems with the great annual variability of the water supply.

General water quality of both ground and surface sources within the basin is good. Further efforts to improve water quality will likely be directed at lower basin irrigation return flow and control of recreation subdivision effluent.

The basin population is 38,050 (14 per square mile) with 56 percent located in incorporated areas. The major industries are agriculture and government. Tourism related sales approach 20 percent of total sales for Fremont and Teton Counties. Tourism plays a much smaller role in Madison County. Personal income in the basin although increasing in real dollars is declining relative to the nation. This is also true for the state as a whole. The amount of underemployed is very high with from 50 to 62 percent of the families in each basin county under the near-poverty level (defined as two times the poverty level for a family of four, in 1990, 2 times $13,359 or $26,718).

The recreation resources in the upper basin are outstanding with not only national recognition but international recognition given to portions of the fishing resources. The geographic proximity to Yellowstone National Park, Grand Teton National Park and the Madison River area of Montana creates an area-wide recreation complex. Second home construction is prominent in Teton and Fremont Counties.

There is considerable hydropower development potential in the basin. There are state and federal constraints on hydropower development in the basin, particularly on the Henrys Fork River. The impact of hydropower development on other basin values needs to be considered on a case-by-case or river reach basis.

No protected river designation and associated prohibitions has any impact on vested rights. It is not the Board's intent to impact timber harvest, existing livestock watering practices, or the delivery of water to satisfy existing rights.

Recreational designations generally are conditioned to allow alterations of the streambed for existing utilities, roadways, diversion works, fishery enhancement facilities and public access facilities. Also allowed are new public agency fishery enhancement facilities and public, river-access facilities.

The Water Resource Board has weighed the conflicting uses for the streams in the basin, particularly where hydropower development is possible. Three proposed hydropower projects, at Island Park Dam, Ponds Lodge, and the Upper Teton project, are allowed in the plan. No other projects are recommended at this time. As is evident on the accompanying map, some potential hydropower sites in the basin are impacted by the Board's protected river designations. However, circumstances may change, and as project studies and proposed plans are completed they can be considered on a case-by-case basis. In addition, basin plans are reviewed every five years.

River Reach Designations

Approximately 200 miles of the basin's 3,000 miles of streams have been given state recreational or natural river protection. The reach designations are summarized below:

1. Targhee Creek, including West and East Forks: from source to National Forest boundary (12.5 miles) - Natural

2. Henrys Fork: Big Springs to Island Park Reservoir (11 miles) and the lower 2 miles of Henrys Lake Outlet - Recreational

3. Henrys Fork: Island Park Dam to Riverside Campground (16 miles) - Recreational

4. Golden Lake, Silver Lake and Thurman Creek from Golden Lake to mouth (4 miles) - Recreational

5. Henrys Fork: Riverside Campground to Hatchery Ford (4 miles) - Natural

6. Henrys Fork: 100 feet upstream of the Hatchery Ford boat ramp to a point 300 feet downstream of the ramp (approximately 400 feet) - Recreational

7. Henrys Fork: Hatchery Ford boat ramp to National Forest Boundary near Warm River (13 miles) - Natural

8. Henrys Fork: Forest Boundary near Warm River to Ashton Reservoir (8 miles) - Recreational

9. Henrys Fork: Ashton Dam to Falls River (6 miles) - Recreational

10. Buffalo River - (8) miles and Elk Creek (1 mile) - Recreational

11. Warm River: Partridge Creek to the Forest Route 153 bridge (approximately 1/4 mile) - Natural

12. Warm River: Forest Route 153 bridge area (approximately 200 feet) - Recreational

13. Warm River: Forest Route 153 bridge to Forest Route 154 bridge (7 miles) - Natural

14. Warm River: Forest Route 154 bridge area (approximately 200 feet) - Recreational

15. Warm River: Forest Route 154 bridge to Warm River Campground (7 miles) - Natural

16. Robinson Creek: from Yellowstone Park boundary to Forest Route 241 bridge (10 miles) - Natural

17. Robinson Creek: Forest Route 241 bridge to mouth (4 miles) - Recreational

18. Rock Creek: from Yellowstone Park boundary to mouth (9 miles) - Recreational

19. Falls River: Idaho border to a point 100 feet upstream of the Yellowstone Diversion Dam (7 miles) - Natural

20. Falls River: from 100 feet upstream of the Yellowstone Diversion Dam to Kirkham Bridge (11 miles) - Recreational

21. Boone Creek: Idaho border to mouth (4 miles) - Natural

22. Conant Creek: Idaho border to National Forest boundary (6 miles) - Natural

23. Conant Creek: National Forest boundary to Conant Creek diversion structure (3 miles) - Recreational

24. Teton River: Trail Creek to Highway 33 (14 miles) - Recreational

25. Teton River: Highway 33 to Felt Dam (11 miles) - Recreational

26. Teton Creek: from the springs near Highway 33 to mouth (3 miles) - Recreational

27. Fox Creek: from the springs to mouth (2.5 miles) - Recreational

28. Badger Creek: from the springs to mouth (3 miles) - Recreational

29. Bitch Creek: Idaho Border to the railroad trestle (5 miles) - Natural

30. Bitch Creek: Railroad trestle to Highway 32 (2 miles) - Recreational

31. Bitch Creek: Highway 32 to mouth (7.5 miles) - Natural

Recommendations

1. Encourage water resource-related economic development funding for private, city, county, state and federal projects.
2. Provide minimum stream flows where necessary to protect existing uses and values.
3. All regulatory agencies should seek to protect riparian areas.
4. Encourage the screening of irrigation diversion structures to protect fishery values,where necessary or appropriate.
5. The development of new irrigation is kept as a goal and shall be encouraged through state actions where environmental values can be retained.
6. Develop programs or incentives to make water conservation more attractive to water users.
7. Cooperative basin planning is encouraged, particularly where management entities have overlapping interests.
8. Having adopted a plan for the Henrys Fork Basin, the State will oppose actions by other entities which do not recognize and are not compatible with the State's plan.
9. Having identified river reaches where the state wants the construction of hydropower projects prohibited, the state recommends modification of the Northwest Power Planning Council's protected areas designations to coincide with the river reaches identified in the basin plan.
10. Flood control studies are needed on several river reaches.
11. Encourage water conservation and the use of water bank water, in lieu of new impoundments, as a source of additional water.
12. Study the availability of the ground-water resource in the plateau areas east of St. Anthony and in the Canyon Creek area.
13. Water yield, water quality, and water development opportunities should be a planning consideration by the U.S. Forest Service and U.S. Bureau of Land Management.
14. The state should seek to insure sufficient flow in the tributaries to Henrys Lake and the tributaries to the Teton River to provide spawning habitat for the resident fishery.
15. Support the efforts of the Division of Environmental Quality, Fremont County, the Yellowstone Soil Conservation District, Idhao Department of Fish and Game, and the Henrys Lake Foundation to improve the water quality in Henrys Lake and its tributaries.
16. The state should reexamine the role of artificial recharge within the basin. Earlier studies in the Egin Bench area can provide direction to the study effort.
17. The following waterways have recreational values that deserve special recognition and stringent application of existing regulatory authorities whenever new stream-altering activities are proposed:
    Henrys Fork: confluence with Falls River to mouth

Falls River: Kirkham Bridge to mouth
Teton river: Bitch Creek to North Branch (Fork) - South Branch (Fork) at point of division
Teton River: North Branch (Fork)
Teton River: South Branch (Fork)

Water Budget - Henrys Fork Basin

Drainage Area	3,220 square miles	
Average Precipitation	24.1 inches	4,139,000 ac-ft
Average River Outflow	2,100 cfs	1,407,000 ac-ft
Surface Diversions:		
Madison and Fremont Co.- Watermaster Records		1,100,000 ac-ft
Irrigation Consumption	300,000 ac-ft	
Return Flow	100,000 ac-ft	(100,000 ac-ft)
Ground-water Recharge	700,000 ac-ft	
Other Madison and Fremont Co. Consumption		100,000 ac-ft
Teton County Consumption		100,000 ac-ft
Ground-water Consumption (all counties)		200,000 ac-ft
Natural and Dry-farm Evapotranspiration plus Ground-water Recharge		1,300,000 ac-ft

Annual Flows (Adjusted to 1985 Development Levels)

(1000 acre-feet)

	1934	1977	Average	1984
Henrys Fork near Lake	33	37	39	82
Henrys Fork below Island Park	290	460	429	785
Falls River near Squirrel	357	385	564	831
Henrys Fork near Ashton	722	1087	1068	1714
Teton River above damsite	289	338	561	921
Teton River near St. Anthony	320	356	575	931
Henrys Fork near Rexburg	436	1019	1407	3001

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Executive Summary

This component of the Comprehensive State Water Plan is prepared by the Idaho Water Resource Board in keeping with their constitutional and legislative charge to formulate and implement a state water plan. This portion of the water plan is prepared for the entire part of the Henrys Fork basin in Idaho including the Falls River and Teton River drainage basins. The basin extends from the Idaho border to the Henrys Fork junction with the South Fork Snake River north of Idaho Falls.

In 1988 the Idaho Legislature directed that the main stem Henrys Fork be studied from its origin at Henrys Lake to Ashton Reservoir. The study was expanded to include the tributary streams and lower river area because of the requirement to adopt a comprehensive water plan for the state and the provision for that plan to be based on geographic areas.

Each river or basin plan, which is a component of the state water plan, may identify rivers which are designated as state protected rivers. This plan has no direct impact on existing irrigation rights and uses, timber harvest, stockwater use, or other vested rights. In river reaches designated for protection, the purpose of the plan is to protect the streambed from disturbances that are not in the public interest. It is not intended that this plan be used to justify federal wild, scenic or recreational river designations of any of the Henrys Fork basin waterways.

This plan is the result of much thought, study, research and public input. The local advisory group was of great value in developing the plan. It was a team effort with many participants.

The Henrys Fork plan describes and evaluates the water resources and related economic, cultural, and natural resources of the basin. The planning process is outlined and constraints identified. The goals and recommendations of the Water Resource Board are presented relative to improving, developing and conserving the water resource uses of the Henrys Fork basin. Each resource element has been addressed in the plan. The goals of the plan seek to ensure future water resource use that will complement and supplement State goals directed toward maintaining Idaho's high "quality of life."

The Henrys Fork is a major tributary of the Snake River draining about 2,700 square miles in Idaho plus 500 square miles of Wyoming. Over 50 percent of the basin is public land. The average estimated amount of water entering the basin each year as precipitation is nearly 4,100,000 acre-feet. The amount leaving the basin as the annual flow for the Henrys Fork is 1,400,000 acre-feet. An additional 700,000 acre-feet leave the basin as ground-water outflow. 500,000 acre-feet of surface water and 200,000 acre-feet of ground water are consumptively used within the basin. The remaining 1,300,000 acre-feet is consumed through natural evapotranspiration. These averages are adequate to meet current beneficial uses, and to support some economic growth. There, however, are problems with the great annual variability of the water supply.

General water quality of both ground and surface sources within the basin is good. Further efforts to improve water quality will likely be directed at lower basin irrigation return flow and control of recreation subdivision effluent.

The basin population is 38,050 (14 per square mile) with 56 percent located in incorporated areas. The major industries are agriculture and government. Tourism related sales approach 20 percent of total sales for Fremont and Teton Counties. Tourism plays a much smaller role in Madison County. Personal income in the basin although increasing in real dollars is declining relative to the nation. This is also true for the state as a whole. The amount of underemployed is very high with from 50 to 62 percent of the families in each basin county under the near-poverty level (defined as two times the poverty level for a family of four, in 1990, 2 times $13,359 or $26,718).

The recreation resources in the upper basin are outstanding with not only national recognition but international recognition given to portions of the fishing resources. The geographic proximity to Yellowstone National Park, Grand Teton National Park and the Madison River area of Montana creates an area-wide recreation complex. Second home construction is prominent in Teton and Fremont Counties.

There is considerable hydropower development potential in the basin. There are state and federal constraints on hydropower development in the basin, particularly on the Henrys Fork River. The impact of hydropower development on other basin values needs to be considered on a case-by-case or river reach basis.

No protected river designation and associated prohibitions has any impact on vested rights. It is not the Board's intent to impact timber harvest, existing livestock watering practices, or the delivery of water to satisfy existing rights.

Recreational designations generally are conditioned to allow alterations of the streambed for existing utilities, roadways, diversion works, fishery enhancement facilities and public access facilities. Also allowed are new public agency fishery enhancement facilities and public, river-access facilities.

The Water Resource Board has weighed the conflicting uses for the streams in the basin, particularly where hydropower development is possible. Three proposed hydropower projects, at Island Park Dam, Ponds Lodge, and the Upper Teton project, are allowed in the plan. No other projects are recommended at this time. As is evident on the accompanying map, some potential hydropower sites in the basin are impacted by the Board's protected river designations. However, circumstances may change, and as project studies and proposed plans are completed they can be considered on a case-by-case basis. In addition, basin plans are reviewed every five years.

River Reach Designations

Approximately 200 miles of the basin's 3,000 miles of streams have been given state recreational or natural river protection. The reach designations are summarized below:

1. Targhee Creek, including West and East Forks: from source to National Forest boundary (12.5 miles) - Natural

2. Henrys Fork: Big Springs to Island Park Reservoir (11 miles) and the lower 2 miles of Henrys Lake Outlet - Recreational

3. Henrys Fork: Island Park Dam to Riverside Campground (16 miles) - Recreational

4. Golden Lake, Silver Lake and Thurman Creek from Golden Lake to mouth (4 miles) - Recreational

5. Henrys Fork: Riverside Campground to Hatchery Ford (4 miles) - Natural

6. Henrys Fork: 100 feet upstream of the Hatchery Ford boat ramp to a point 300 feet downstream of the ramp (approximately 400 feet) - Recreational

7. Henrys Fork: Hatchery Ford boat ramp to National Forest Boundary near Warm River (13 miles) - Natural

8. Henrys Fork: Forest Boundary near Warm River to Ashton Reservoir (8 miles) - Recreational

9. Henrys Fork: Ashton Dam to Falls River (6 miles) - Recreational

10. Buffalo River - (8) miles and Elk Creek (1 mile) - Recreational

11. Warm River: Partridge Creek to the Forest Route 153 bridge (approximately 1/4 mile) - Natural

12. Warm River: Forest Route 153 bridge area (approximately 200 feet) - Recreational

13. Warm River: Forest Route 153 bridge to Forest Route 154 bridge (7 miles) - Natural

14. Warm River: Forest Route 154 bridge area (approximately 200 feet) - Recreational

15. Warm River: Forest Route 154 bridge to Warm River Campground (7 miles) - Natural

16. Robinson Creek: from Yellowstone Park boundary to Forest Route 241 bridge (10 miles) - Natural

17. Robinson Creek: Forest Route 241 bridge to mouth (4 miles) - Recreational

18. Rock Creek: from Yellowstone Park boundary to mouth (9 miles) - Recreational

19. Falls River: Idaho border to a point 100 feet upstream of the Yellowstone Diversion Dam (7 miles) - Natural

20. Falls River: from 100 feet upstream of the Yellowstone Diversion Dam to Kirkham Bridge (11 miles) - Recreational

21. Boone Creek: Idaho border to mouth (4 miles) - Natural

22. Conant Creek: Idaho border to National Forest boundary (6 miles) - Natural

23. Conant Creek: National Forest boundary to Conant Creek diversion structure (3 miles) - Recreational

24. Teton River: Trail Creek to Highway 33 (14 miles) - Recreational

25. Teton River: Highway 33 to Felt Dam (11 miles) - Recreational

26. Teton Creek: from the springs near Highway 33 to mouth (3 miles) - Recreational

27. Fox Creek: from the springs to mouth (2.5 miles) - Recreational

28. Badger Creek: from the springs to mouth (3 miles) - Recreational

29. Bitch Creek: Idaho Border to the railroad trestle (5 miles) - Natural

30. Bitch Creek: Railroad trestle to Highway 32 (2 miles) - Recreational

31. Bitch Creek: Highway 32 to mouth (7.5 miles) - Natural

Recommendations

1. Encourage water resource-related economic development funding for private, city, county, state and federal projects.
2. Provide minimum stream flows where necessary to protect existing uses and values.
3. All regulatory agencies should seek to protect riparian areas.
4. Encourage the screening of irrigation diversion structures to protect fishery values,where necessary or appropriate.
5. The development of new irrigation is kept as a goal and shall be encouraged through state actions where environmental values can be retained.
6. Develop programs or incentives to make water conservation more attractive to water users.
7. Cooperative basin planning is encouraged, particularly where management entities have overlapping interests.
8. Having adopted a plan for the Henrys Fork Basin, the State will oppose actions by other entities which do not recognize and are not compatible with the State's plan.
9. Having identified river reaches where the state wants the construction of hydropower projects prohibited, the state recommends modification of the Northwest Power Planning Council's protected areas designations to coincide with the river reaches identified in the basin plan.
10. Flood control studies are needed on several river reaches.
11. Encourage water conservation and the use of water bank water, in lieu of new impoundments, as a source of additional water.
12. Study the availability of the ground-water resource in the plateau areas east of St. Anthony and in the Canyon Creek area.
13. Water yield, water quality, and water development opportunities should be a planning consideration by the U.S. Forest Service and U.S. Bureau of Land Management.
14. The state should seek to insure sufficient flow in the tributaries to Henrys Lake and the tributaries to the Teton River to provide spawning habitat for the resident fishery.
15. Support the efforts of the Division of Environmental Quality, Fremont County, the Yellowstone Soil Conservation District, Idhao Department of Fish and Game, and the Henrys Lake Foundation to improve the water quality in Henrys Lake and its tributaries.
16. The state should reexamine the role of artificial recharge within the basin. Earlier studies in the Egin Bench area can provide direction to the study effort.
17. The following waterways have recreational values that deserve special recognition and stringent application of existing regulatory authorities whenever new stream-altering activities are proposed:
    Henrys Fork: confluence with Falls River to mouth

Falls River: Kirkham Bridge to mouth
Teton river: Bitch Creek to North Branch (Fork) - South Branch (Fork) at point of division
Teton River: North Branch (Fork)
Teton River: South Branch (Fork)

Water Budget - Henrys Fork Basin

Drainage Area	3,220 square miles	
Average Precipitation	24.1 inches	4,139,000 ac-ft
Average River Outflow	2,100 cfs	1,407,000 ac-ft
Surface Diversions:		
Madison and Fremont Co.- Watermaster Records		1,100,000 ac-ft
Irrigation Consumption	300,000 ac-ft	
Return Flow	100,000 ac-ft	(100,000 ac-ft)
Ground-water Recharge	700,000 ac-ft	
Other Madison and Fremont Co. Consumption		100,000 ac-ft
Teton County Consumption		100,000 ac-ft
Ground-water Consumption (all counties)		200,000 ac-ft
Natural and Dry-farm Evapotranspiration plus Ground-water Recharge		1,300,000 ac-ft

Annual Flows (Adjusted to 1985 Development Levels)

(1000 acre-feet)

	1934	1977	Average	1984
Henrys Fork near Lake	33	37	39	82
Henrys Fork below Island Park	290	460	429	785
Falls River near Squirrel	357	385	564	831
Henrys Fork near Ashton	722	1087	1068	1714
Teton River above damsite	289	338	561	921
Teton River near St. Anthony	320	356	575	931
Henrys Fork near Rexburg	436	1019	1407	3001

INTRODUCTION

Authority

(1988 Idaho Session Laws 1091, c. 370, Section 1)
(Relating to the Development of a Comprehensive State Water Plan)

"The legislature finds and declares that a central component of state sovereignty is the inherent right of the state to regulate and to control the natural resources of the state. In a state such as Idaho, it is essential that this state exercise its full authority to manage its water. To that end, it is the purpose of this act to provide for the full exercise of all the state's rights and responsibilities to manage its water resource."

Idaho Code 42-1734A
1988 Update of 1965 Legislation

(1) "The Idaho Water Resource Board shall, subject to legislative approval, progressively formulate, adopt and implement a comprehensive state water plan for conservation, development, management and optimum use of all unappropriated water resources and waterways of this state in the public interest. As part of the comprehensive state water plan, the board may designate selected waterways as protected rivers as provided in this chapter . . . ."

(2) "The board may develop a comprehensive state water plan in stages based upon waterways, river basins, drainage areas, river reaches, ground-water aquifers, or other geographic considerations."

Idaho Code 42-1734H
1988 Update of 1965 Legislation

(1) "The board shall designate the following waterways as interim protected rivers pursuant to section 42-1734D, Idaho Code . . . . (e) Henry's Fork and the Snake River from its point of origin at Henry's Lake to the point of its confluence with the backwaters of Ashton Reservoir."

Acknowledgements

For this plan, a prime input has been the Henrys Fork advisory group listed in the methodology section. This group, made up of basin residents, was created to bring up issues as viewed by different segments of the basin population.

The help of many federal and state agencies is greatly appreciated. Excellent cooperation was received from the planners of the Targhee National Forest, Bob Williams and Maureen McBrien and their staff. Idaho Department of Fish and Game regional fishery manager Steve Elle at Idaho Falls gave significant early input along with several state office personnel. Idaho Department of Parks, Harriman State Park manager, Gene Eyraud, as well as the state office planner, Mary Lucachick, were quite helpful many times. Several personnel from the Idaho Division of Environment's Pocatello field office provided input and review assistance. Lastly, personnel from the U.S. Bureau of Reclamation in Boise and Burley were involved at different times, particularly early in the study when Harold Ward gave much help as a result of the Teton Project reanalysis.

Basin Description

This portion of the state water plan is prepared for the entire part of the Henrys Fork basin in Idaho including the Falls River and Teton River drainage basins. The basin extends from the Idaho border to the Henrys Fork junction with the South Fork Snake River north of Idaho Falls (Figures 1 and 2). The Henrys Fork is a major tributary of the Snake River draining about 2,700 square miles in Idaho plus 500 square miles of Wyoming. Over 50 percent of the basin is public land. The average estimated amount of water entering the basin each year as precipitation is nearly 4,100,000 acre-feet. The amount leaving the basin as the annual flow for the Henrys Fork is 1,400,000 acre-feet.

Goals

Broad Basin Goals

As set forth in Idaho Code 42-1734A(1):

1. Existing rights, established duties and relative priorities of water established in the Idaho Constitution shall be protected and preserved.

2. Optimum economic development shall be achieved by the integration and coordination of the use of water, the augmentation of existing supplies, and the protection of designated waterways for all beneficial uses.

3. Adequate and safe supplies for human consumption and maximum supplies for other beneficial uses shall be preserved and protected.

4. Minimum streamflow for aquatic life, recreation, aesthetics, minimization of pollution, and the protection and preservation of waterways shall be fostered and encouraged, and consideration shall be given to the development and protection of water recreation facilities.

5. Watershed conservation practices consistent with sound engineering and economic principles should be encouraged.

One must note that while optimum economic development is stipulated, minimum streamflows are also stipulated. Within this framework, specific basin goals are listed below.

Figure 1:
Location of Henrys Fork Basin

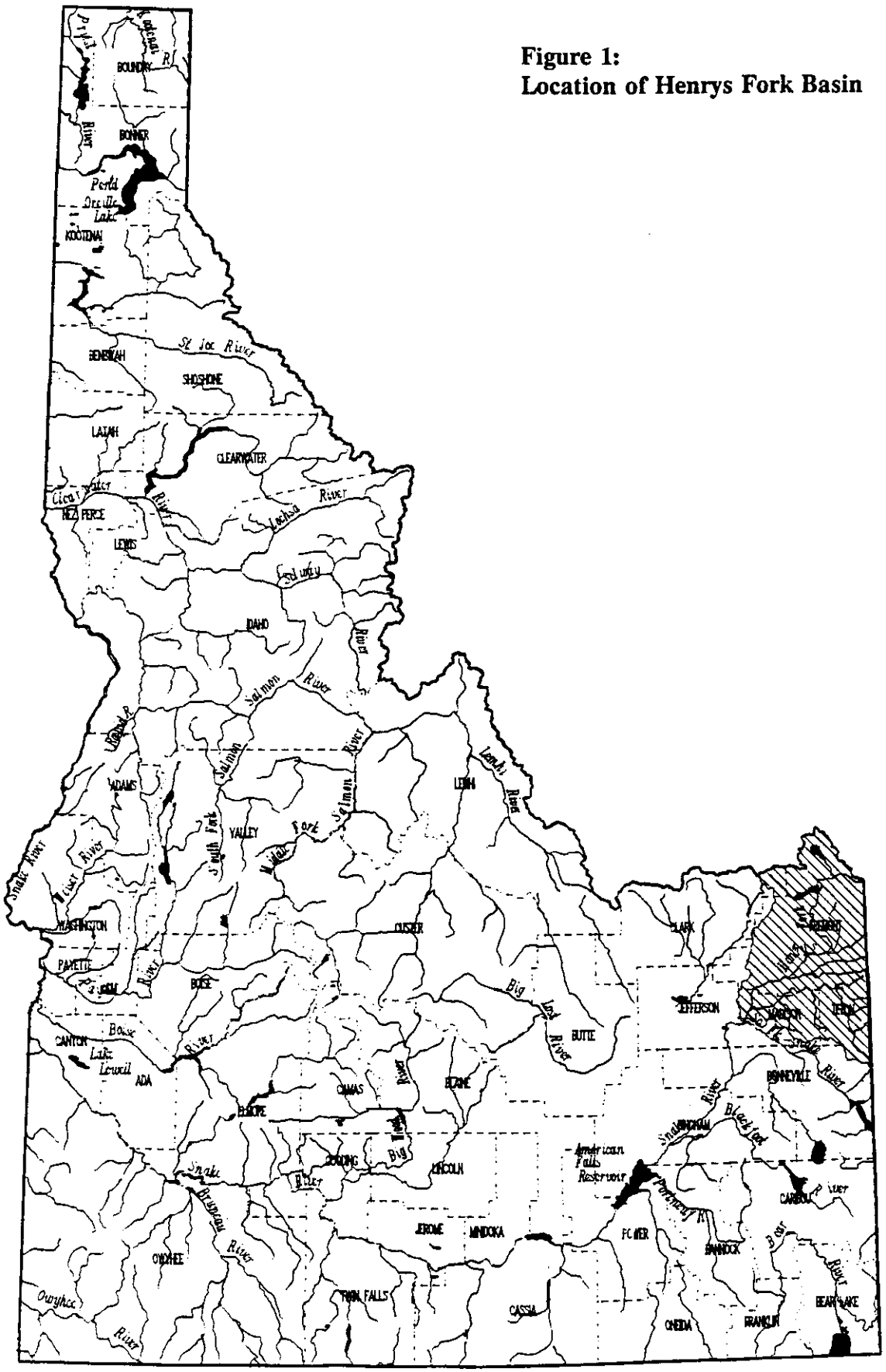
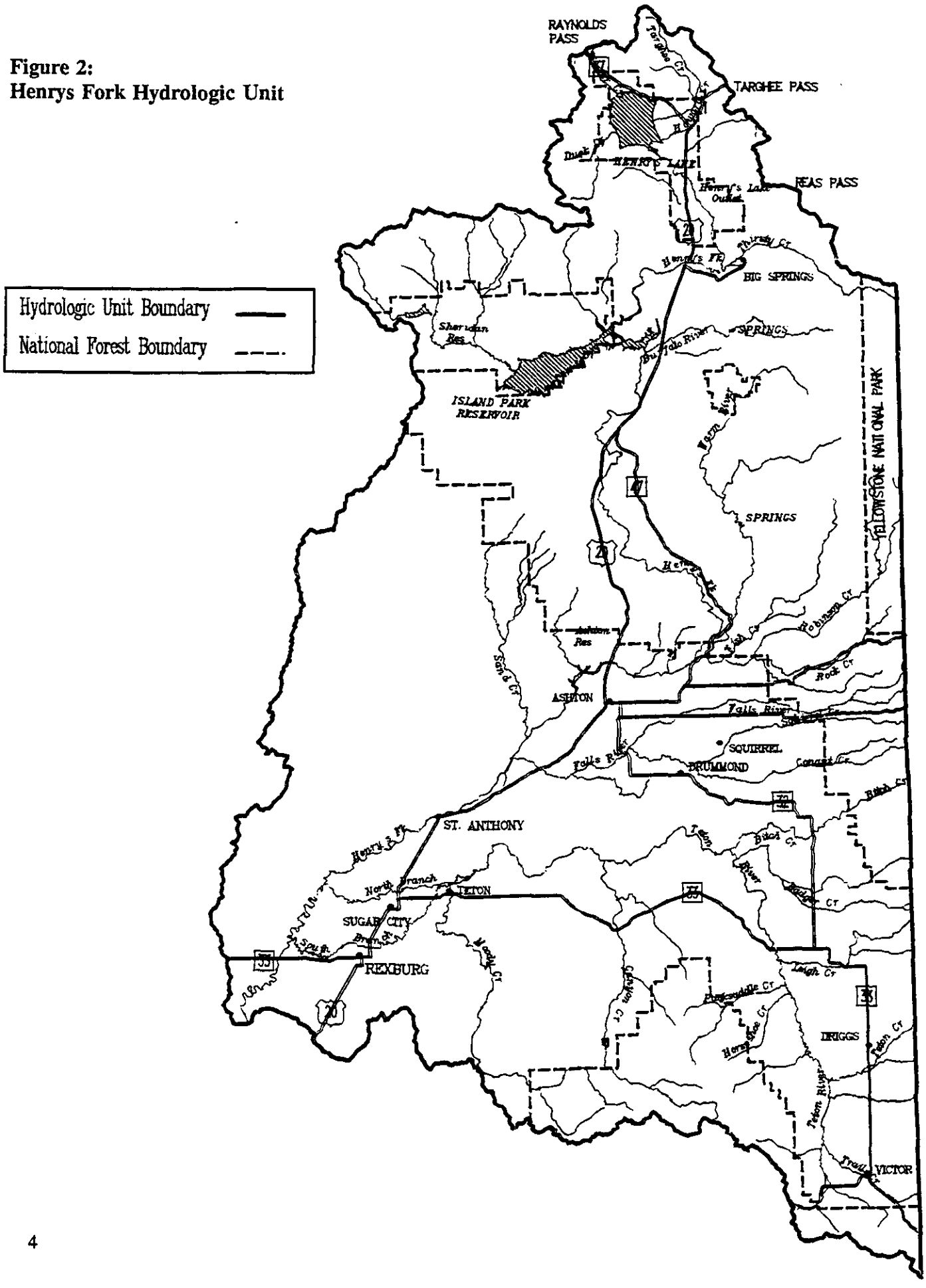


Figure 2:
Henrys Fork Hydrologic Unit



Cultural Features, Human Resources, and Economic Activity Goals

1. Increase efforts to identify and care for historic and archaeologic sites.

2. Encourage long-range, sustainable economic growth that is sensitive to environmental concerns.

Basin-wide population growth is above the state average. The county with the highest recreational resources, Fremont County, however, has not increased in the last ten years. The recent growth largely has been in Madison County, a trade center with a large regional junior college. Teton County had fair growth in the last twenty years, largely resulting from a spill-over effect from Jackson Hole including many employees from that area living in Teton County.

The average economic level in all counties of the basin presents a different picture. The average income level of the counties has been declining relative to the U.S. average for the last 20 years as has the Idaho average.

The percent of families below the poverty income level and below the near poverty income level is considerably greater in all basin counties than the average in Idaho. In 1980 in the United States, 32 percent of the families were below twice the family poverty income (2 x $12,800) while in Idaho 38 percent were below this income. In Fremont, Madison and Teton counties, the percent below this near poverty income level was 50, 60 and 62 percent respectively. Thus, there appears to be many underemployed people in the basin. Similarly, the poverty rates of roughly 20 to 25 percent are considerably higher than the Idaho average. The seasonal employment of two main industries, agriculture and tourism, is a major cause of underemployment. Unemployment levels in Madison and Teton counties are similar and are sometimes lower than the State of Idaho average. In Fremont County the rate has been about 50 percent higher than the Idaho average unemployment rate.

The main industry in Fremont and Teton counties is agriculture. For Madison County, Ricks College appears to be the main income generator while agricultural related activities are a close second. For Fremont County, tourism is a significant factor, estimated to be about 30 percent of the agricultural sector value.

The basin possesses sites and artifacts of archeological and historical significance. Archeological and cultural sites, buildings, and artifacts provide critical historical information, and provide a visual glimpse and geographic link to people and events of our collective past.

Fish and Wildlife Goal

1. Maintain and enhance fish and wildlife populations and their habitat.

The Henrys Fork basin is rich in fish and wildlife diversity and abundance. The area is wintering and nesting ground for species of concern, such as the grizzly bear, the trumpeter swan, and the bald eagle. The streams, lakes, and reservoirs provide excellent habitat for fish, and draw international recognition from the fishing public. Wetlands and riparian vegetation around lakes and along streams provide critical habitat for wildlife species and fish.

Wildlife contribute to the food supply, recreation, education, and aesthetic pleasure of human beings. Title 36, Idaho Code declares all wildlife within the state of Idaho to be the property of the State of Idaho, and "It shall be preserved, protected, perpetuated, and managed." Protection of fish

and wildlife habitat is noted in both the Idaho Code and the 1986 State Water Plan, and is declared a beneficial use of water.

Development projects must take into consideration fish passage and the maintenance of fish and wildlife habitat. Potential conflicts with water projects revolve around the amount of water left in the streambed, and disturbance of nesting, calving and wintering areas.

Natural Features and Scenic Values Goal

1. Protect outstanding natural features and scenic values in the basin.

The Henrys Fork basin is rich in scenic landscape and prominent natural features. In particular, the basin is noteworthy for features of the Island Park caldera, views of the Teton mountain range, many canyon environments and Mesa Falls. Aesthetic factors are highly significant in determining the quality of an environment for human beings. Visual experiences which give pleasure and enjoyment, enrich our lives. Natural features of the basin are also important by virtue of scarcity and scientific study value. Protection of scenic resources and natural features is in the public interest.

The scenic and aesthetic value of water is noted in both Idaho Code 67-4301 to 67-4311 and the 1986 State Water Plan, and it is declared a beneficial use of water. Planning should protect and mitigate negative impacts to scenic landscapes and natural features from project development or general growth.

Aquaculture Goal

1. Ensure proper effluent controls are required for aquaculture.

Aquaculture at a commercial level is possible in certain areas of the basin. There are State of Idaho fish production facilities and limited farm-pond fish production facilities in the basin. There appears to be a potential for commercial fish production in the south of Rexburg to Newdale area; although, the necessary water would need to be pumped. For any new facility, the benefits to the economy must be balanced against negative impacts from effluent releases.

Domestic, Commercial, Municipal, and Industrial Water (DCMI) Goal

1. Good quality water must be maintained to meet the present and future domestic, commercial, municipal and industrial water use needs.

DCMI water generally has the highest priority of use. In the past and in the foreseeable future, the DCMI use in the basin has been and will continue to be small when compared to other uses.

The broad basin goals suggest all DCMI needs should be preserved and protected. Since natural flow water is fully appropriated in drought years, new DCMI water would need to be provided by ground-water appropriation, by a long-term rental agreement, or by the purchase of natural flow or storage water. The general source has been ground water and likely will continue to be ground water for most new uses.

Irrigation Goals

1. Encourage orderly and efficient new irrigation development in the basin within the statutory guidelines.

2. Initiate practices to further increase the net economic return from the existing land.

3. Improve safety practices to reduce canal drownings.

Irrigation provides the means by which the majority of the economic activity in the basin takes place. Recently, more efficient use has been made of the basin's land and water through crop selection and conversion to labor- and water-efficient irrigation systems. Some expansion in the amount of irrigated acreage has occurred. The economic health of the area appears to be well served by a continuation of these trends. Related is the large amount of recharge to the ground water by gravity irrigation over shallow soils which benefits down gradient ground-water areas. There are, however, environmental impacts during low-flow periods from diversion amounts which approach the available water supply.

Livestock Water Goal

1. Meet present and future water needs for livestock.

The amount of livestock water use is very minor; the water generally comes from ground water, thus impacts are very small. Grazing livestock will use surface water sometimes from surface runoff catchment ponds but largely from streamflows. The stream banks provide good vegetative feed and thus draw livestock for more than the water. In many areas, concentrated livestock movement can cause stream-bank damage which leads to a loss of protected, shaded, slow water areas for fish, other aquatic life and waterfowl.

The instream watering of livestock is suggested in 1984 state legislation (Idaho Code 42-113) as a use that should be continued. The requiring of this livestock water study element in the 1988 comprehensive water plan legislation reiterates the same 1984 legislative concern. Neither reference suggests that some guidance of livestock into selected areas is not acceptable.

This guidance into selected areas for watering is the approach encouraged in high-value stream areas by the fish management agencies. The amount of higher value feed made not available may be small if fencing is placed close to the stream bank. There are nonfish related wildlife needs for wide stream-bank areas. These issues can influence the width of stream-bank fencing or related protection, but are not directly water related.

To file a water right claim or an application for a water right permit for instream or adjacent livestock watering, would clearly notify all other potential water users of the need to provide for livestock water needs. This is important mainly when the livestock use is downstream of potential upstream diversions.

Mining Goal

1. Make water available for mining if the project is environmentally acceptable, is in the local public interest, and meets the other water appropriation criteria.

Sand and gravel production for local construction, mainly for roads, is the primary mineral production activity throughout the basin. There is a minor amount of water used to wash soil particles from the sand and gravel.

There are significant coal deposits in the Big Hole Mountain area of the basin, but the coal beds dip steeply which would make open-pit mining very costly. Underground mining for coal cannot

compete with open-pit mines in the West. Oil-shale deposits also are located in the same areas as the coal deposits as are a significant amount of phosphate deposits. Other phosphate deposits are located in the Centennial Mountain area adjacent to Montana. The beds of all these deposits dip steeply making an open-pit mine quite costly in relation to deposits in other areas of the West. Large expenses would need to be made for environmental mitigation measures to mine these sedimentary materials by open-pit methods.

The geologic structures in the basin suggest there is oil and gas potential but extensive folding, fracturing and volcanism evidently has prevented the collection of oil and gas into economical reservoirs. There is one small decorative building stone quarry in the basin as well as a few small gem stone occurrences that interest the part-time collector.

In summary, the mining associated water use and potential use in the basin is very small.

Navigation

Navigation for commercial purposes currently does not take place in the basin and is not likely to take place. Navigation for recreational purposes occurs, and is discussed in the recreational opportunities section under a boating category. Thus any related goals, objectives and recommendations are within the recreational opportunities section.

Recreation Goal

1. Protect the quantity and quality of prime recreation waters.

Outdoor recreation can be a powerful directive force which broadens and develops individual personality and achievement. Recreation affords a change from daily routines and helps relieve stress. Idaho's quality of life is often measured by the abundance of opportunities for outdoor recreation. Idaho has progressed through history fully reliant on her natural resources, economically and recreationally. Recreation can be an important economic factor in the basin. Not only do tourists bring money into the area, but many residents take advantage of the recreational opportunities in the basin rather than travelling to areas outside the basin and spending money there.

Water Safety is a necessary aspect of recreation. As mentioned in the irrigation section, public awareness of water safety issues needs to be continually advocated. Along this line, learn-to-swim campaigns have been mentioned.

There is public interest in paving primary access roads to encourage greater use of recreational resources not located on major highways.

Timber, Grazing and Dry Farming Goals

1. Encourage timber production, grazing, and dry farming at a sustained yield with protective provisions for riparian areas, recreation corridors, fire control, and erosion control.

2. Water yield should be a planning consideration.

3. Encourage the use of best management practices throughout the basin.

Each of these resource industries deals primarily with land-use issues and generally are regulated by other agencies. The water-related issues deal mostly with water quality as influenced by land use

and precipitation runoff. Water yield from grazing and forested land is increased significantly when the vegetation shifts more to a grass type.

Energy Conservation Goal

1. Achieve energy conservation through cost-effective retrofits and insulation improvements.

2. Encourage local units of government to adopt stringent construction standards to ensure that new construction will be energy efficient.

Energy conservation can be a cost-effective method of providing new energy resources. Energy conservation is not done in one project by one entity, but by a total of many small projects by many entities. Education therefore becomes an important part of any energy conservation program.

There is an appreciable amount of energy conservation potential in the basin. Energy savings are possible by residential, commercial and irrigation electric users, and by some industrial users. Currently education and regulatory programs are causing some energy conservation activities. More emphasis is needed in both areas.

Geothermal Energy Goal

1. The use of ground-water heat pumps for space heating is encouraged, especially where warm ground water exists.

2. High temperature geothermal uses are encouraged if the resource can be developed without appreciable impact upon other resource uses.

Geothermal water is available in the basin, but, in general, only low-temperature uses are possible. Aquaculture uses are discussed in a separate section. Earlier views of a high-temperature resource in the Island Park area now are questioned. Any drilling for warm water in the agricultural portion of the basin, that is downstream from Warm River, is far enough removed from the Yellowstone National Park area that any connection of systems would be unlikely. Low temperature uses mostly would be for space heating and generally would need to make use of ground-water heat pumps.

Power Development Goals

1. The Board's position is that the acquisition of cost-effective energy conservation and efficiency improvements are the most desirable actions at this time. Within these bounds, it is the goal of the Idaho Water Resource Board to encourage energy conservation and the development of new hydropower at existing dams and diversion structures whenever feasible.

2. In keeping with the State Energy Plan, it is the goal of the Idaho Water Resource Board to allow development of hydropower sites that are economically feasible, compatible with existing water rights, and environmentally acceptable on streams not designated for protection, on rivers that are designated as "Recreational Rivers" where hydropower is not prohibited, and in off-stream areas.

3. Proposals to develop new hydropower sites on protected rivers will be evaluated on a case-by-case basis. Where the need for and benefit to the state outweigh negative consequences associated with the proposed development, the Board will support such development.

There are several potential small hydroelectric sites in the basin. Their location along the basin's main water courses, however, in most cases, conflicts with the instream use of the water during the summer recreation season. Many of these conflicts are in such high value recreational use areas that the conflicts are difficult to mitigate. Even for the sites where mitigation is possible, the amount of power able to be produced is small.

In addition to state water right approval, any new project on the Henrys Fork down to Ashton Reservoir would require not only Federal Energy Regulatory Commission approval along with the agencies they consult but also congressional approval (1986 - Public Law 99-495; 100 Stat. 1243). The Idaho Water Resource Board has a 1,000 cfs summer minimum flow right for the Mesa Falls area which would prevent water being used for hydroelectric production except for the use of Island Park Reservoir or Henrys Lake storage releases for much of the summer period. The 300 cfs winter minimum flow in the Mesa Falls area will not greatly constrain power development, nor will the year-round 300 cfs flow from the mouth of the Buffalo River to the Mesa Falls area.

There are several small sites in the basin that appear economically feasible. The likely method of development would be with a partial stream diversion to a canal paralleling the stream. Then after a few miles, there would be a penstock for the drop to a stream-bank powerhouse. Dams also could develop these hydropower sites, although, the environmental changes would be much greater than with the stream diversion-canal method. In the Basin Resources portion of this plan nearly 30 potential hydropower sites are identified.

Flood Control Goal

1. Lessen annual property value losses and other economic impacts resulting from repeated flooding through economically feasible and environmentally acceptable actions.

Flooding from the lower Teton River between the mouth of the Canyon and the junction with the Henrys Fork is a common occurrence. General area inundation occurs more frequently than every 10 years. The general area flooding is increased by low bridge design of about nine structures over the Teton River of which at least three have beams under water during a 10 year flood. These low bridges in turn accentuate the local flooding and could make the bridge owners liable for the increased water inundation damages.

The Teton River bank full capacity appears to be 2,000 cfs while the 100 year flood is 13,000 cfs. Currently, about 11,000 acres would be flooded in the 100 year flood with a present value and project limit in lieu of purchasing a flood easement of $16,000,000. The Federal Energy Management Agency stipulates that the 100 year flood is the standard to be used in zoning for new development. The Corps of Engineers chooses the size of a flood control project based on the greatest net economic benefits (damages prevented in excess of project costs) consistent with protecting the environment.

A recent federal reanalysis of the feasibility of rebuilding Teton Dam allocated $49,000,000 of the construction cost to flood control while the least cost flooded area purchase option is only near $16,000,000. This is one of several factors which makes Teton infeasible at this time.

There also is a flooding problem on the lower Henrys Fork, below Ashton Reservoir, with special problems from four miles below St. Anthony to the junction with the Snake River. Limited control could come from more dual flood control-irrigation space being provided in the upstream reservoirs and exchanged for straight irrigation storage in main-stem Snake River reservoirs. Study is needed of this area to more fully identify the problem and solutions.

A reconnaissance flood control study would help in identifying alternatives for managing the Teton River and Henrys Fork flooding. There appear to be some flood control actions that could be cost-effective. Any federal project would require at least 25 percent nonfederal cost sharing.

Water Quality Goals

1. The surface water quality in the area shall be kept at a high level consistent with good nutrient levels for high aquatic life production.

2. In areas where aquatic life production can be increased through water-quality improvement, remedial actions are recommended.

3. Ground water shall be maintained at a high level to allow for its use as a drinking water supply.

The water quality in the basin generally appears good. Moderate nutrient loads promote plant growth which in turn supports a highly productive fishery in the upper Henrys Fork, Island Park Reservoir, and Henrys Lake. However, there have been summer periods with excessive algae growth and subsequent oxygen depletion in the Henrys Fork. Treatment of wastes from summer homes in the upper Henrys Fork basin is one solution to the problem of excess algae production. Further study of the need to limit nutrient addition to the upper river, Henrys Lake, and Island Park Reservoir appears to be needed. In certain areas and at certain times, additional nutrients could be beneficial for more instream fish production.

The Bureau of Reclamation is providing assistance to the Idaho Department of Health and Welfare in the development of a water quality management plan for Henrys Lake. The purpose of the lake management plan is to provide alternatives for controlling the input and recycling of nutrients. Completion of the management plan is expected in April, 1993.

In the lower Henrys Fork basin shallow perched water levels create an environment easily contaminated by household waste water. Area-wide sampling has shown some well contamination. Further study appears to be warranted in the lower basin. A potentially similar condition occurs in the upper Teton Valley. A study may show the need to upgrade the wastewater treatment for many rural homes. Ground-water contamination may occur due to the downward migration of agricultural chemicals.

In areas of rhyolitic rock radium-226 levels in the drinking water and soil gas radon-222 levels in buildings may be elevated. These areas are located in portions of the Island Park plateau and in the higher plateau lands east of the Henrys Fork.

The impact of runoff from erodible, cropped agricultural land should continue to be controlled. These lands generally are located on sloping plateau benches. Best management practices for farming of the land has been the recommended control strategy. Education has been the tool to encourage the use of the best management practices. New practices are being established as improved chemicals and improved equipment are being developed. As new best management practices are established, the control of sheet (general broad-area) erosion will be under control in the few areas where added control now would be beneficial.

Water Supply and Water Conservation Goals

1. Encourage a greater efficiency of use of the basin's water supply, including possible ground-water recharge during average flow and high flow years.

During an average year 4,100,000 acre-feet of precipitation occurs in the basin, of which 1,300,000 acre-feet evaporates from the ground and water surface or transpires through vegetation at the place of precipitation (evapotranspiration). An additional 1,400,000 acre-feet moves out of the basin through surface outflow. The remaining water is accounted for as follows:

Surface Water Irrigation Consumption	= 500,000 AF
Ground Water Irrigation Consumption	= 200,000 AF
Ground Water Outflow	= 700,000 AF

The above averages are highly variable. For example, the yearly average of 1,410,000 acre-feet of surface outflow under present conditions has varied from 440,000 acre-feet to 2,370,000 acre-feet. This highly variable outflow generally is stored at American Falls Reservoir for downstream users unless exchanged for use by upstream users.

Low water years provide considerably less water for surface water irrigation. The maximum allowable shortage in the worst year of record under current Bureau of Reclamation planning criteria is a 50 percent shortage. Additionally, no more than an average shortage of 10 percent per year over 10 years should be allowed. For the basin the worst average shortage has been less than the maximum allowable (50 percent). There are, however, a few canals that have greater than the maximum shortage. Several remedial measures could help lessen the low-flow year impact.

In general, there are five sources which might provide water for additional use: (1) the water bank, (2) water conservation, (3) pumping ground water, (4) weather modification, and (5) off-stream surface water storage.

First, in many areas of the basin, especially in the lower Henrys Fork basin, more water could be made available through increased use of the rental pool. In the upper basin stream flows may not be sufficient to provide exchangeable water. (Exchanges now require the approval of the water right holder.)

Water conservation on presently irrigated lands and in related distribution systems is a second source of water. Sandy soils located over much of the lower Henrys Fork basin, coupled with gravity irrigation methods command high water use. Similarly, distribution systems through these areas lose considerable amounts of water. The most cost-effective method of conserving water would be to change field application systems from gravity to sprinkler. This conversion is currently happening in the Henrys Fork basin. If large areas are changed to sprinkler irrigation, large amounts of water can be conserved. Perhaps the most economical method to conserve water in distribution systems in the lower valley area where ground water is available at depths of under 100 feet, is to change the entire system to ground water pumps.

During average and good water years there are advantages to inefficient water use in the Henrys Fork basin. Water applied in the Henrys Fork basin recharges the Snake Plain aquifer and is used primarily outside the basin. An ideal system would promote surface water use and gravity irrigation methods in high and average flow years, and ground water use and sprinkler irrigation methods in low flow years. Water conservation which results in reduced irrigation diversions could have third party impacts and these must be investigated as part of water conservation activities.

A third source of water would be ground water. In many areas where new lands for irrigation are located, ground water may be available only in limited quantities. Complete ground water studies are needed in the area east of St. Anthony and north of the Teton River and north of Bitch Creek as

well as in the Canyon Creek area. In the lower Henrys Fork valley large amounts of ground water are available at low lifts for supplemental water use in that area and for exchange purposes if water right requirements can be met.

A fourth source of water is weather modification based on cloud seeding. The success is generally an increase of 10 to 15 percent in precipitation, yet the increase in runoff may be a little greater. This may be a very low cost method of providing additional water. For less than a region-wide water using group, new legislation may be needed to allow the implementing group to acquire use of the increased water. Special conditions will be needed to provide that the other water users are protected.

The fifth source of additional water is new surface water storage. Several off-stream sites have been identified in the plan. The sites generally would allow the water to be used on higher ground than the proposed on-stream storage at the Teton site. Any surface water site will have a late storage priority, thus development might need to include the purchase or rental of water in a main-stem Snake River reservoir. These are off-stream sites in the sense that most of the water would be moved from the Falls River or the Teton River. Conflicting development would best be encouraged to move to other areas. (As noted earlier, a recent reanalysis of the feasibility of rebuilding Teton Dam has shown a federal project there not to be feasible. Future water needs may show a different result, even through the yield of water from the reservoir must be augmented during low flow years.)

A limited review of a privately developed Teton project may be helpful not only at this time but also in the future. Over time the need for electric energy increases. Thus, significant hydroelectric benefits from a Teton project when coupled with water storage and flood control benefits may make the project feasible in the future.

Planning Methodology

In 1988 the Idaho Legislature amended state water planning requirements and provided for the development of a comprehensive State Water Plan (Chapter 17, Title 42, Idaho Code). The State Water Plan may be generated in stages by developing comprehensive plans for each river basin, drainage area, river reach, ground-water aquifer, or other geographic area. The resources to be described in each plan are:

- Water Supply
- Timber
- Flood Control
- Mining
- Irrigation
- Livestock Watering
- Power Development
- Scenic Values
- Energy Conservation
- Natural or Cultural Features
- Fish and Wildlife
- Domestic, Commercial, Municipal, and Industrial Uses
- Recreational Opportunities
- Navigation
- Other Aspects of Environmental Quality and Economic Development

Each item is addressed in the following pages as they relate to the Henrys Fork basin.

The 1988 legislation directed the Idaho Water Resource Board to designate seven river reaches in the state as Interim Protected Rivers. One of these reaches was the Henrys Fork from its point of origin at Henry's Lake to the point of its confluence with the backwaters of Ashton Reservoir. This designation served to prohibit many types of activity within the river for a period of two years. The Water Board was charged with using the two years to develop a detailed plan for the area. Since interim protection for the Henrys Fork lasted only until July 1, 1990, the Department of Water Resources petitioned the legislature for an extension of the planning process. The Idaho Legislature extended the interim protection period through December, 1991.

On January 3, 1992 the Idaho Water Resource Board adopted a plan for the Henrys Fork Basin. A bill approving the Board's plan passed the Idaho Senate, but was defeated in the House of Representatives. In order to provide some state protection to waterways in the basin, the Idaho Legislature directed the Water Resource Board to place most of the Henrys Fork and portions of the Warm, Teton, and Falls Rivers as well as the Idaho portion of Bitch Creek in interim protection. This interim period could not extend for more than 10 days after the conclusion of the 1994 legislative session. On April 17, 1992 the Board placed the designated streams in interim protection until 10 days after the 1993 legislative session or until a new comprehensive state water plan for the Henrys Fork Basin was adopted by the Water Resource Board.

The Water Resource Board proposed changes to the plan they had adopted in January and circulated this new version for public review. Information meetings to inform the public about the proposed changes were held in Driggs, Ashton, and Rexburg on September 14, 15, and 16, 1992 respectively. Formal hearings were held in Idaho Falls on October 21 and St. Anthony on October 22, 1992. After reviewing the public comment, the Water Resource Board made further revisions to the plan and adopted this version on December 3, 1992.

The planning statute provides for the designation of protected rivers in the Comprehensive State Water Plan, based on a determination by the Idaho Water Resource Board (IWRB) that the value of preserving a waterway for particular uses outweighs that of developing the waterway for other beneficial uses. The protected designations are either as a Natural or Recreational River. A Natural River is defined as a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values, which is free of substantial existing man-made impoundments, dams or other structures, and of which the riparian areas are largely undeveloped, although accessible in places by trails and roads. A Recreational River must also possess outstanding fish and wildlife, recreation, geologic or aesthetic values, but the segment might include some man-made developments within the waterway or within the riparian area of the waterway. In Idaho's protected river designations the riparian area is defined by the legislation as the area within 100 feet of the mean highwater mark of a waterway. Man-made developments or the lack thereof in the riparian area is a factor to be considered in determining the eligibility of a stream for protected status. However, when streams are designated for protection, the associated prohibitions apply only to the streambed.

Eligibility for state protected river designation in the Henrys Fork basin was based solely on the relative significance of the reach as a public resource, for example, to be eligible for protection a reach must contain at least one "outstanding" fish and wildlife, recreational, aesthetic or geologic value. An initial attempt to assess these values in the Henrys Fork basin has been documented by the Pacific Northwest Rivers Study (1985). That study was a cooperative effort of the three northwest states, Montana, the Indian tribes, the federal natural resource agencies and northwest power

agencies. A matrix of stream segment assets was assembled based on that study, and updated as noted on the matrix (see Resource Evaluation section of report).

The matrix was used to help identify stream segments with "outstanding" natural and recreational resource values. In order to highlight outstanding stream segments in the Henrys Fork basin, screening criteria were applied to the matrix values. Stream segments in the Henrys Fork basin that met criteria for outstanding fish and wildlife, recreational, aesthetic, and geologic resource values are described in the Resource Evaluation Section. After eligibility was determined, an assessment of the effects of designation on other identified resource uses was undertaken.

By statute, in designating a Natural River, the Board shall prohibit the following activities within the streambed:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alteration of the streambed; and
- mineral or sand and gravel extraction within the streambed.

In designating a Recreational River, the Board shall determine which of the activities listed above shall be prohibited or may specify terms and conditions under which the listed activities may go forward.

To supply further direction for the river basin planning effort, the Idaho Water Resource Board established Planning Rules and Regulations. A provision of the Rules and Regulations states, "The Board shall seek the involvement of volunteers from the geographic area to be affected by a portion of the comprehensive water plan. These volunteers shall constitute a local advisory group that shall inform the Board of local concerns throughout the planning process."

On January 31, 1989, a public meeting held in St. Anthony, Idaho, announced the beginning of the river planning effort for the Henrys Fork basin. The need for persons to serve on the citizens advisory group was announced. Selected local citizens for the Henrys Fork Advisory Group were:

Paul Bowen, Rexburg - Member of Upper Snake River Fly Fishers
Ed Clark, Ashton - board member Fremont-Madison Irrigation District
Jan Jensen, Island Park - resort operator
Arnold Kunz, Victor - Teton County Commissioner, 1989-1991
Mike Lawson, St. Anthony - Henrys Fork Foundation
Robert Lee, Rexburg - president, Hydro-Idaho, Inc. and Golden West Irrigation Co.
Del Raybould, Rexburg - irrigation interest member
James Siddoway, Teton - Fremont County Commissioner
Ronald Stoddard, St. Anthony - Stoddard Lumber Company
Bruce Webster, Rexburg - Madison County Commissioner - 1989-1991
Cal Wickham, Ashton - past manager of Fall River Rural Electric Coop
Keith Kunz, Victor - Teton County Commissioner, 1991-present
Reed Sommer - Madison County Commissioner, 1991-present

The Henrys Fork Advisory Group provided guidance and insight into resource values, use, and potential, basin goals, and plan recommendations. Members were selected who represented conflicting user viewpoints. While balance is sought, consensus is not necessary since the group is advisory in nature and attempts to insure that all potential uses and conflicts are considered during the planning process. Advisory Group meetings were held in St. Anthony at the Fremont County Courthouse. Meeting dates were:

#1 - April 5, 1989
#2 - October 25, 1989
#3 - June 14, 1990
#4 - November 20, 1990
#5 - February 13, 1991
#6 - February 26, 1991
#7 - April 17, 1991

Prior to the formal hearing process, the Board held information meetings in Ashton, Rexburg, and Idaho Falls. Hearings were held in Ashton, Rexburg, Idaho Falls, Driggs, and St. Anthony. Board member J.D. Williams acted as hearing officer. Written comments were accepted as part of the hearing record for 92 days after the original notice of proposed action appeared. Oral testimony was provided by 114 persons. The Board received 249 written comments relating to the Henrys Fork Plan. The Board weighed competing uses for the water resources of the basin. The Board endeavors to balance uses so that public interest concerns are met while providing for the overall benefit of the state.

Amendments to the Plan

The Water Resource Board will amend the water plan when it determines that amendments are in the public interest. The Board will consider proposals to amend the plan from private parties as well as state agencies. In the event the Board determines that any such proposal has a substantial possibility of not impairing the values which were the basis of the protected river designation the Board shall follow the public hearing process and procedures required for the adoption of the original plan (Sections 42-1734A and B, Idaho Code). The Board shall determine whether or not to amend the plan after weighing the impact the uses allowed by the proposed amendment would have on the other uses and values which were the basis of the original protected river designation. In addition, the Board shall review and reevaluate the Comprehensive State Water Plan at least every five years (Section 42-1734(B)(7)). All amendments to the state water plan shall be submitted for consideration of the Idaho Legislature as required by law (Section 42-1734B).

BASIN DESCRIPTION

General

The Henrys Fork basin is located in the northeast corner of Idaho. The basin includes the major portions of the counties of Fremont, Madison and Teton with their county seats of St. Anthony, Rexburg and Driggs. The main river systems are the Henrys Fork which originates in small streams which empty into Henrys Lake (the main stem of the Henrys Fork is usually described as originating at Big Springs), Falls River which originates in the southwest corner of Yellowstone National Park and the Teton River which partially originates on the west edge of Grand Teton National Park.

The major part of the upper Henrys Fork basin consists of a high mountain plateau with lodgepole pine and large open meadows. The upper portion of the Teton River basin largely consists of a wide high-mountain valley. The middle portion of the Henrys Fork basin consists largely of undulating plateau lands. The lower basin consists of the relatively flat upper end of the Snake River Plain.

The Henrys Fork of the Snake River drains 1,750,000 acres. From Henrys Lake, set in a pocket of the continental divide at 6,500 feet, the stream drains to the south-southwest and flows for 117 miles before entering the Snake River. Basin elevations vary from about 4,800 feet in the southern part of the Snake River to over 10,000 feet at the mountain peaks to the north.

The basin has one of Idaho's colder climates. Freeze-free periods at the Ashton and Island Park climatological stations are 90 and 45 days. Annual precipitation, much of which falls as snow, averages 16.9 and 28.9 inches at Ashton and Island Park Dam. Annual precipitation varies from 10 inches in the lowlands to 60 inches in the mountains.

The upper Henrys Fork basin is at the eastern end of the Snake River Plain, a downwarped feature arcing across southern Idaho into Wyoming. As the plain was downwarped, volcanism and sedimentation filled it with basalt, rhyolites, and sedimentary deposits. A large shield volcano formed in the south-central part of the Henrys Fork basin and later collapsed to form the Island Park caldera, an elliptical bowl approximately 18 by 23 miles. Basalt flows later impinged on the caldera's rim from the south while rhyolitic flows reached the rim from the Yellowstone plateau and filled the bowl along with other sediment. The upland agricultural soils are almost all silt loams derived from wind-blown sediment. Valley soils are generally alluvial in origin.

Land use is timber production and grazing in the uplands with both irrigated and dryland farming in the lower plains. In 1975 forested land comprised 9 percent of the basin area, rangeland 26 percent, irrigated cropland 15 percent, dryland agriculture 13 percent and other uses 7 percent. Irrigated cropland in the Henrys Fork basin amounts to about 321,000 acres planted primarily to grain, potatoes and hay. The bulk of the irrigated lands lie on both sides of the lower Henrys Fork and lower Teton River between the Snake River and Ashton. Land use is shown on Figure 3.

The basin is sparsely populated with a total of 38,000. The principal cities of Rexburg, St. Anthony, Ashton, Driggs and Sugar City had 1990 populations of 13,000 in Rexburg and 8,000 in the remaining towns. Urbanization onto agricultural lands is not considered a problem in the basin. Summer tourist influxes are heavy and contribute substantially to sewage loading of surface streams. Land ownership is shown below in Table 1 and delineated on Figure 4.

Table 1. Land Ownership

Ownership	Acres	% Basin
Private	763,485	46%
Forest Service	643,259	39%
BLM	120,311	7%
National Park Service	36,722	2%
State	86,620	5%
Water	18,738	1%

Henrys Lake is a very shallow natural lake which has been raised by the construction of a low dam at the outlet allowing approximately 12 feet of water storage capacity. With the high elevation, Henrys Lake is a relatively cold lake. Ice cover persists from mid-November to late April in most years. Some stagnation occurs beneath the ice, but dissolved oxygen usually does not fall below 3 to 4 mg/l. Thermal stratification is slight since the shallow lake undergoes nearly continuous mixing throughout the summer. Organic loading and algae production are high, so even with no thermal stratification, oxygen depletion will occur in deeper waters (14-20 feet) during the warm summer-fall period. Algal blooms in Henrys Lake are very heavy. The colonial blue-green algae, *Gleotrichia* and *Aphanizomenon*, bloom every year through the summer. Near-surface concentrations of algae masses are swept downstream into the Henrys Fork River, thereby carrying high oxygen demand into that stream and significantly reducing its transparency above Island Park Reservoir.

Island Park Reservoir is also shallow, less than 50 feet in most places, and similar to Henrys Lake in mixing characteristics. Dissolved oxygen and temperature profiles show little stratification, indicating well mixed waters. Island Park Reservoir has a number of significant impacts on the Henrys Fork River. One study showed that median August temperature increased 7°F over the inflow (from 59° to 66°F); median August dissolved oxygen declined from over 9 to 7.5 mg/l; BOD doubled with passage through the reservoir (from algal production in the pool); August total phosphorus increased from 0.02 to 0.05 mg/l; Kjeldahl nitrogen increased from 0.23 to 0.37 mg/l; and ammonia increased from 0.01 to 0.08 mg/l.

Major tributaries in this reach, Buffalo River and Warm River, obtain most of their flow from groups of springs either at their heads or along their channels. These springs occur along the base of the steep-fronted bluffs of Yellowstone plateau rhyolite. The combined flow of these springs is about 600 cubic feet per second (cfs), or about 42 percent of the average discharge of the Henrys Fork near Ashton. These springs are large, two of them discharging more than 200 cfs.

After leaving Island Park Reservoir, the Henrys Fork cuts across the Island Park caldera before dropping off the plateau at Mesa Falls then flows to the south toward Ashton. Average stream gradient in this reach is a precipitous 26 feet per mile. Below Ashton the river levels out as it flows across the agricultural regions at an average gradient of 8 feet per mile.

The mean annual flow of the Henrys fork near the mouth is 1,407,000 acre-feet or 2,100 cfs with approximately one-third of that contributed by the Falls River and one-third by the Teton River. The flow range is extreme between wet and dry years; it varies from 600,000 acre-feet to 3,000,000 acre-feet. An additional estimated 1,000,000 acre-feet is recharged into the Snake Plain Aquifer and flows to the west.

Figure 3:
Land Use in the Henrys Fork Basin

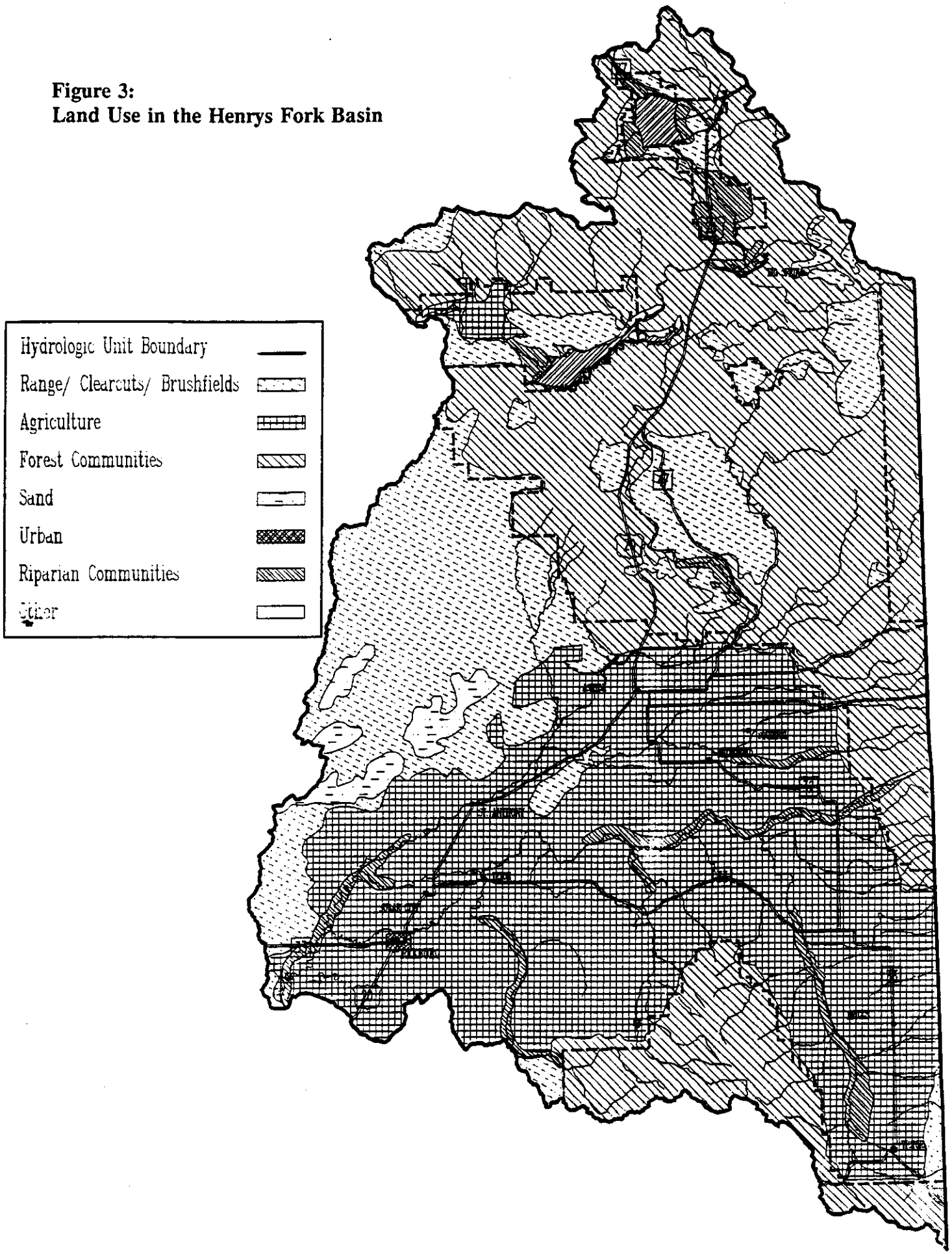
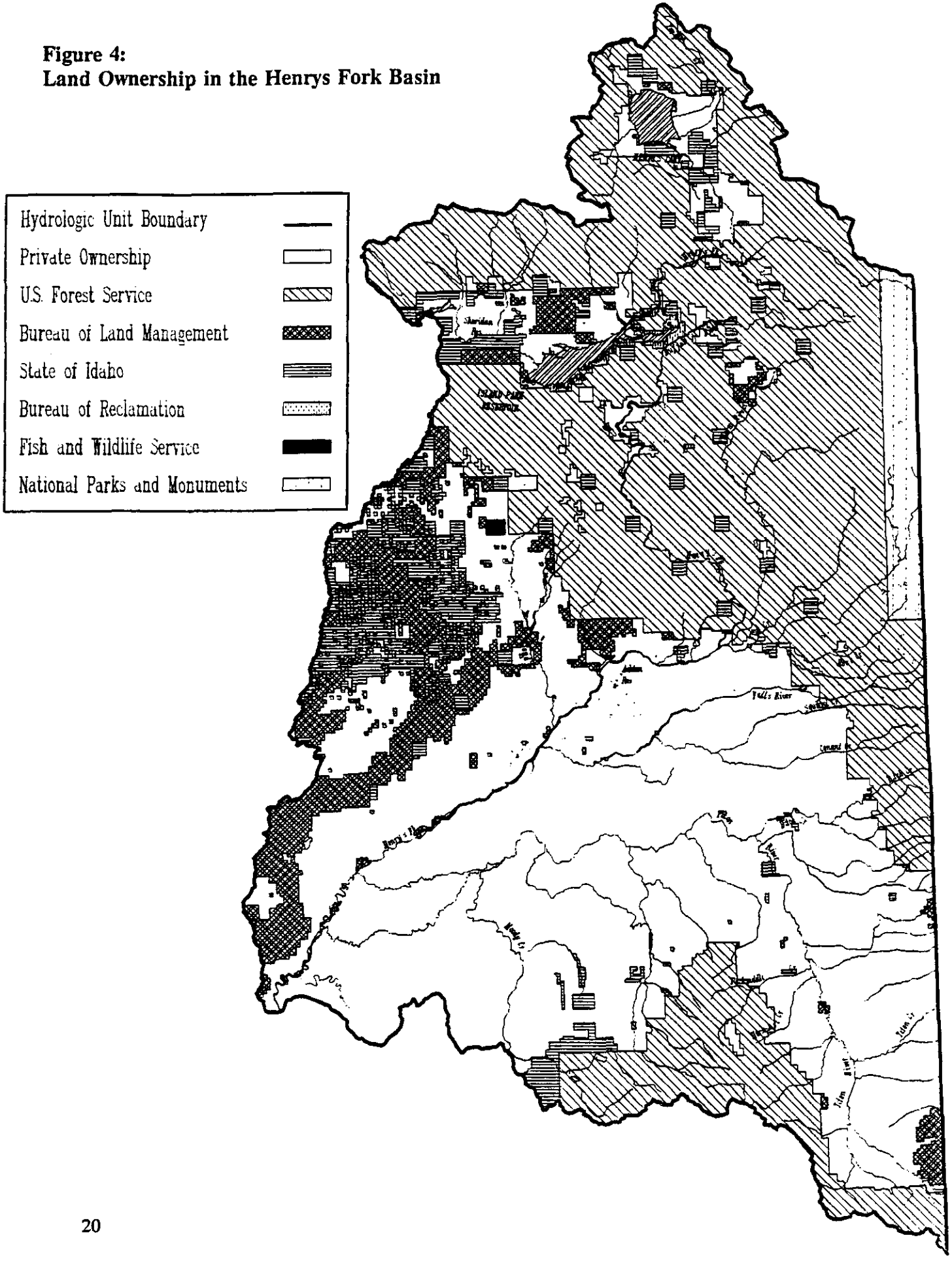


Figure 4:
Land Ownership in the Henrys Fork Basin



Source

Bennett, David, H., C. Michael Falter and Robert G. White. *Columbia Basin Water Withdrawal Environmental Review, Appendix D Fish Part II Snake River,* U.S. Army Corps of Engineers, Portland, District. 1980.

Early History

Evidence of early human presence in the lower Henrys Fork Valley coincides with findings in other parts of southern Idaho. Radiocarbon dating of artifacts from the Wilson Butte Cave in the Shoshone-Dietrich area shows the earliest known activity to be 14,500 before present (B.P. = 1950). The Jaguar Cave in the Blue Dome area of Birch Creek had artifacts dating back to 11,600 B.P.

After the introduction of the horse (about the year 1700), Shoshone and Bannock Indians traveled through the Henrys Fork area on elk hunts into Yellowstone Park via Targhee Pass. They established camps in the basin in the Island Park area and in the Teton Valley. Other tribes visited the area. The Blackfeet of Montana sent raiding parties into the area. The Crow, Flathead, and Nez Perce made summer visits to the area using Targhee, Reas, and Raynold Passes.

In 1808, John Colter, after leaving the 1805-06 Lewis and Clark expedition, was the first white to enter the region. His entrance was via the Teton Basin later referred to as Pierre's Hole. (Pierre Tevanitagon, an Iroquois Indian who traveled through the area about 1819, was an employee of Donald McKenzie of the British North West Company headquartered near present day Lewiston, Idaho.) John Colter was employed by Manual Liza, founder of the Missouri Fur Company, a rival of the British Hudson Bay Company and the North West Company.

In 1810, Andrew Henry, also of the Missouri Fur Company, built Fort Henry (a cabin about 10 x 10 feet) near St. Anthony. The company established the rendezvous system (1825-1840) which gave the Americans advantages over the British, although the British were active in southeast Idaho under Peter Skene Ogden and Donald McKenzie. An area-wide rendezvous site, used both in 1829 and in 1832, was Pierre's Hole or the Upper Teton Valley. Fort Henry was abandoned in 1856 because of Indian hostilities, largely from the Crow of Montana. A notable trapper, Richard "Beaver Dick" Leigh and Jenny, his Shoshone wife, settled and trapped in the area starting in the 1840's until 1876 when Jenny and all their children died of smallpox.

In 1868, Gilman Sawtell set up base near Sawtell Peak. A few other individuals subsequently settled in the area. The Bannock Chief, Targhee, whose name is used throughout the area, was killed by the Crow in the winter of 1871-1872 after signing the Fort Bridger Treaty of 1868. In 1877, the upper Henrys Fork was crossed by Chief Joseph and the Nez Perce as they were eluding the troops of General Howard.

Although Brigham Young visited the valley in 1852 following the 1847 westward migration, the possibilities of early frost delayed Latter-Day Saints (LDS) settlement until 1879. LDS settlers in the lower Teton River area near Rexburg built a diversion for the McCormick-Rowe Canal from the South Branch of the Teton River and another for the Teton Island Feeder Canal from the North Branch of the Teton River. In the upper Snake River area, two irrigation diversions predate these canals. The first was in 1874 from Willow Creek, above Ririe Reservoir but below Tex Creek, and a second diversion in 1876 from lower Willow Creek, south of the settlement of Ririe. In the Teton Valley the first permanent settlement is reported to have been in 1882 by non-LDS. In the Falls River vicinity, the LDS settled at Chester in 1885.

Yellowstone Park was created in 1872, predating the adjacent agricultural settlements. The Targhee National Forest was created in 1903 out of portions of the Forest Reserves set aside in 1891. Grand Teton National Park was created in 1929.

Demographics

A general decrease in rural population, prevalent across the United States since the turn of the century, is reflected in population figures for the three Henrys Fork Basin counties between 1920 and 1960. Beginning in the 1960s, but specifically through the 1970s, the U.S. observed an increase in rural population (Table 2 and 3). The shift is attributed to a strong agricultural economy, industrial development in rural areas, and a desire for rural settings and small towns. Population increase in the three basin counties since 1970 reflects this change and general growth in the western U.S., particularly the Pacific and Mountain states. In the 1980s population growth focused again on urban areas, but rural "amenity rich" counties, defined as providing recreation opportunity, scenic beauty, services, and/or cultural amenities, continued to experience growth.

Most of the population growth in the basin has been in Rexburg and may be associated with growth at Ricks College. Likewise, the secondary home market and the tourism sector in upper Fremont and Teton counties has supported the growth of Rexburg as a trade center. Recent growth in Teton County is primarily from retirees who are moving permanently into their "recreation" homesites. In Teton County most of the new residents are from out-of-state. In Fremont County, where growth slowed significantly in the 1980s, retirees from Eastern Idaho, primarily Idaho Falls and Pocatello, are the predominant newcomers. The INEL workforce is also moving into the basin (Hefferon, 1991; see also Table 4 for town population figures).

Table 2. Population Levels

	1920	1930	1940	1950	1960	1970	1980	1990	2000[a]	2010[a]
United States	106,000,000	123,000,000	132,000,000	151,000,000	179,000,000	203,000,000	227,000,000	248,000,000	268,000,000	282,000,000
Idaho	432,000	445,000	525,000	589,000	667,000	713,000	944,000	1,006,000	1,047,000	1,079,000
									[c]1,107,000	[c]1,198,000
Fremont	10,380	8,320	9,190	9,160	8,680	8,710	10,810	10,937	11,400	12,500
Madison	9,170	9,920	10,300	9,350	9,420	13,450	19,580	23,674	27,400	31,100
Teton	3,920	3,570	3,600	3,200	2,640	2,350	2,890	3,439	4,000	4,700
TOTAL BASIN	23,470	21,810	23,090	21,710	20,740	23,510	33,280	38,050	42,800	48,300

[a] Bonneville Power Administration county projections published in January, 1990.

[b] The number of second-home sites in Fremont County (1,500) with 2.75 people per house suggests an additional 4,000 summer residents plus another estimated 4,000 short-term visitors for a total summer increase of 8,000 people, mostly in the Island Park area. The total summer increase for Teton County is estimated to be nearly 1,000.

[c] Idaho projections by Northwest Power Planning Council in the 1989 Supplemental to 1986 Northwest Conservation and Electric Power Plan, Volume Two, medium-low scenario.

Sources: County figures are from the Idaho Almanac from Idaho Division of Tourism and Industrial Development, 1977, p. 315-316; United States and Idaho projections are from the U.S. Department of Commerce Bureau of Census, Current Population Reports, Population Estimates and Projections of the Population of the States by Age, Sex and Race 1988 to 2010, Table 5; county figures for 1990 are from preliminary 1990 census data; county projections use the 1980 to 1990 rate of change.

Table 3. Population Rate of Change in Percent

	1920-30	1930-40	1940-50	1950-60	1960-70	1970-80	1980-90	1990-2000	2000-2010
United States	16	7	14	19	13	12	9	8	5
Idaho	3	18	12	13	7	32	7	4	3
								10	8
Fremont	-4	4	-9	-7	0	24	1	5	10
Madison	-9	10	0	3	43	46	21	16	14
Teton	-9	1	-11	-18	-11	23	18	21	15
TOTAL BASIN	-7	6	-9	-4	18	36	14	13	13

Table 4. Growth of Henrys Fork Basin Towns

	1960	1970	1980	1990
Fremont	8,680	8,710	10,813	10,937
Ashton	1,242	1,187	1,219	1,114
Drummond	31	13	25	37
Island Park	53	136	154	159
Newdale	272	267	329	377
Parker	284	266	262	288
St. Anthony	2,700	2,877	3,212	3,010
Teton	399	390	559	570
Warm River	20	19	2	9
Madison	9,420	13,450	19,480	23,674
Rexburg	4,767	8,272	11,559	14,302
Sugar City	584	617	1,022	1,275
Teton	2,640	2,350	2,897	3,439
Driggs	824	727	727	846
Tetonia	194	176	191	132
Victor	240	241	323	292

Source: U.S. Department of Commerce, Bureau of Census.

Birth rates shown in Table 5 are one element in the population growth pattern. In-migration or out-migration as a result of economic conditions are the major influences affecting population. Birth rates in the basin have usually been higher than the average for the State of Idaho. Idaho birth rates have historically been higher than the average for the United States. While national birth rates have been constant, Idaho as well as basin birth rates have fallen considerably; so, at least Idaho birth rates now approximate national birth rates. The decline, however, has been slower in Madison County (see Table 5).

The 1988 death rates for the basin counties range from 3.8 to 7.5 per thousand or less than half of the birth rates. The difference between birth rates of 20 and death rates averaging 5 per thousand indicates a natural increase in population. The net increase of 15 per 1,000 per year gives a 10 year net increase of 16 percent. In the Henrys Fork basin the natural increase of 16 percent is more than the population growth of 14 percent, therefore, some out migration is occurring.

The educational level of basin residents generally is above the average in the United States and in Idaho (see Table 6).

Table 5. Birth Rates Per 1,000 Population and 1988 Death Rates Per 1,000 Population

	1983	1984	1985	1986	1987	1988	Deaths 1988
United States	15.5	15.7	15.7	15.5	15.7	15.9	8.8
Idaho	19.0	18.0	17.5	16.4	16.0	15.7	7.6
Fremont	21	22	19	18	15	17	7.5
Madison	25	22	23	22	19	22	3.8
Teton	24	19	24	22	19	15	6.9
Basin Average	24	22	22	21	18	20	5.1

Source: Idaho Department of Health and Welfare, Annual Summary of Vital Statistics.

Table 6. Educational Attainment Residents 25 Years and Older

	Percent High School Graduates	Percent with Four Years or More of College
United States	66.5	16.2
Idaho	73.7	15.8
New Hampshire	72.3	18.2
Colorado (highest in nation)	78.6	23.0
Fremont	71.5	12.0
Madison	81.3	18.7
Teton	78.5	17.0
Ada	81.7	22.1

Sources: U.S. Department of Commerce, Bureau of Census, 1980 Census of Population, Volume 1, Characteristics of the Population, Chapter C, General Social and Economic Characteristics, Part 14, Idaho, tables 66 and 175; also Part 1, U.S. Summary, Table 102.

Employment and Income Trends

Average annual employment in the three basin counties shows an upward trend over the twenty year period 1970-1990. The increase in employment numbers is greatest in Madison County, followed by Fremont and Teton respectively. Despite the upward trend overall, Fremont County experienced a large drop in employment in 1978 and showed little growth in the 1980s. Madison County had a large drop in employment in 1980, but employment numbers grew again through the decade.

The 1990 average annual employment figure for Fremont County is an increase of 30 percent over 1970 (see Table 7). According to the Idaho Department of Employment, there were 3284 people employed in Fremont County in 1970 compared to 4284 in 1990. Farm employment fell 23 percent and non-farm employment grew by 34 percent. Total employment increased 71% in Madison County and 94% in Teton County between 1970 and 1990. In Madison County farm employment fell 31 percent and non-farm employment grew over 150 percent between 1970 and 1989. In Teton County farm employment remained relatively steady and non-farm employment increased 97 percent (Idaho Department of Employment, Labor Statistics, 1970-1990; Bureau of Economic Analysis, U.S. Department of Commerce).

The unemployment rate in Fremont County usually exceeds both the national and state average. Since 1984, the Teton County unemployment rate has often exceeded both the national and state average while the Madison County rate generally has been below the Idaho average rate (see Table 8). Since 1985, the reduction in the unemployment rate throughout Idaho and the nation has not, on average, taken place in Fremont County. An indicator of an economically depressed area is an unemployment rate of 1.5 times the national rate. During the 1980s Fremont County's unemployment rate has generally been 1.5 times the U.S. unemployment rate.

Table 7. Average Annual Employment

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Fremont	3284	3242	3545	3923	3925	4065	3748	3962	3171	4523	4561	4574	4418	4520	4533	4563	4389	4489	4419	4443	4284
Madison	4693	5529	5493	4729	6244	7080	7055	7788	8261	8331	6733	6648	6965	7199	7409	7383	7501	7596	7897	8171	8034
Teton	80	822	880	897	973	970	1059	1107	1166	1120	1220	1271	1501	1482	1454	1488	1532	1444	1474	1550	1542

Source: Idaho Department of Employment, The Labor Force in Idaho 1970-1990.

Table 8. Average Annual Unemployment - In Percent

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	March 1990
United States	7.0	7.5	9.5	9.5	7.4	7.1	6.9	6.1	5.5	5.3	5.2
Idaho	6.4	6.5	8.8	7.5	6.3	6.5	6.5	5.7	4.7	5.1	5.5
Fremont	7.8	6.5	9.1	10.6	9.0	9.7	10.4	9.3	7.3	7.6	9.3
Madison	5.4	4.5	4.8	5.6	4.6	5.6	6.0	5.0	5.0	4.3	4.9
Teton	6.2	5.1	6.5	7.7	6.9	7.2	7.3	7.7	6.2	5.2	5.6
Ada*	6.6	6.1	7.5	7.9	5.3	5.9	5.9	5.7	3.9	3.4	3.5

* for comparison

Sources: Idaho Department of Employment, *The Labor Force in Idaho*; U.S. data from U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, Table A-1.

Average annual unemployment and poverty rate levels are related. As shown in Table 9, the average basic poverty rate in Idaho in 1980 was only slightly greater than the average in the United States. The poverty rate in Fremont, Madison, and Teton counties was about twice the average State of Idaho rate. The high rate in these counties is close to the rate in Mississippi, the state with the highest poverty rate in the nation.

Although the actual poverty rate of 20 to 25 percent is important, many more people are affected when underemployment levels in these counties are considered. Table 9 shows that half of the people had incomes under 200 percent of the poverty rate. The number of underemployed in the Fremont, Madison and Teton counties area was twice the rate of urban areas such as Boise, Pocatello or Idaho Falls. The relatively rural state of New Hampshire had statewide rates equal to Idaho urban areas, thus, a rural character does not necessarily determine a condition of high poverty or underemployment. A major cause of high underemployment is the seasonal nature of two major industries, agriculture and tourism. There is a great need for companion employment in these industries during their nonpeak periods.

Table 9. Percent Below Poverty Levels - 1980

	Below Actual Rate	Below 150% of Poverty Level	Below 200% of Poverty Level
United States	12	22	32
Idaho	13	24	38
Connecticut (lowest state rate)	6	14	22
New Hampshire	9	17	28
Mississippi (highest state rate)	24	38	51
Fremont County*	17	33	50
Madison County*	28	45	60
Teton County	18	40	62
Ada County (at Boise-comparison)	9	17	27
Bannock County (at Pocatello)	9	18	29
Poverty Level Family Income with Four People	$12,800	$19,100	$25,500

* Persons in college dormitories or in institutions are not included in these calculations.

Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population; Volume 1, Characteristics of the Population; Chapter C, General Social and Economic Characteristics; Part 1, United States Summary, Tables 108 and 245; and Part 14, Idaho, Table 181.

Related to underemployment is the distribution of the income within an area, that is, the income levels of the most affluent when compared to the poorest section of the population. The calculated equity ratio of the income levels in the Fremont-Madison-Teton county area appear to be similar to urban Idaho counties and to the United States equity ratio. The actual dollar amounts, however, are considerably lower in these counties for both the richest and the poorest fifth of the population than the levels in more urban areas within the state.

Related to income levels, the household assessed valuation gives an indication of the available assets in the county. The three counties of Fremont, Madison and Teton are compared in Table 10 to the Idaho average and to the high and low counties in the state. By using values per household instead of per capita, the influence of families with large numbers of children is somewhat negated. Statewide, two counties with a destination recreation economy (Blaine and Valley) rank near the top in valuation per household. Teton County, which has a spillover recreation economy from Jackson, Wyoming, also has a high valuation. The other two basin counties, Fremont and Madison, are near the state average in valuation per household. There are fairly good asset values per household in the basin counties, yet the income levels are low, causing higher than normal near poverty levels. Thus the assets in many cases are not income producing or are low income or wage producing assets.

Table 10. Household Valuation

Rank	County	Valuation in $1,000 - 1986	Households 1985	Valuation Per Household
1	Power	$ 544,000	2,300	$236,000
2	Valley	553,000	2,600	213,000
3	Blaine	1,165,000	5,500	212,000
9	Teton	144,000	1,000	144,000
15	Fremont	306,000	3,200	96,000
	Idaho-State	29,551,000	354,000	83,000
29	Madison	444,000	5,600	79,000
43	Bannock	1,470,000	24,300	61,000
44	Payette	350,000	5,800	60,000

Despite a decline in the number of people employed on farms, farm income continued to rise in all three counties between 1981 and 1989. Farm income is a significant percentage of all personal income in the basin. Retirement and Investment income is also significant and increasing in importance in the three basin counties (see Table 11; U.S. Department of Commerce, Bureau of Economic Analysis).

In Madison County the broad "Service" sector generates the greatest personal income. The service sector is here defined to include health, business, professional, customer services as well as finance, insurance, wholesale and retail trade. Rexburg is the trade center for the basin. Manufacturing has also grown considerably in Madison County. Some of this growth is in the potato processing industry. Total personal income in Madison County amounted to $231,449,000 in 1989, a 28 percent increase from 1981 (adjusted to 1989 dollars).

In Fremont County, the government sector is a primary income source due to federal land holdings. Total personal income in Fremont County amounted to over $130 million in 1989, a 9 percent increase from 1981 (adjusted to 1989 dollars). The bulk of that increase came from improved returns in farming and retirement income. Fremont County experienced a decline in service sector income and employment during the 1980s. This is counter to the national and regional trend and suggests an opportunity for improvement. Employment and income figures for the retail sector indicate that potential sales are not being realized.

Teton County has had growth in manufacturing, transportation, and the service sectors as well as in retirement and investment income. Total personal income in Teton County amounted to over $40 million dollars in 1989, a 23 percent increase over 1981 (adjusted to 1989 dollars). Income from

farming in Teton County increased by almost 40 percent over the past 20 years, from $7.6 million in 1969 to $12.5 million in 1989.

Table 11. Percentage of Total Personal Income by Source

	Fremont	Madison	Teton
Agriculture	19%	12%	31%
Manufacturing	6%	8%	<1%
Construction	2%	3%	4%
Services	17%	44%	15%
Government	13%	8%	10%
Retirement	12%	7%	11%
Investment	16%	15%	18%
Other Transfer Payments and Calculated Residence Adjustment	15%	3%	10%

Source: U.S. Department of Commerce, Bureau of Economic Analysis

The percentage of retail trade that is tourism related is estimated at 0.12, 20, and 23 percent respectively for Madison, Fremont, and Teton counties. The recreation economy in the basin appears, in many respects, to be an immature industry. There are many small operators attempting to provide services, but recreation needs are not being met, particularly for the large out-of-state market. As the basin's recreation industry grows, managers will develop new services, greater experience, and financing to capitalize on recreational opportunities in the basin.

Related to the poverty level and underemployment data is the median family income level. Table 12 shows that the median family income in the basin counties is considerably below the Idaho average median family income, and also is below the non-urban Idaho average. Similarly, the Idaho median family income is below the average United States median family income and more importantly, below the average United States non-metropolitan median family income. The Teton County average is actually below the lowest state in the nation, Mississippi, and is below the average non-metropolitan median family income for Mississippi. These figures are not per capita income so the affect of larger families is not reflected. See Table 12 for persons per household and per capita income.

There has been a noticeable drop in the median family income for the State of Idaho when compared to the nation over the last 20 years. The basin counties have followed the state trend of lagging behind the nation. A median family income of 59 to 71 percent of the national average seems low even when cost of living factors are considered.

Table 12. Median Family and Per Capita Income

	Family Income	Family Income Comments	Persons per Household - 1987	Per Capita Income - 1987
United States - 1990	$35,700		2.6	$15,500
- 1990 Metro	$38,200			
- 1990 Nonmetro	$28,000			
- 1969	$9,600			
Idaho - 1990	$27,200	44th State 76% of U.S.	2.7	$11,900
- 1990 Metro	$32,700			
- 1990 Nonmetro	$26,000			
- 1969	$8,400	37th State 88% of U.S.		
Mississippi - 1990	$24,600	50th State	2.8	
- 1990 Metro	$30,000			

- 1990 Nonmetro	$22,500			
- 1969	$6,100			
Alaska - 1990	$46,200	1st State	2.9	
- 1969	$12,400			
Fremont - 1990	$25,300	71% of U.S.	3.2	$11,000
- 1969	$7,800	81% of U.S.		
Madison - 1990	$26,000	73% of U.S.	3.8	$8,700
- 1969	$8,100	84% of U.S.		
Teton - 1990	$20,900	59% of U.S.	3.1	$11,000
- 1969	$5,900	61% of U.S.		
Bonneville - 1990	$33,900	1st Idaho County	2.9	$12,700
- 1969	$9,700			

Median Family Income - The amount which divides the distribution into two equal groups, one having incomes above the median and the other having incomes below the median. A family is limited by those related individuals who reside together.

Source: U.S. Department of Housing and Urban Development Office of Economic Affairs: Economic and Market Analysis Division: HUD Users office telephone 1-800-245-2691 for yearly data.
Metro = Metropolitan Statistical Areas (Ada County only in Idaho)

Amenities

The basin generally has a very good highway system including many paved arterial routes within the national forest. On the Upper Henrys Fork plateau during the winter, however, only U.S. 20, Idaho 87 past Henrys Lake, and a few short access roads are kept open. Railroad service is available up river to Ashton. Airstrips are available at Rexburg, St. Anthony, Driggs, and Henrys Lake.

Electric power is available to all the basin communities and to most of the isolated rural areas. High schools have been consolidated into the larger towns throughout the basin. Rexburg has a large well-established two-year college which provides associated cultural benefits.

Recommended Action

1. Encourage protection of paleontological sites, aboriginal village or camp sites, historic trails, early pioneer structures, fur-trade related sites, and Chief Joseph war related sites.
2. Encourage development of archeological and/or historical site interpretation facilities for public appreciation and education.
3. Encourage water resource-related economic development funding for private, city, county, state, and federal projects that strive for increased long-term, sustainable returns to the local economy.
4. Develop companion employment for non-peak periods in the agricultural and tourism industries.

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Fish and Wildlife

Management plans for fish and wildlife are developed every five years by the Idaho Department of Fish and Game. Their documents contain valuable descriptions of the status of fish and wildlife values in the basin and establish management goals for species and areas. An excellent discussion of wildlife values is contained in the environmental impact statement for the leasing and development of the Island Park Geothermal Area (1980) which covers a substantial portion of the northern part of the basin.

Wildlife

For wildlife much information is available on some animal species, yet little is available on other species. When possible, information has been quantified. To the extent possible, animals are discussed as individual species or groups of similar species.

For the Island Park area a total of 5 amphibians, 8 reptiles, 179 birds and 61 mammals were identified according to habitat and seasonal use. Migrant and accidentally occurring species are included in the Appendix. Species are oriented to a habitat if they use that type for reproduction and feeding. Table 13 is a partial listing of the number of habitats used by common species and those of special interest (Appendix A contains a summary of all species).

The number of habitats each species uses for feeding and reproduction is a measure of the adaptability of the species. The greater the number of habitats used the more adaptable the species and the less vulnerable it is to habitat manipulation or loss. The more species using the habitat for feeding and reproduction the more important it is to wildlife. Table 14 gives a summary of the wildlife-habitat associations.

Analysis of wildlife in the preceding manner does not allow consideration of certain key components of wildlife management such as winter range, migration routes, reproduction areas or legal considerations. The following discussion considers key points for species or groups of special interest. Wildlife population projects and goals are presented and, when relevant, past trends are discussed.

1. Big Game

The following map shows big game winter range. Deer and moose also winter throughout the middle of the elk winter range. Much of the elk and deer winter range is within the Sand Creek Wildlife Management Area (Figure 5).

Elk (Wapiti) have long been an important game animal in the area. Their occurrence in the area depends mainly upon the presence of their food supply. Their numbers have varied, but the present population is increasing after a 10 to 15 year low, as shown in Table 15.

Most elk migrate by late November and congregate on a major staging area in the lower elevations (Figure 5). Much of this staging area is on lands administered by the Bureau of Land Management and the State of Idaho. The specific function of this staging area is unknown; however, animals spend most of the staging area time feeding, apparently preparing for winter. During mild

winters they use the staging area for winter range. In summer, elk are distributed throughout the forested area. Habitat use patterns vary with climate and various activities in the area (grazing, logging and recreation). Elk wander back and forth across the Yellowstone National Park boundary throughout the summer.

By mid-December of most winters, elk have moved to the Juniper Mountains/Sand Dunes winter range approximately 30 miles southeast of the forest boundary. This winter range is administered by the Bureau of Land Management and the Idaho Department of Fish and Game (IDFG) in cooperation with the Department of Lands and private landowners. Most of the elk that summer in the forest spend the winter on this range.

Since 1974 hunting in Idaho has been "bulls only" during general seasons, with fewer special permits, fewer general hunts and shorter seasons. Some either sex permits issued during special hunts will continue to be used in the future.

There are no discrete elk calving grounds. Calving occurs on the winter, spring and summer range and is totally dependent upon climate. In years with heavy snowfall and a "late" spring, calving takes place on the winter range. In years with light snowfall, elk may calve anywhere in the forest in suitable habitat. However, key calving areas (those used every year of "normal" snowfall) are along Big Bend Ridge and Thurmon Ridge.

Table 13. Some Common and Special Interest Wildlife Species and Number of Habitats Each Uses (See Table 14 for Different Habitats)

Chorus frog	6	Great horned owl	24	House finch	19
Leopard frog	19	*Burrowing owl	4	Pine siskin	22
*Rubber boa	21	*Short-eared owl	14	Green-tailed towhee	11
Racer	20	Common nighthawk	22	*Vesper sparrow	4
Common garter snake	23	Calliope hummingbird	18	Dark-eyed junco	18
*Western grebe	13	Belted kingfisher	17	Brewer's sparrow	5
Great blue heron	19	Common flicker	21	White-crowned sparrow	24
*Black-crowned night heron	5	*Lewis woodpecker	21	Vagrant shrew	24
*American bittern	4	Yellow-bellied sapsucker	15	Little brown myotis	23
*Trumpeter swan	19	*Hairy woodpecker	19	Silver-haired bat	19
Canada goose	12	Eastern kingbird	19	Big brown bat	25
Mallard	23	Western tanager	21	Pika	5
Gadwall	15	Hammond flycatcher	19	Snowshoe hare	18
Pintail	16	Western wood pee-wee	18	Least chipmunk	19
Blue-winged teal	12	Olive-sided flycatcher	22	Yellow pine chipmunk	25
Baldplate	15	Horned lark	7	Yellow-bellied marmot	12
Northern shoveler	15	Tree swallow	24	Richardson's ground squirrel	2
Redhead	16	Bank swallow	17	Red squirrel	18
*Canvasback	11	Gray jay	19	Northern pocket gopher	24
Turkey vulture	25	Black-billed magpie	21	Beaver	24
*Sharp-shinned hawk	23	Common raven	23	Deer mouse	31
*Cooper's hawk	24	Clark's nutcracker	16	Boreal red-back vole	12
Red-tailed hawk	27	Black-capped chickadee	25	Mountain vole	20
*Swainson's hawk	21	Red-breasted nuthatch	18	Muskrat	10
*Ferruginous hawk	5	Brown creeper	14	Western jumping mouse	17
*Golden eagle	29	Dipper	20	Porcupine	25
*Bald eagle	23	Canyon wren	15	Coyote	30
*Marsh hawk	10	American robin	26	*Gray wolf (Northern Rky.Mtn.Wolf)	27
*Osprey	17	Mountain bluebird	26	Black bear	31
*Prairie falcon	7	Golden-crowned kinglet	14	*Grizzly bear	27
*Merlin	23	*Loggerhead shrike	10	Marten	14
*American kestrel	25	Starling	10	*Fisher	21
Blue grouse	25	*Warbling vireo	11	Long-tailed weasel	30
Ruffed grouse	20	*Yellow warbler	5	Mink	26
*Sharp-tailed grouse	8	Yellow-rumped warbler	23	*Wolverine	17
*Sage grouse	6	*Yellow-breasted chat	16	Badger	16
Sandhill crane	14	House sparrow	7	Striped skunk	18
Common snipe	14	Western meadowlark	7	*Canada lynx	19
Spotted sandpiper	11	Yellow-headed blackbird	6	*Bobcat	26
American avocet	12	Red-winged blackbird	7	Elk (Wapiti)	24
California gull	11	Northern oriole	14	Mule deer	23
Mourning dove	17	Brewer's blackbird	15	Pronghorn	25
*Barn owl	17	Evening grosbeak	19	Moose	25

Table 14. Wildlife Habitat Associations Based on Reproduction and Feeding
AF = Subalpine Fir; DF = Douglas Fir; LPP = Lodgepole Pine

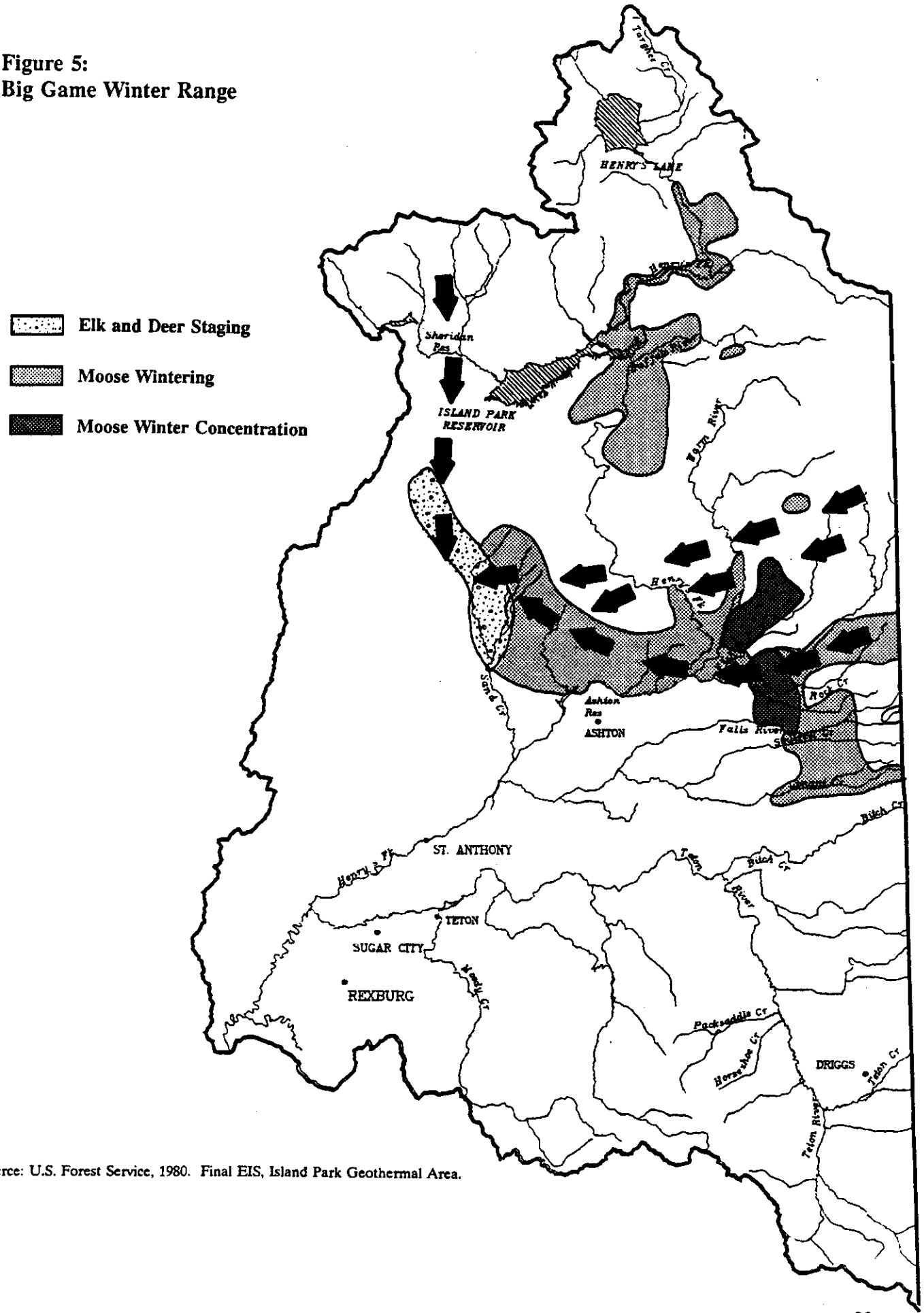
Habitat	Number of Wildlife Species Using Habitat for: Reproduction	Feeding	Total Number of Species Using Habitat
AF/Snowberry	122	141	142
DF/Snowberry	130	160	162
AF/Spirea	121	142	143
AF/Huckleberry	99	106	108
AF/Whortleberry	90	95	96
AF/Pinegrass	94	105	106
DF/Huckleberry	137	162	163
DF/Pinegrass	133	168	168
DF/Spirea	90	116	143
DF/Mountain Maple	127	148	149
LPP/Bitterbrush	72	73	74
Forest Successional stage			
Grass Forb	57	164	165
Shrub - Seedling	85	175	175
Seral pole	83	150	151
Full-size seral	128	142	152
Full-size climax	125	133	143
Old growth	113	127	136
Aspen Groves	77	123	126
Sagebrush	68	103	103
Mountain brush	71	103	104
Dry Meadows	41	122	122
Wet Meadows	48	128	128
Rivers & Streams	132	192	193
Lakes & Reservoirs	82	144	144
Riparian Deciduous	123	170	176
Marshes	109	148	152
Cliffs & Rims	39	48	62
Talus	23	59	61
Caves	21	10	25
Snags	44	43	58
Down Material	45	73	84

Table 15. Status of Big Game in the Island Park Area

	Year	Population	Harvest	Demand (Hunter Days)	Success (Days/Animal)
Elk (Wapiti)	1975	1,700	275	12,712	40.6
	1980	1,920	375	15,750	38.1
Mule Deer	1975	2,700	525	6,220	13.3
	1980	2,300	295	6,000	12.5
Moose	1975	320	22	84	4.7
	1980	200	4	20	5.0
Black Bear	1975	430	25	845	30.8
	1980	465	35	1,630	48.0

Source: Idaho Department of Fish and Game

Figure 5:
Big Game Winter Range



Source: U.S. Forest Service, 1980. Final EIS, Island Park Geothermal Area.

The mule deer is the most important big game species in Idaho in terms of total animals harvested and hunter participation. The entire forest is summer range in fair to good condition with good summer range in short supply. Deer numbers are low (Table 15) due to several factors: mule deer populations have fluctuated over the past 100 years with variations in habitat, climatic conditions, reproductive success and fawn/yearling survival. Low deer numbers are not limited to Idaho, as adjacent states have indicated that deer herds are below desired levels and have declined for the past several years.

The main deer winter range is the Juniper Mountains/Sand Dunes range described above for elk. Approximately 1,200 deer used this range in the winter of 1977-78. Numbers have ranged from 700 to 1,100 in the past 5 to 10 years. Deer use the same migration routes described for elk (Figure 5); fawning occurs along these routes.

Moose are distributed throughout the forest with variable patterns of habitat use. During the summer small groups (2-5) and single individuals are scattered through forest, mountain brush and riparian habitat. Willow areas receive considerable use.

Previous high density moose populations in the forest declined severely in the 1970's. Wintering numbers decreased due to winter mortality, uncontrolled Indian harvest and illegal kills. Within the last ten years the moose numbers have significantly increased with over 100 hunting permits issued for use in the basin for 1990.

The forested area provides extensive winter range for moose. Range condition varies throughout the area, but in most portions is good. The main winter areas are: (1) Fall River-Warm River Butte, which receives heavy use during extreme winters and is rated fair to poor winter range. Moose in portions of this area reach densities of 10-20 animals per square mile. Most move into Yellowstone National Park and Wyoming during the summer. (2) Big Bend Ridge--this range is in good condition, but the population has been declining, possibly due to illegal harvest. The main concentration areas are Snake River Butte and drainages. (3) Island Park-Henrys Lake--the main areas of use are along Henrys Fork with scattered use in the Henrys Flat region. This range is also considered good. Approximately 30 to 40 moose winter along the south shoreline of Island Park Reservoir utilizing willow-covered peninsulas.

Snow depth in extreme winters can be a problem to moose. They are able to get along in deep snow, but depths of six and seven feet can increase mortality of old and young animals. Food availability determines winter range selection and overall well-being of the herds. Important forage species include willow, bitterbrush, chokecherry, serviceberry, subalpine fir, sedges and grasses.

Black bear reach highest numbers in the eastern half of the forest, however, they are present throughout the area. Despite a continual open season and indiscriminate killing, densities remain high in certain portions, especially in the southeastern section.

The mountain lion is present in the area, but its status and numbers are unknown. Total numbers are undoubtedly low since the area has less than optimum mountain lion habitat. Mountain lions are currently protected in Idaho.

Antelope use Henrys Lake Flat. This flat is predominantly private grassland used for livestock grazing, with small pockets of sagebrush throughout. The IDFG estimates that 180 pronghorn use the summer range in and around Henrys Lake Flat. The herd migrates through Raynolds Pass into Montana for the winter. A few permits (muzzleloader or shotgun only), are issued to hunt this herd.

2. *Upland Game*

Sage grouse use sagebrush-grass and mountain brush habitats for summer feeding and brood rearing (Figure 6). Preferred habitats are associated with stream areas where water and meadows with succulent vegetation are available for brood rearing. The strutting grounds are in the northwest portion of the basin. Preferred nesting habitat is usually within a two-mile radius of the strutting grounds. Despite annual fluctuations, sage grouse populations generally have increased since 1960. A peak was reached around 1970, and a decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (Table 16).

Sharp-tailed grouse are rare in the basin with most sightings in mountain brush along the southwestern edge of Big Bend Ridge. Sharp-tailed grouse are associated largely with grasslands interspersed with brush. The sharp-tailed grouse is a species of special concern to the IDFG, which recommends that all possible measures be taken to protect, enhance, and expand existing habitat. A peak in numbers was reached around 1970, and decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (Table 16).

Two species of forest grouse, blue and ruffed grouse, are common in forested areas of the basin. Blue grouse use most habitats and move to higher elevations for wintering. They nest on grassy open slopes and sagebrush covered ridges, usually at the base of a small tree or shrub. Nesting habitat is usually found at elevations below the mature coniferous forest used for wintering. They depend on conifer needles for winter food. Ruffed grouse are also found in the forest. Although these birds eat a variety of food during much of the year, they feed largely on the buds of aspen and other deciduous species during the winter.

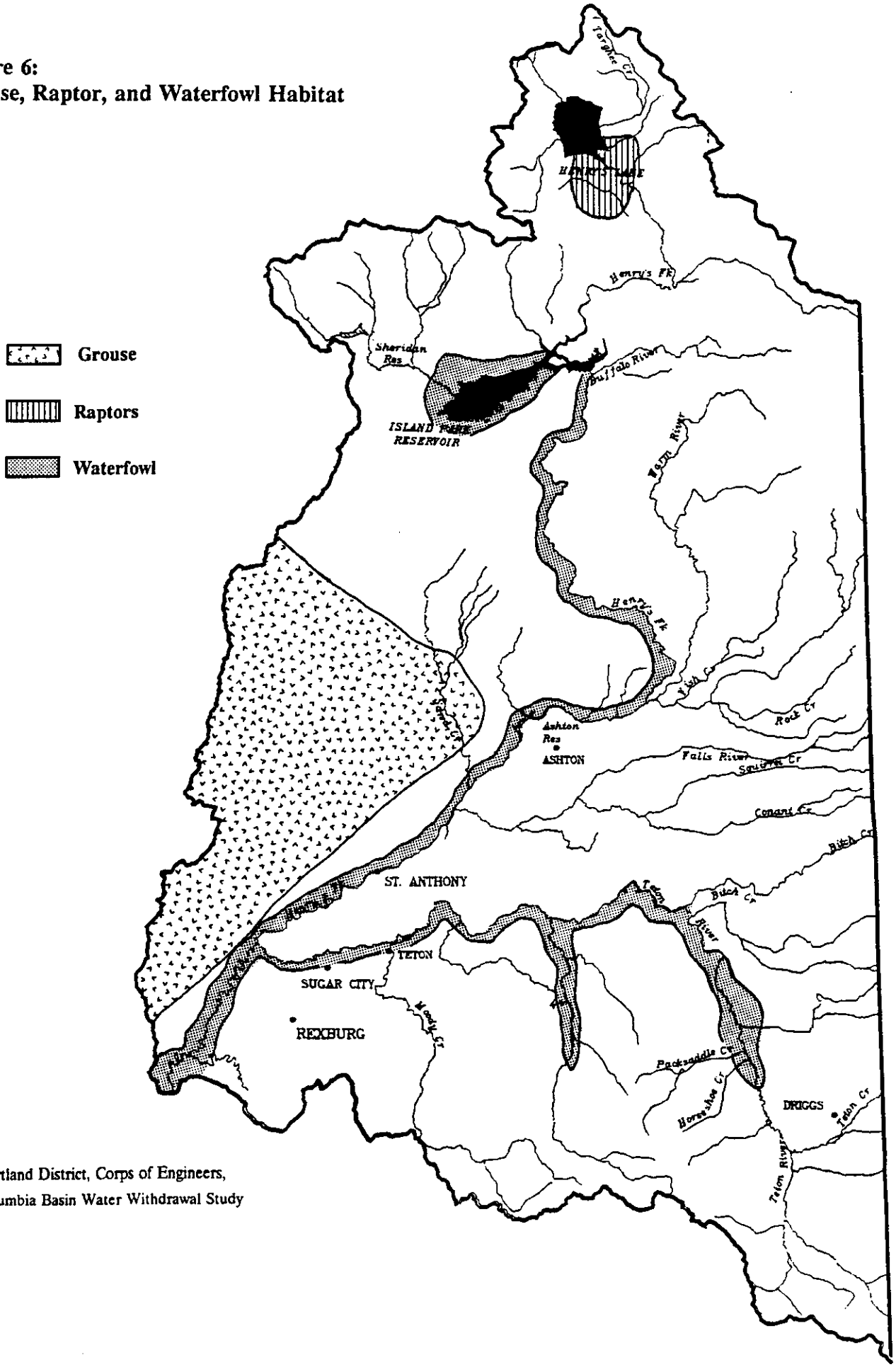
Populations of forest grouse typically fluctuate and may be cyclic. Allowing for these fluctuations, past populations have been relatively stable, and this trend is expected to continue through 1990 (Table 16). Most forest grouse are harvested incidentally during big game hunting, although grouse hunting is increasing in popularity. Harvest levels have steadily increased. Demand and harvest are both projected to continue increasing through 1990, with a fairly consistent hunter success rate.

The mourning dove is common throughout the Henrys Fork Basin; migratory and nesting populations are present. It is associated mainly with sagebrush-grass, mountain brush and riparian habitats, but also occurs in some forested habitat types. Mourning dove populations gradually increased from 1960 through 1975. Under current management levels and habitat trends, populations should remain at present levels through 1990 (Table 16).

Mourning doves fall under the jurisdiction of the Migratory Bird Treaty Act. Under this Act, harvest regulations and management are primarily the responsibility of the U.S. Fish and Wildlife Service. The earliest opening date allowed under this Act is September 1, which coincides with the peak of migration out-of-state and effectively limits hunting.

Mountain cottontails (rabbits) are associated primarily with nonforested habitat, aspen groves and riparian habitats. Essentially stable populations of the last 10-15 years are projected to remain so through 1990. Less than 20 cottontails are harvested annually on the forest. Cottontails are a main constituent in the diet of many raptorial birds.

Figure 6:
Grouse, Raptor, and Waterfowl Habitat



Source: Portland District, Corps of Engineers,
Columbia Basin Water Withdrawal Study

Table 16. Upland Game Bird Statistics for the Island Park Area

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
		SAGE GROUSE AND SHARP-TAILED GROUSE			
1975	5,500	600	330	790	0.8
1980	5,600	680	340	800	0.8
1985	5,760	860	360	800	1.0
1990	6,000	1,000	400	1,000	1.0
		FOREST GROUSE			
1975	40,000	2,100	700	2,800	0.8
1980	45,000	2,600	1,000	4,000	0.7
1985	45,000	3,000	1,200	4,800	0.6
1990	45,000	3,800	1,500	6,000	0.6
		MOURNING DOVE			
1975	2,000	345	35	117	2.9
1980	2,000	360	40	130	2.8
1985	2,000	380	48	160	2.4
1990	2,000	400	50	170	2.4

Source: Idaho Fish and Game Department

3. *Waterfowl*

The basin is located along a portion of the Pacific waterfowl flyway. Over a million waterfowl migrate over the area in spring and fall. Fall movements begin in mid-to-late-August and continue through December. Large numbers of ducks and geese concentrate on and around Island Park Reservoir, Henrys Lake, Hebgen Lake and Harriman State Park before moving south. These areas are immediately adjacent to the Red Rock Lakes Migratory Water Waterfowl Refuge in Montana, only 15 miles to the northwest. Migrating waterfowl make extensive use of watercourses, lakes, marshes and potholes in the area. The northward migration begins in late March and continues through May.

Resting and feeding habitat in the area for migrating waterfowl is currently adequate to support the numbers passing through or overwintering. These conditions are not expected to change through 1990. Numbers of migratory birds are dependent upon production in out-of-state areas, primarily Canada. Despite annual fluctuations, numbers have been generally stable. Populations of migratory ducks are expected to decrease due to losses of suitable habitat. With growing hunting demands, harvests and success, rates will decrease.

Some waterfowl breed and produce young in the area. The best production areas are small bodies of water, such as beaver ponds, large and small streams, and marshes. Allowing for normal fluctuations, the number of ducks produced in the basin has remained relatively constant since 1960. Harvests vary with duck populations and hunter numbers; success rates are projected to persist through 1990 (Table 17).

Canada geese breed in the nonforested, riparian habitats in the basin. Nesting occurs primarily along rivers and streams, small lakes and potholes. Many migrating geese use the area for nesting and feeding. Numbers have generally increased since 1960. Migratory goose populations and harvests are expected to increase through 1990 (Table 17). The IDFG has a major effort underway to

create new and improved nesting and rearing habitat. As part of this effort nesting platforms have been installed on Island Park Reservoir.

Table 17. Waterfowl Statistics for the Island Park Area

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
		DUCKS			
1975	13,500	1,000	165	660	1.5
1980	13,500	1,100	175	720	1.5
1985	14,500	1,200	180	800	1.5
1990	15,000	1,400	200	900	1.6
		CANADA GEESE			
1975	1,500	450	360	1,080	0.4
1980	1,500	480	390	1,365	0.4
1985	1,500	525	420	1,640	0.3
1990	1,500	540	435	1,780	0.3

Source: Idaho Department of Fish and Game

4. *Raptors*

A survey of birds of prey in the Targhee National Forest was done by the U.S. Fish and Wildlife Service in 1977. Their report detailing nest locations, breeding territories, reproductive effort and diversity of raptors is on file with the Targhee National Forest. It indicates that 31 species of raptors use the area during some portion of the calendar year. Appendix A has a list of these birds and their habitats.

Birds of prey subsist mainly on small rodents, fish, reptiles, amphibians, carrion and an occasional hoofed animal (ungulate). Shrubs, trees and cliffs provide cover and nesting sites for most of the species. In open country around Henrys Lake Flat utility poles, fence posts, snags and other isolated structures provide important perches for nesting and hunting. Many of these structures are also found around sagebrush flats, meadows and riparian habitats in the area. Raptors are important elements in predator-prey relationships in most ecosystems. They can help control small prey species such as rabbits, hares and rodents.

The U.S. Fish and Wildlife Service raptor report emphasized the importance of Henrys Lake Flat. This high elevation grassland is used by hundreds of fledged falcons and hawks as a staging area during migration in August and September. Nearby ridges funnel birds in from the north, south and west to the Flats, where they use the surrounding forest for hunting. Raptors are completely protected by the Federal Migratory Bird Treaty Act and State regulations.

5. *Species of Special Concern*

Of special concern are species whose restricted range, specific habitat requirements and/or low numbers make them vulnerable if adverse impacts on populations or habitat occur. The following are found in the area: grizzly bear, Northern Rocky Mountain wolf, Canada lynx, fisher, wolverine, trumpeter swan, sharp-tailed grouse, ferruginous hawk, prairie falcon, American peregrine falcon and northern bald eagle. The grizzly, wolf, peregrine falcon, and bald eagle are federal Threatened and Endangered Species.

The bobcat, Canada lynx, fisher and wolverine are common to rare mammalian predators whose numbers have declined in the past 10 to 15 years. Rising prices for bobcat and lynx pelts and

uncontrolled harvest have reduced their numbers drastically. They have been removed from predator lists and placed under Idaho Department of Fish and Game's control. The fisher, requiring forested, wilderness habitat, is also under State control. The wolverine, which also requires wilderness habitat, is extremely rare in the area.

The trumpeter swan is a common resident of the area. While the species is no longer endangered or threatened, in recent years trumpeter breeding populations have experienced extremely high mortality among the young (60-90 percent). Breeding habitat requirements of these birds are:

1. Waters with a relatively static level, not marked by seasonal fluctuations.
2. Quiet waters of lakes, marshes or slough, not subject to current or constant wave action.
3. Shallow waters of lakes or open marshes, not so deep as to preclude digging and foraging for lower aquatic plant parts, roots and tubers.
4. Minimum human disturbance and relatively remote areas.

The open waters of the Henrys Fork drainage are the primary wintering areas for all of Canada's trumpeter swans. In addition to the migrants, approximately 50 percent of the year-round resident trumpeters winter within the area. The relative isolation, abundant submerged vegetation and open waters of the Henrys Fork are critical to the welfare of the remaining trumpeter population of Canada and the United States (Hebgen Lake, approximately four miles north of the basin, also supports wintering trumpeter swans). To prevent downstream freezing, minimum flows of about 500 cfs (300 cfs from Island Park Reservoir and 200 cfs from the Buffalo River) may be needed.

The sandhill crane, considered unique, is common in the basin. It is a summer resident which breeds and nests where there are abundant marsh and riparian habitat. Sandhill cranes congregate on a major staging area in the forest where they feed and prepare for the fall migration.

6. Threatened and Endangered Species

The Endangered Species Act of 1973 (P.L. 93-205) officially recognizes two categories of animals, endangered species and threatened species. Section 7 of the Act requires all federal agencies to take necessary actions to insure critical habitat for endangered or threatened species is not adversely modified or destroyed.

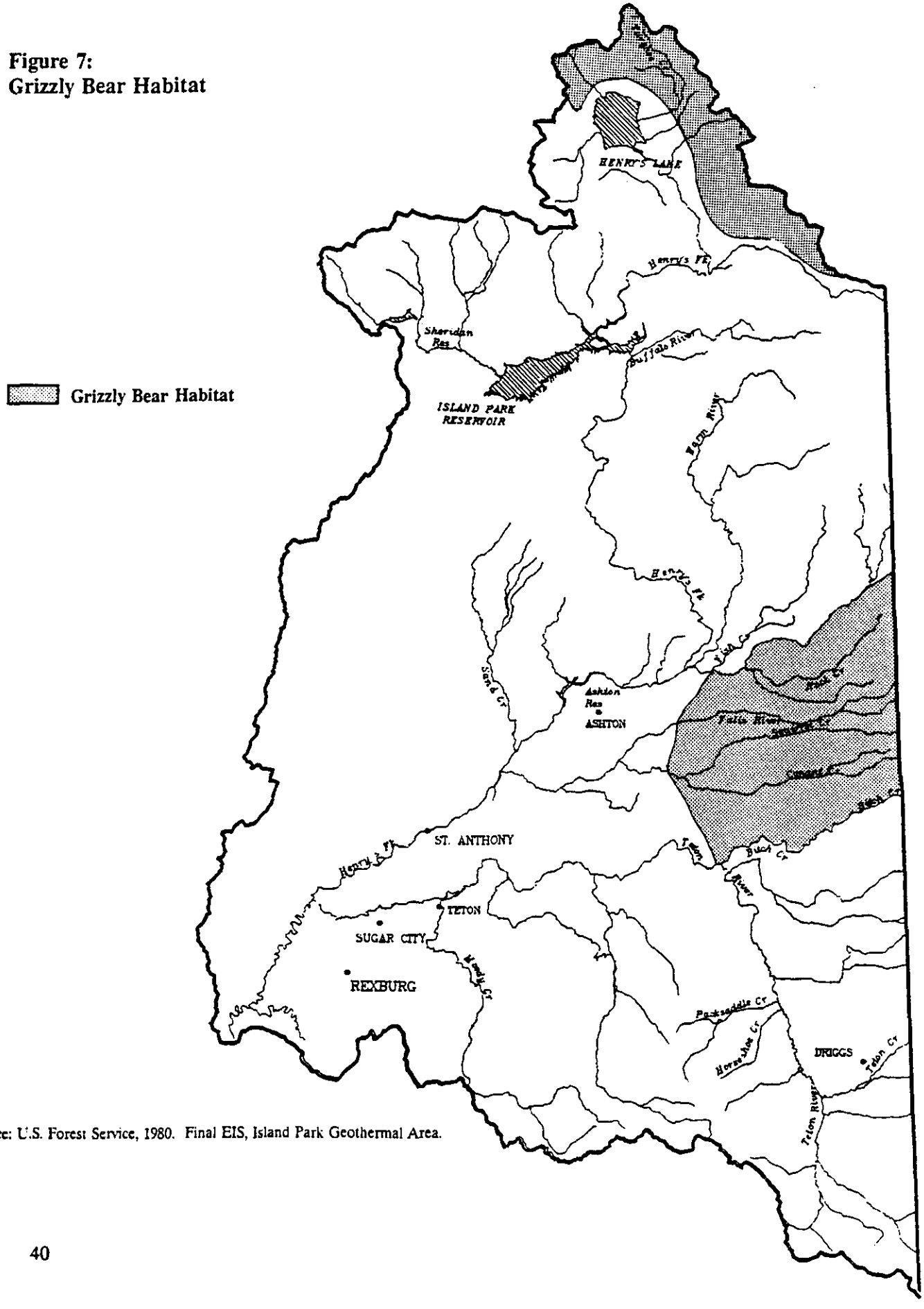
Three endangered and one threatened species inhabit the basin. Although most wildlife lists and maps show the range of the endangered spotted bat (*Euderma maculata*) extending into the basin, no authenticated records of spotted bats have been collected.

The grizzly bear (*Ursus arctos horribilis*), a threatened species, occurs throughout the eastern portion of the forested area. Bears in this area are part of the Yellowstone population, which has been studied since 1973 by an Interagency Grizzly Bear Study Team of research biologists from the National Park Service, Fish and Wildlife Service, Forest Service and the states of Wyoming, Montana and Idaho.

Approximately 94,000 acres of the forested area have been designated as land where the grizzly bear will receive management priority (Figure 7). Pending formal determination of critical habitat, this area will be treated as critical habitat and protected from adverse modification or destruction. Delineation of grizzly bear habitat in the area relied heavily upon past sightings.

In the area, some habitat appears more valuable to grizzlies than other habitat, particularly those lands in the Reas Pass area northeast of Macks Inn and the Winegar Hole area south of Falls River.

Figure 7:
Grizzly Bear Habitat



Source: U.S. Forest Service, 1980. Final EIS, Island Park Geothermal Area.

The Reas Pass and Winegar Hole areas have highly productive forest understories, open wet meadows, bogs, swamps and potholes. Both contain extensive downed timber which supports heavily used food sources (fungi, rodents and insects). Tall huckleberry habitat in Winegar Hole supports some of the most productive rodent populations in the Targhee National Forest. Rodents, particularly pocket gophers (*Thomomys talpoides*), are an important grizzly food. Large numbers of rodents are present in both the Reas Pass and Winegar Hole areas with highest densities in wetter areas.

The Northern Rocky Mountain wolf (*Canis lupus irremotus*), one of 32 subspecies or geographic races of the gray wolf, was listed as endangered and became legally protected in 1974. The historical and current distribution of the wolf includes the Henrys Fork Basin. Unverified sightings have occurred in the area for several years, and verified sightings have been made. The basin is at the edge of the wolf's present range, and thus is used occasionally (Dennis Flath, Team Leader, Northern Rocky Mountain Wolf Recovery Team, 1978).

The American peregrine falcon (*Falco peregrinus anatum*), an endangered species, is known to use the area. Only one active natural nest has been observed in recent years. Hack towers have been installed at two locations in the basin.

The endangered bald eagle (*Haliaeetus leucocephalus*) feeds extensively along lakes and reservoirs in the summer, and some birds winter in the area. There are 15 known active bald eagle nests in the basin.

Fisheries

The Henrys Fork basin provides one of the most important rainbow trout fisheries in the state. In addition to the Henrys Fork itself, important fisheries occur on the tributary Teton, Warm, and Buffalo rivers. Henrys Lake and Island Park Reservoir are important components of the Henrys Fork fishery. Basin streams contain rainbow trout, westslope cutthroat, brook trout, coho, kokanee, mountain whitefish, and grayling. Although cutthroat trout are the native salmonid in the drainage, rainbow trout are the most important game species present. Mountain whitefish are the most numerous game species in the basin.

The Henrys Fork below St. Anthony suffers from impacts associated with irrigation water returns and low flows due to upstream diversions. The ability of the river to support salmonid populations is limited by these impacts. Management goals for this reach of the Henrys Fork project catch rates of 0.3 fish per hour.

The Henrys Fork between St. Anthony and Big Springs attracts fishermen from throughout the nation. Fish and Game surveys have documented annual angler use and harvest along this reach of river at 175,000 hours of effort with catch rates of 1.25 fish per hour (see Table 18). Wild rainbow trout make up the bulk of the fish in the creel with lesser numbers of brook trout, hatchery rainbow trout, mountain whitefish and cutthroat. Native cutthroat make up less than 1 percent of the catch. Management plans will emphasize wild, natural populations without hatchery supplementation. Ashton Reservoir will be managed as a yield fishery with hatchery rainbow trout, under general regulations.

Fishing on the Henrys Fork near Harriman State Park.

Table 18. Angler Effort - Henrys Fork Basin of the Snake River

Reach of Stream	Miles of Stream Surveyed	Fishing Season 1991	Fisherman-Hours 1973/74	1976	198-		Hours/Mile	Trout Per Hour 1976
Railroad Trestle to Macks Inn Bridge	4.2	5/25-11/30	38,600	32,500	25,700	(1988)	6,100	1.12
Macks Inn Bridge to McCrea Bridge	6.1	5/25-11/30	25,100	22,100	—		3,600	1.68
Island Park Dam to Buffalo River	0.5	5/25-11/30	6,300	3,200	3,900	(1982)	7,800	1.28
Buffalo River to No. Boundary Harriman State Park	5	5/25-11/30	20,500	17,500	22,500	(1982)	4,500	1.73
No. Boundary Harriman State Park to Osborne Bridge (main Harriman State Park)	5	6/15-10/15	16,500	25,600	31,000	(1982)	6,200	0.72
Osborne Bridge to South Boundary Harriman State Park	2.5	6/15-10/15	4,800	7,100	4,200	(1982)	1,700	0.77
South Boundary Harriman State Park to Riverside Campground	3.5	5/25-11/30	7,000	6,600	2,500	(1982)	700	.91
Riverside Campground to Lower Mesa Falls	12	5/25-11/30	2,000	4,400	12,000	(1986)	1,000	0.50
Lower Mesa Falls to Warm River	6.5	5/25-11/30	1,700	2,900	—		400	1.12
Warm River to Wendell Bridge	7	5/25-11/30	5,200	8,500	5,100	(1980)	700	.51
Wendell Bridge to Ashton Dam	4	year-round	7,100	5,300	4,700	(1980)	1,200	0.95
Ashton Dam to Chester Dam	6	5/25-11/30	17,500	21,900	19,200	(1980)	3,200	1.27
Chester Dam to St. Anthony	7	year-round	11,500	12,500	9,834	(1980)	1,400	0.67
St. Anthony to North Fork Teton River - (limited data available)								
North Fork Teton River to Mouth - (limited data available)								
Buffalo River	3	5/25-11/30			7,400	(1988)	2,500	
Warm River	9	5/25-11/30			8,000	(1985)	900	
Falls River - No level of use studies known; use estimated to approach Teton Canyon Use.								
Teton River Upper Teton Valley	21.0	5/25-11/30	17,500		21,700 18,100	(1981) (1988)	900	
Teton River Canyon	16.0	5/25-11/30	1,400		6,100 4,800	(1988)	300	
Teton River below the Dam Site	25	5/25-11/30	5,100		29,700 9,000	(1980) (1988)	400	
Henrys Lake	–	5/25-10/31		68,100	63,300 340,000		(1982) (1989)	
Island Park Reservoir (above Lakeside Lodge	–	1/1-3/13 & 5/25-12/31 5/25-11/30)		100,000	124,400 49,000		(1982) (1989)	
Ashton Reservoir	–	5/25-11/30			4,700 12,600		(1980) (1985)	

Source: IDFG, 1990; Angradi and Contor, 1989; Maiolle, 1987; Rohrer, 1984; 1981; Moore et al., 1983; Jeppson, 1982; 1981; Coon, 1977, 1978.

Island Park Reservoir is a widely fluctuating irrigation reservoir on the Henrys Fork. It contains important fisheries for rainbow trout, coho, and kokanee with catch rates of up to 0.6 fish per hour. Drought conditions have had severe impacts on the reservoir fishery, flushing large numbers of fish downstream. Island Park will be stocked with rainbow trout, coho, and kokanee.

From Island Park Reservoir upstream to Henrys Lake the Henrys Fork provides a yield fishery supported by natural reproduction and further supplemented with hatchery rainbow trout. At the Henrys Lake outlet, harvest is supported by emigration of trout from Henrys Lake.

Henrys Lake is a shallow, highly productive lake covering 6,300 acres at the headwaters of the Henrys Fork. It has a long history of supporting an extensive sport fishery for large, native cutthroat trout. The Department of Fish and Game has managed Henrys Lake as a trophy fishery since 1976. The goal for Henrys Lake is to provide catch rates of 0.15 fish per hour for cutthroat-rainbow hybrids, 0.10 fish per hour for brook trout and 0.45 fish per hour for cutthroat trout. Fish and Game hopes to achieve size goals of 20 percent of the hybrids over 20 inches in length, 10 percent of the

cutthroat over 20 inches, and 5 percent of the brook trout over 18 inches. Recent increases in angler use and estimated harvest suggest the resource may soon approach full-capacity use (Table 19).

Table 19. Angler Effort - Henrys Lake

Year	Angler Hours	Estimated Harvest	Catch & Release	Total Catch	Catch Per Hour
1978	85,000	26,000	15,000	41,000	0.48
1979	94,000	19,000	11,000	30,000	0.32
1980	68,000	9,000	5,000	14,000	0.21
1981	66,000	8,000	7,000	15,000	0.23
1982	63,000	7,000	22,000	29,000	0.46
1983	96,000	25,000	97,000	122,000	1.27
1984	163,000	47,000	224,000	271,000	1.66
1985	126,000	38,000	121,000	159,000	1.26
1986	173,000	67,000	88,000	155,000	0.90
1987	150,000	36,000	45,000	82,000	0.54
1988	100,000	20,000	62,000	81,000	0.82
1989	340,000	104,000	156,000	259,000	0.77

The Idaho Department of Fish and Game and the Henrys Lake Foundation are working with local landowners cooperative effort to improve instream habitat and fish passage on tributaries to the lake. This involves fencing and the screening of irrigation diversions.

Warm River is a major tributary to the Henrys Fork. A large spring six miles upstream from its mouth provides the base flow. Warm River has large sections of good spawning gravels and fairly constant temperatures which make for ideal trout spawning conditions. Due to the lack of good spawning habitat in the Henrys Fork between Ashton Dam and Mesa Falls, Warm River is critical to maintenance of wild rainbow and brown trout populations in this section of the Henrys Fork.

Falls River is the largest tributary to the Henrys Fork. It supports an excellent wild rainbow trout fishery. Cutthroat trout also contribute to the angler catch from Falls River.

The Teton River fishery was severely impacted by the construction and failure of Teton Dam. Overall catch rates of 1.42 fish per hour declined to about 0.75 fish per hour. Despite intensive fish stocking efforts, in 1988 the catch rate below the dam site was 0.48 fish per hour. Efforts are now underway to improve both habitat lost through the collapse of the dam and habitat affected by changes in land use practices. Goals are to improve conditions so that the cutthroat population becomes self-sustaining and to maintain a catch rate of at least 1.0 fish per hour.

Most of the smaller tributaries in the Henrys Fork drainage are managed with restrictive regulations to preserve the native cutthroat trout.

Factors Limiting the Fishery in the Henrys Fork

1. Late winter under-ice low oxygen levels in Henrys Lake.
2. Excessive summer-fall blue-green algae blooms in Henrys Lake and Island Park Reservoir reducing zooplankton and littoral zone production that is usable by salmonids.
3. Extreme drawdown of Island Park Reservoir eliminates most summer benthic invertebrate production in that pool.
4. Low fall-winter flows in the Henrys Fork River below Island Park Reservoir and below Henrys Lake.

5. Late summer low flows below St. Anthony and in the lower Falls River as irrigation waters are diverted.
6. Irrigation return flows in the lower Teton and Henrys Fork rivers.

Recommended Action

1. Examine the need for minimum streamflows in basin streams. Where the need for a state protected flow is identified, seek to provide such flow.
2. Support protection of fish passage on existing and future projects. Because of grandfather rights, several streams need corrective action. Prime examples are passage problems at the mouth of the Buffalo River associated with the Ponds Lodge hydroelectric project and highway culverts on Targhee and Howard creeks which are tributary to Henrys Lake.
3. Construct self-cleaning screens on irrigation diversion structures in selected streams to reduce fish mortality.
4. Encourage protection of riparian vegetation which is important to fish and wildlife.
5. Encourage protection of key seasonal habitats such as wildlife calving areas and winter ranges.
6. Give consideration for land use and water use management to aid in recovery of populations of threatened and endangered species.
7. Increase the research program to evaluate and improve the fisheries on important Henrys Fork tributaries such as the Falls, Teton, Warm and Buffalo rivers, and Bitch and Robinson creeks.

Sources

Final Environmental Impact Statement of the Island Park Geothermal Area. U.S. Department of Agriculture - Forest Service and U.S. Department of the Interior - Bureau of Land Management, 1980, Targhee National Forest.

Fishery Research Reports including Regional Fishery Management Investigations, Idaho Department of Fish and Game, 1979-89.

Fisheries Management Plan 1991-1995, Idaho Department of Fish and Game.

Idaho Bald Eagle Research Project, Greater Yellowstone Ecosystem, Annual Production Summary 1991, USBLM, USFS, IDFG, Northern Rockies Conservation Cooperative.

Natural Features and Scenic Values

The Island Park plateau, located above the town of Ashton and the Teton Valley, a high mountain valley, are scenic focal points in the Henrys Fork basin. High snowfall combined with pleasant cool-dry summers support coniferous forests with large open meadows. Porous rock allows for the infiltration of much of the snowmelt providing good summer recreation-season streamflows.

Prominent scenic attractions are the Tetons, a series of mountain peaks in Wyoming, Henrys Lake, Sawtell Peak, Island Park Reservoir, and Mesa Falls. The 6,300-acre Henrys Lake, the 8,400-acre Island Park Reservoir, and the Henrys Fork meandering through the canyons and open meadows of the Island Park plateau attract national notice. The 4,060-acre Harriman State Park complex and the scenic Big Springs-Macks Inn reach are focal points for visitors.

The Teton Range is a prominent scenic feature of the basin.

Mesa Falls, on the Henrys Fork, is one of the most impressive falls in the State. The Upper Falls has a drop of 114 feet, but the Lower Falls, dropping 65 feet one mile downstream, is perhaps more impressive because the river is constricted. Sheep Falls, four miles upstream of Upper Mesa Falls on the Henrys Fork, also is noteworthy with a drop of 35 feet. Sheep Falls on Falls River, about two miles downstream from the Idaho border, has about a 30-foot drop. These falls can be viewed at the end of a two-mile trail.

Northwest of St. Anthony, are many lava caves of which Crystal Falls Cave is one of the most remarkable. The name comes from the ice formations found within the cave.

Mountain Ranges

Centennial Mountains - This part of the Continental Divide between Idaho and Montana reaches from the western boundary of the basin to Red Rock Pass, west of Henrys Lake. This relatively narrow range is one of the most magnificent in the state with high rugged backbones and deep canyons.

Henrys Lake Mountains - This crescent-shaped range arcs around the north of Henrys Lake from Red Rock Pass on the west to the Madison Plateau of Yellowstone National Park southeast of the lake. Located east of the Centennial Mountains, these mountains are also a part of the Continental Divide between Idaho and Montana.

Big Bend Ridge - Approximately eight miles wide, the ridge extends northwest for 18 miles from the Henrys Fork near Ashton to the valley of Island Park Reservoir. It reaches an altitude of 7,500 feet.

Big Hole Mountains - These mountains are west of the towns of Victor, Driggs, and Tetonia and parallel the Teton Range. The extension of these mountains into Wyoming from the south end of the Teton Basin is known as the Snake River Range.

Snake River Range - The South Fork of the Snake River parallels the range to the south. The Teton Basin is to the north. The range extends 40 miles from Wyoming into Idaho, and varies in width from 12 to 24 miles.

Sand Hills (Juniper Buttes) - A prominent group of hills, composed of gently sloping lavas northwest of St. Anthony, beyond the sand dunes.

Teton Range - Perhaps one of the most picturesque mountain ranges in the United States, their highest point, Grand Teton, is 13,766 feet above sea level. These pointed mountains form part of the Henrys Fork basin boundary located just across the state line in Wyoming. This range is a major visual feature seen throughout the basin.

Thurmon Ridge - This low, gently rising ridge is the prominent west background feature for the heavily used recreational stretch of the Henrys Fork, adjacent highway, and resort area starting at the Island Park Reservoir and extending south past Harriman State Park. Likewise, this ridge from its other side is the south background feature for the main body of Island Park Reservoir and adjacent land.

Targhee Peak (10,285) - The highest point in the Idaho portion of the basin, four miles north of Henrys Lake.

Black Mountain (10,237) - Located three miles north of Henrys Lake.

Mount Jefferson (10,196) - Located six miles southwest of Henrys Lake, west of Sawtell Peak. There are really two peaks, each rises steeply 600 feet above timber line, with almost vertical north faces. The summit elevation is the highest in the Centennial Mountains.

Bald Peak (Lionhead Peak) (10,180) - Located six miles northeast of Henrys Lake adjacent to Targhee Peak.

Sawtell Peak (9,866) - This prominent landmark south of Henrys Lake, northwest of Macks Inn, and North of Island Park, forms a backdrop to much of the Upper Island Park recreational area.

Taylor Mountain (9,855) - The highest point in the western part of the Centennial Mountains is located northwest of Island Park Reservoir.

Red Rock Mountain (9,512) - A companion peak to Mount Jefferson, located on the south side of Red Rock Pass, north of Mount Jefferson.

Reas Peak (9,371) - In the Centennial Mountains, located directly north of the middle of Island Park Reservoir.

Garns Mountain (9,016) - Located southwest of Driggs.

Oliver Peak (8,987) - Located south of Victor.

Ryan Peak (8,860) - Located west of Driggs.

Two Top (8,710) - These barren twins are directly east of the southern part of Henrys Lake.

Bishop Mountain (7,810) - Located south of the main body of Island Park Reservoir.

High Point (7,281) - A prominent point located southwest of Harriman State Park is seen from much of the recreation area below Island Park Reservoir.

Menan Buttes (5,619) - These broad, prominent, and picturesque twin crater buttes rise out of the lowland agricultural area near the junction of the Henrys Fork with the Snake River, just west of Rexburg.

Lakes, Reservoirs, and Rivers

Table 20 includes still-water areas of 20 acres or larger. There are many more lakes, most of which range from 1 to 5 acres.

Water areas are associated both with open meadows and with wooded areas. The many streams in the basin cover approximately 3,600 acres. This is probably an underestimate since now many narrow streams and smaller rivers with overhanging vegetation cannot be identified through photo interpretation. The principal creeks and rivers are:

Henrys Fork and Henrys Lake Outlet - While the Idaho Legislature has stated that the Henrys Fork originates at Henrys Lake, local usage is to assume that the Henrys Fork originates at Big Springs, located east and upstream from Macks Inn. Big Springs flows at a nearly constant 170 cubic feet per second. The continuation of the Henrys Fork nine miles into the upper basin above Big Springs is known as Henrys Lake Outlet. The Henrys Fork, including Henrys Lake Outlet, is about 117 miles long. This water area provides outstanding opportunities for recreation and is a major irrigation supply for the lower basin.

Sand Creek/Blue Creek/Pine Creek - Sand Creek and the noted tributaries originate along the west or desert side of Big Bend Ridge, and flow south into the Henrys Fork about five miles downstream of Ashton Dam.

Sheridan Creek - tributaries originate in the Centennial Mountains and flow into the west end of Island Park Reservoir.

Icehouse Creek - originates in the lower hills of the Centennial Mountains and flows into the upper end of Island Park Reservoir.

Sheep Creek and Yale Creek - originate in the east end of the Centennial Mountains and flow into the northeast end of Island Park Reservoir.

Table 20. Lakes and Reservoirs

Name	Size in Acres	Location
Island Park Reservoir	8,400	West of Town of Island Park
Henrys Lake	6,300	Upper End of Basin
Sheridan Reservoir	415	7 Miles Northwest of Island Park Res.
Ashton Reservoir	398	West of Ashton on Henrys Fork
Silver Lake	150	In Harriman State Park
Quayle Lake	≈160	13 Miles West of St. Anthony
Trudes Bay	90	Northwest End of Island Park Res.
Blue Creek Reservoir #4 (aka as Sand Creek)-for fishing	78	16 Miles North of St. Anthony
Lower Arcadia	68	11 Miles North of St. Anthony
Icehouse Creek Reservoir	64	4 Miles North of West End of Island Park Res.
Davis Lake	≈55	6 Miles West of St. Anthony
Blue Creek Reservoir #2	≈45	14 Miles North of St. Anthony
Lemon Lake	≈45	6 Miles West of Ashton
Fish Pond	40	2 Miles Southeast of Harriman State Park Headquarters
Hossner Pond	≈40	1 Mile West of Ashton
Upper Arcadia	40	11 Miles North of St. Anthony
Blue Creek Reservoir #3	39	16 Miles North of St. Anthony
Last Chance Pond	35	1 Mile South of Last Chance
Golden Lake	50	In Harriman State Park
Horseshoe Lake	30	Near Southwest Corner of Yellowstone National Park
Swan Lake	≈30	3 Miles South of Silver Lake
Elk Creek Reservoir	25	1 Mile North of Island Park
Railroad Pond	25	1 Mile Northeast of Fish Pond
Sheep Creek Reservoir	25	1 Mile North of East End of Island Park Res.
Bishop Lake	20	West End of Island Park Res.
Blue Creek Reservoir #1	≈20	14 Miles North of St. Anthony
Robinson Lake	20	Southeast Corner of Yellowstone National Park
TOTAL	15,900	

≈ means about aka - also known as

Duck Creek - drains the north side of the Mount Jefferson-Sawtell Peak area and flows into the west side of Henrys Lake.

Targhee Creek - drains the small but rugged area northeast of Henrys Lake. The creek empties into the east side of Henrys Lake.

Moose Creek - originates near the Wyoming border and flows into Henrys Fork from the southeast at Macks Inn.

Buffalo River - originates from many springs east of Ponds Lodge and flows into the Henrys Fork just below Island Park Dam at an average rate of 170 cfs.

Split Creek originates along the Wyoming border and flows west before moving into the ground-water system east of the settlement of Island Park. Many of the Warm River springs originate from this water source.

Warm River - originates from many springs and highland runoff along the Yellowstone Park boundary. The spring sources give the river a uniform base flow. Warm River discharges into the Henrys Fork just after it drops off the Island Park plateau east of Ashton.

Fish Creek - one of the tributaries of Warm River.

Robinson Creek - originates in the southwest section of Yellowstone National Park and flows into the Warm River just above its mouth. Steep walls and a deep canyon make the middle part of this stream one of the most picturesque in the State.

Rock Creek/Porcupine Creek - are two significant tributaries of lower Robinson Creek.

Falls River (Fall River) - is a large tributary of the Henrys Fork. It has a highly variable flow with runoff equal to the Teton River and perhaps higher peak flows. The unregulated flow varies from an average monthly flow of over 2,000 cubic feet per second (cfs) in May or June to near 400 cfs in the fall and winter. The total runoff is quite large, averaging 600,000 acre-feet. This river drains a major portion of southwest Yellowstone Park. There are many fast water areas along this river with a timbered deep, picturesque, lava canyon above Boone Creek. The lower river is recessed in rolling farmland. Federal agency maps use the term Falls River, while the local people and earlier U.S. Geological Survey water publications use the name Fall River.

Boone Creek - a tributary of Falls River that originates in the northern portion of the Teton Range. Only the lower four miles are in Idaho.

Conant Creek - also originates in the northern portion of the Teton Range and flows into the lower Falls River.

Squirrel Creek - a major tributary of Conant Creek, both of which originate in Wyoming.

Teton River - a 60 mile tributary of Henrys Fork. The Teton River drains a large portion of the southern part of the basin. The river originates from many streams in the Teton Range in Wyoming. It flows through a wide, agricultural, high-mountain valley before entering a lengthy 600-foot deep canyon that transects an agricultural plateau. The Teton River discharges into the lower Henrys Fork River near Rexburg. This river is a major tributary of the Henrys Fork, along with the Falls River. The unregulated flows are very similar to those of Falls River.

Bitch Creek - originates in the Teton Range of Wyoming and flows into the Teton River. The Idaho portion of Bitch Creek is about 15 miles long and lies within a rugged canyon which is inaccessible over much of its length. The name comes from the French word biche meaning doe.

Badger Creek - also originates in the Teton Range of Wyoming and flows into the Teton River. Its drainage area is smaller than that of Bitch Creek.

Teton Creek - originates in the Teton Range of Wyoming near the Grand Tetons and flows into the Teton River near Driggs.

Trail Creek and tributaries - originate in the southern Teton Range of Wyoming at the southern end of the Idaho Teton Basin. Trail Creek is the most upstream source of the Teton River.

Canyon Creek and Calamity Creek - originate east-southeast of Rexburg in the Big Hole Mountains. Canyon Creek flows into the Teton River in the lower portion of the Teton Canyon.

Moody Creek - also originates southeast of Rexburg in the Big Hole Mountains and flows into the lower Teton River near Rexburg, below Canyon Creek.

Other scenic features related to water are incised canyons (see alson Table 21). The named canyons of the basin are listed below. The order of listing will be from north to south.

Table 21. Named Canyons

Name	Location
Garner Canyon	East of Henrys Lake Outlet
Carrot Canyon	North of West Side of Island Park Reservoir
Dry Canyon	North of Island Park Reservoir
* White Elephant Canyon	Southeast Side of Sawtell Peak
Black Canyon	East of Macks Inn
Box Canyon	Below Outlet to Island Park Reservoir
Cooney Canyon	Southwest of Island Park Reservoir
* Porcupine Canyon	Adjacent to Cooney Canyon
* Smead Canyon	Adjacent to Cooney Canyon
* Bear Canyon	Close to Cooney Canyon
* Green Canyon	Close to Cooney Canyon
* South Fork Split Creek Canyon	Near Yellowstone Park Boundary
* Trail Canyon	Upper End of Warm River
* Flat Canyon	Northeast of Settlement of Warm River
Trail Canyon	Northeast of Settlement of Warm River
* Anderson Mill Canyon	West of Lower Mesa Falls
* Hale Canyon	West of Settlement of Warm River
* De Witt Canyon	North of Ashton
* Box Canyon	North of Ashton
* Kerr Canyon	North of Ashton
* Putney Canyon	North of Ashton
* Jump Out Canyon	North of Ashton
* Coleman Canyon	North of Ashton
Teton River	Northeast of Rexburg
Bitch Creek	Northeast of Rexburg
Canyon Creek	East of Rexburg
Moody Creek	Southeast of Rexburg
* Dry Creek Canyon	Off Moody Creek
* Limekiln Canyon	Upper End of Moody Creek
Pole Canyon	South of Victor

* See 1:24,00 scale topographic maps

The open meadows and valleys surrounded by forest are admirable scenic assets of the upper portions of the Henrys Fork basin. Table 22 is a listing of the named valleys and meadows.

Table 22. Valleys and Meadows	
Name	Location
Henrys Lake Outlet Valley	Downstream from Henrys Lake
Shotgun Valley	The North Side of Island Park Reservoir
Toms Creek Meadow	One Mile East of Island Park
North Antelope Flat	South of Eastern Island Park Reservoir
Antelope Flat	South of Eastern Idaho Park Reservoir
Putney Meadow	Three Miles South of Southwest Corner of Yellowstone Park
Moody Meadow	Upper End of Moody Creek
Teton Valley	Valley Surrounding Driggs
Thousand Springs Valley	West of Garns Mountain (W. of Victor)
Harriman State Park (Main River Ranch portion)	Below Island Park

Recommended Action

1. Protect natural vegetation along lake and reservoir shorelands as well as along natural and recreational river shorelands.
2. Encourage development set-backs to preserve both water quality and aesthetics along lakes, reservoirs, rivers and streams.
3. Encourage development of greenbelts along rivers in urban and rural areas.
4. Encourage protection of outstanding scenic resources including canyon environments.

Aquaculture

Aquaculture or the hatchery production of fish has been undertaken in the Henrys Fork Basin. The Ashton hatchery, operated by the Idaho Department of Fish and Game, is ranked seventh in size among the thirteen State of Idaho hatcheries which produce non-anadromous (non-ocean migrating) fish. The Ashton facility is the hatchery serving the Upper Snake River. The non-anadromous State of Idaho fish hatcheries and their percent of total production in pounds are listed in Table 23.

The water temperatures at the Ashton hatchery are a little cooler (52°F) than at the larger production facilities at Hagerman, American Falls, and Nampa (57-59°F), so the growth rates are slightly lower at Ashton. Other water chemistry measurements at Ashton are clearly within limits for good growth rates.

Table 23. Percent of State Hatchery Production of Resident Fish	
Hagerman	34%
American Falls	17%
Nampa	17%
Grace	10%
Mackay	8%
Hayspur (Blaine County)	7%
Ashton	4%
Clark Fork (North Idaho)	2%
Cabinet Gorge (North Idaho)	1%
McCall -- Distribution Center	
Henrys Lake -- Egg Production	
Eagle -- Research Use	

The Henrys Lake hatchery, located on the east shore of Henrys Lake, is used almost exclusively for the production of cutthroat trout eggs which are shipped to other state hatcheries. Fish rearing at the hatchery would not be efficient because of the effect of water temperature (46°F) on growth rates.

The State of Idaho's Warm River Hatchery, located about eight miles upstream of the mouth of Warm River or about 22 miles northeast of Ashton by road, was closed about 5 years ago. The hatchery had a water temperature of 50°F. The hatchery was closed because of restricted available land at the site, the need for installation of pollution control equipment, and higher production costs than at other hatcheries.

There are 30 identified warm water sources in the Henrys Fork Basin with water temperatures in the optimum growth range of 60°F and higher. Generally, these water sources are located in the lower valley, particularly in the Rexburg to Newdale area. A second potential warm water area for aquaculture use is in the Island Park caldera, an approximately twelve-mile circular area bordering the south side of Island Park Reservoir and extending to the southeast. Deeper wells drilled in the area are expected to produce water of suitable temperature for fish culture. However, private land in the area is very limited and has a high value for recreation use. The harsh winter climate in the Island Park area is also a limiting factor.

There are specific water chemistry needs for aquaculture. A preliminary review of some water chemistry from current wells suggests the water chemistry may be satisfactory. The pH level is generally in the range of 7.6 to 8.0. Although a level closer to neutral (7.0) may be optimum, the pH level in itself generally is not a limiting factor. Most of these waters appear to have suitable alkalinity, specific conductance, ammonia and nitrate levels.

In summary, there appears to be potential for private aquaculture development in the basin, although, in most cases some pumping of water will be necessary.

Sources

George W. Klontz and John G. King, Aquaculture in Idaho and Nationwide, Idaho Water Resources Research Institute, 1974.

Idaho Fish and Game Facts, Idaho Department of Fish and Game, 1989.

John C. Mitchell, Linda L. Johnson and John E. Anderson, Geothermal Investigations in Idaho, Part 9, Potential for Direct Heat Application of Geothermal Resources, Idaho Department of Water Resources Water Information Bulletin No. 30, 1980.

Domestic, Commercial, Municipal and Industrial (DCMI) Uses

Domestic water generally refers to systems providing water to one or more suburban or rural private households. Commercial refers to private water systems that serve places of business, including schools. Municipal refers to public water systems for private households, places of business, small manufacturing plants, and irrigation of lands within municipal boundaries. Industrial refers to private water systems for manufacturing plants.

Relative to the large amounts of water diverted for irrigation or required for instream use for fish and recreation or for hydroelectric power production, a minor amount of water is used for domestic, commercial, municipal and industrial (DCMI) needs. In Idaho, and in the Henrys Fork Basin, food processing is the largest industrial use of water. There is some industrial water use associated with lumber manufacturing, however, the major DCMI use is generally associated with municipal water delivery systems. For more populous areas of the nation, DCMI use is significant. For the Henrys Fork Basin it is quite low (Table 24).

Table 24. 1985 DCMI Use (acre-feet)

	Rural Domestic		Domestic, Commercial, Municipal		Industrial		
	Withdrawn	Consumed (24%)	Withdrawn	Consumed (22%)	Withdrawn	Consumed (8%)	Rounded Total
Madison	500	120	3,000	660	400	30	
Fremont	40	10	1,300	290	800	60	
Teton	10		400	90	Minor	–	
Withdrawal	550		4,700		1,200		6,500
Consumption		130		1,040		90	1,300

Total withdrawal in 1985 for DCMI purposes was 6,500 acre- feet--virtually all from ground water. This 6,500 acre-feet is one-half of one percent (0.5%) of the amount diverted for irrigation use (1,153,000 acre-feet) within the Henrys Fork Basin. Total consumption was 1,300 acre-feet. Projections to the year 2010 indicate a 35 percent basin-wide population increase from 1983 population levels. A simplified water use projection would use a proportional increase in domestic, commercial, municipal and industrial water use relative to the population level increase. The projected total water withdrawal for DCMI use in 2010 therefore is 8,700 acre-feet with a total consumption 1,700 acre-feet. The incremental use is 2,200 (8,700-6,500) acre-feet diverted and 400 (1,700-1,300) acre-feet consumed.

Because of the very small future needs for DCMI water use within the basin, there should be little conflict in meeting future needs. The small amount of water needed to meet all anticipated future DCMI growth likely will be provided from new ground-water appropriations.

New withdrawals of ground water within the impact area of the Swan Falls Agreement (see Figure 8) would be part of the trust water assigned for future DCMI use. Ground-water withdrawals in parts of the basin not in the Swan Falls impact area (Idaho Code 42-203B) are regulated by the ordinary water appropriation criteria.

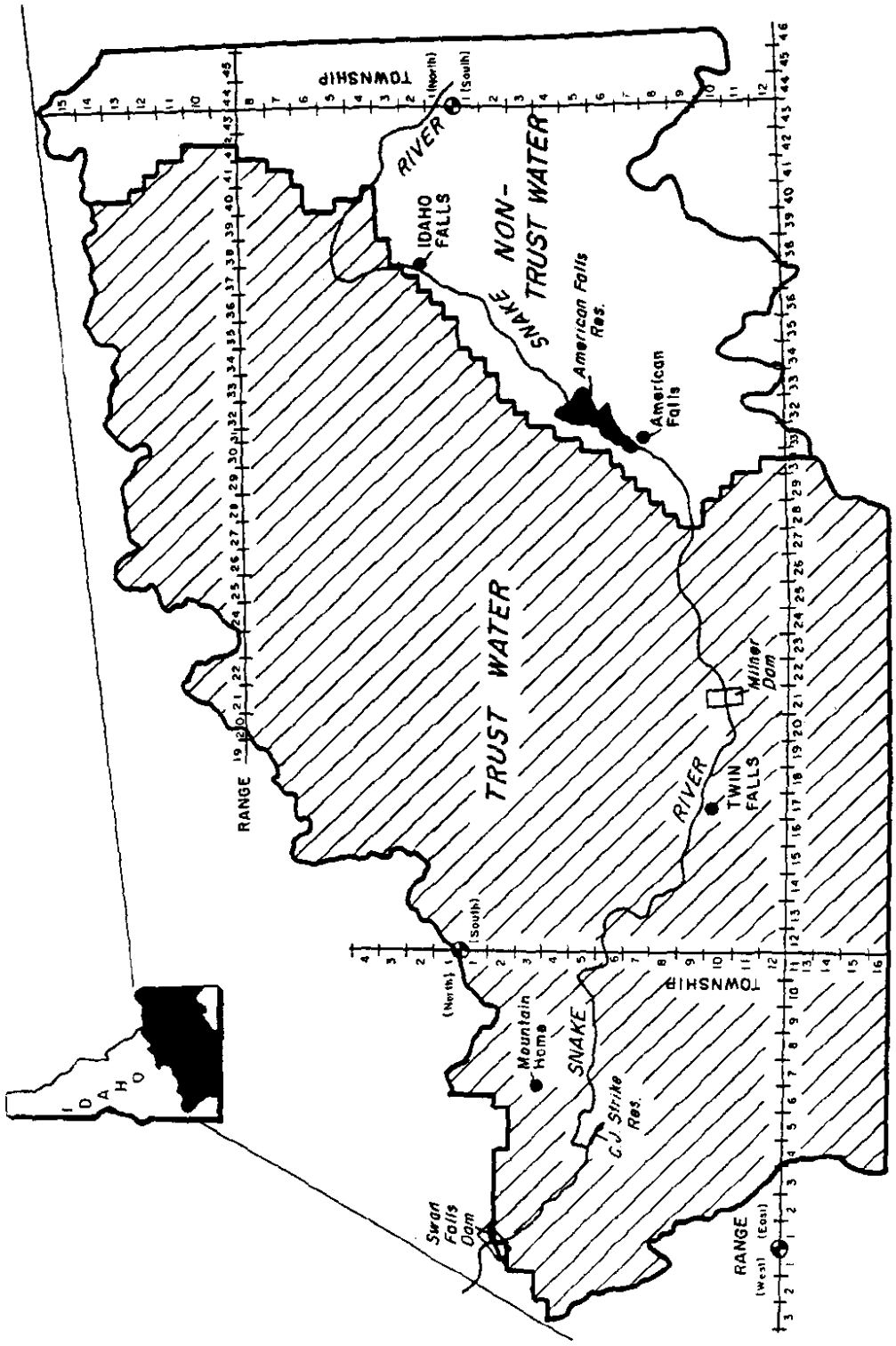
Recommended Action

Future DCMI water needs will likely be met using ground water. Large commercial or industrial water users may have to purchase existing water rights or rely on the water bank.

Sources

Goodell, S.A., 1988, Water Use on the Snake River Plain, Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-E, pp. E37-E44

Figure 8:
Swan Falls Trust Water Area



Irrigation

Present Status

Irrigated agriculture and related food processing is the main economic activity in the Henrys Fork basin. Most crop production within the basin takes place in areas where mollisols are the general soil type. Mollisols of Idaho's highland plateau areas are similar to the fertile soils of the midwest, and the dryland farmed soils of the Moscow-Grangeville area of northern Idaho. Mollisols formed under considerable grass vegetation and generally are inherently fertile. They contrast to the aridisols of the lower main Snake River plain in that there is much less accumulated salts, lime, and clay and much more accumulated organic matter in the mollisols.

The primary agricultural product is potatoes. In the St. Anthony-Rexburg area this largely is fresh pack potatoes as well as some processing potatoes. Because of the shorter growing season in the St. Anthony-Ashton area and in Teton County, the potato acreage is largely seed potatoes. The primary rotation crops are barley and wheat, generally planted in the spring. In addition, significant livestock production occurs in all the basin counties.

The 1979 estimated total potentially irrigable and irrigated acreage as well as the water source and irrigation method are tabulated below by county (Table 25). A recent (1990) reanalysis using current inventory techniques shows the figures are quite close to being current.

Most of the potentially irrigable land is used for dryland grain production, of which 75 percent is spring barley. In Fremont County a minor amount of dryland potatoes are produced. The 1987 estimated acreages of irrigated land use by county are shown in Table 26. The other lands not listed by crop are largely wild hay, pasture and idle land. The barley, wheat and alfalfa lands, which support a livestock sector, are primarily a rotation crop for potatoes.

The increases in the amount of irrigated land between 1969 (a year in which data is available) and 1990 is noteworthy (see Figure 9). There have been significant changes in both surface-water supplied irrigation and ground-water supplied irrigation. Yet the largest change relative to the original acres is the ground-water supplied irrigation.

Table 25. Irrigated and Potentially Irrigable Acreage

County	Potential Irrigable	Total Irrigated	Irrigated Surface Water	Irrigated Ground Water	Irrigated Gravity	Irrigation Sprinkler
Fremont	87,000	124,000	104,000	20,000	23,000	101,000
Madison	73,000	113,000	60,000	53,000	41,000	72,000
Teton	47,000	84,000	71,000	13,000	13,000	71,000
TOTALS	207,000	321,000	235,000	86,000	77,000	244,000

Table 26. Acreage of Principal Crops

County	1987 Barley and Wheat	1987 Potatoes	1987 Alfalfa	1987 Other
Fremont	42,000	30,000	13,000	32,000
Madison	45,000	39,000	12,000	17,000
Teton	24,000	10,000	14,000	36,000
TOTAL	111,000	79,000	39,000	85,000

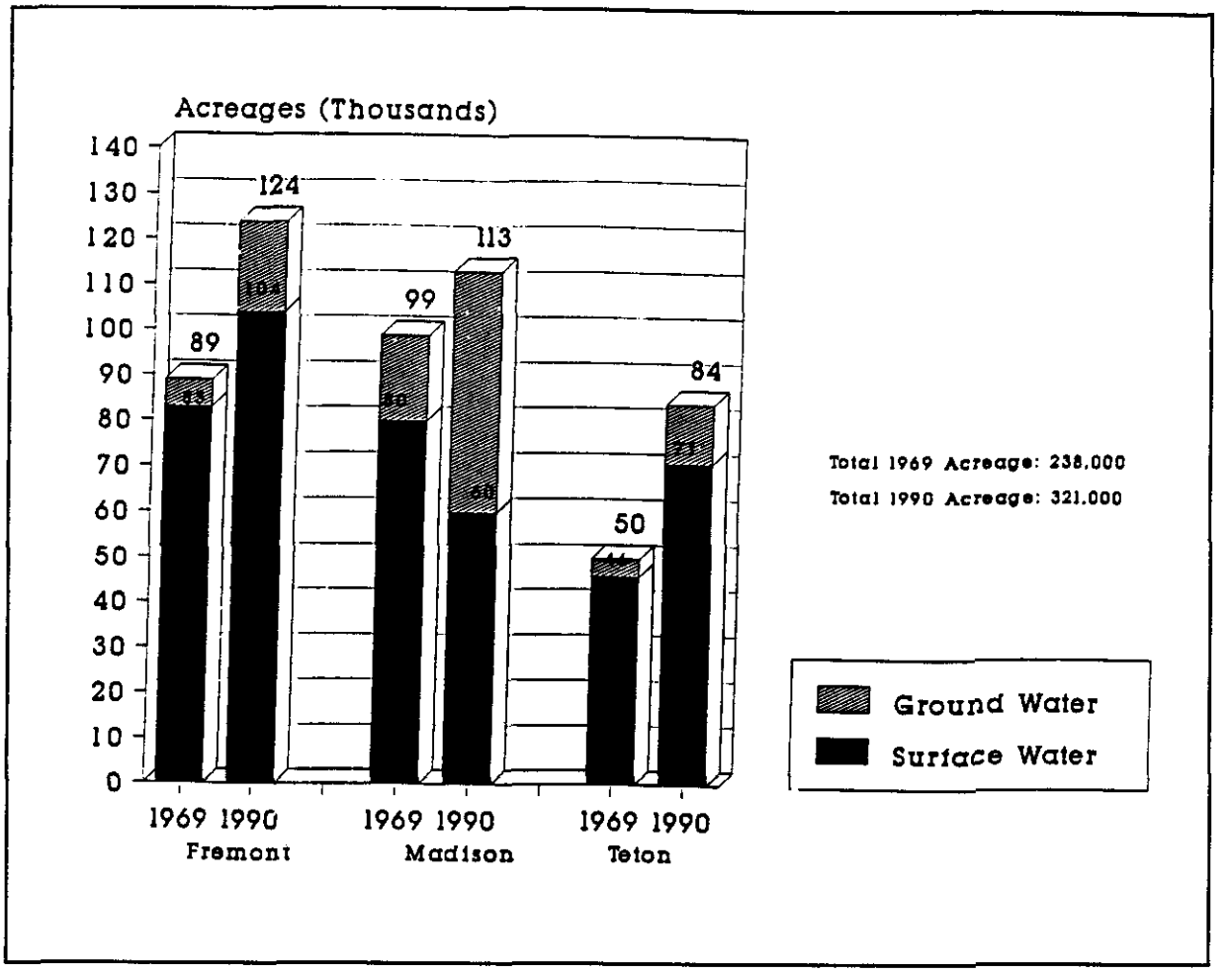


Figure 9. Increase in Irrigated Agriculture 1969-1990

Water Use

The acreages for the main diversion for most of the surface-water irrigated land in the lower Henrys Fork Valley are tabulated in the water supply section. The general location of all surface-water irrigated land and ground-water irrigated land is shown on the maps located toward the end of this section. Also shown are the potentially irrigable lands by a soil land classification rating of 1, 2 or 3.

The Henrys Fork, Lower Teton and Falls River water users are organized into the Fremont-Madison Irrigation District. They collectively have contracted all the storage in Island Park Reservoir and Grassy Lake Reservoir. These two reservoirs are owned and operated by the U.S. Bureau of Reclamation. Six irrigation companies within the irrigation district own and operate the Henrys Lake storage. The many irrigation companies own separate natural flow rights with differing priorities on streams within the basin. Storage reservoirs have water rights with priority dates interspersed with the priority dates of the natural flow rights. The amount of water diverted from natural flow or storage for each right holder is accounted for by Water District 01 (not an irrigation district) which has responsibility for administering water rights within the Snake River Basin above Milner Dam.

Center pivot irrigation in the Henrys Fork Basin.

During the late summer of a low water year, the Fremont-Madison Irrigation District water users continue to divert available natural flows; although, the natural flow rights belong to users below the mouth of the Henrys Fork because of earlier priority dates. This diversion of natural flow in lieu of release of Island Park or Henrys Lake storage is allowed up to the amount of such storage remaining. This water is made available to the lower users from storage water in American Falls Reservoir, Jackson Lake or Palisades Reservoir. The volumes released are charged against the Henrys Fork reservoir for accounting purposes. Thus, through exchange, part of the Island Park Reservoir and Henry's Lake storage may belong to downriver water users. If the reservoirs used in the exchange process fill during the subsequent water year, the water debt is canceled.

However, during a sequence of dry years a large share of Island Park and Henrys Lake storage could be held by others. To meet local storage water needs the Fremont-Madison Irrigation District would need to purchase rental pool water. The current rate is $2.75 per acre-foot. The rental pool is a yearly assignment of storage water by individual canal companies or groups in Water District 01.

As additional demands are placed upon the main-stem Snake River reservoirs, such as winter hydroelectric releases of rental water, there is a reduced chance of fill of these main-stem reservoirs. A last-fill rule assigned to nonirrigation rental water used below Milner Dam protects the Henrys Fork users from being impacted by additional rental water use. Irrigation companies that placed water into the rental pool that is used below Milner Dam are given a later fill for that portion of their allotment.

The following is a U.S. Bureau of Reclamation discussion of how they operate the federal water storage system in conjunction with natural flow water rights:

The Henrys Fork reservoirs are operated along with other Snake River reservoirs to enhance refill capabilities in subsequent years. Natural flows of the Henrys Fork tributaries often provide most of the water demanded for irrigation by direct diversion on the Henrys Fork even after the natural flow rights of these diversions are superseded by earlier rights downstream from Rexburg (downstream from the confluence of the Henrys Fork and Snake River). During the period when water diverted is rightfully stored, downstream demands entitled to natural flow are supplied from Snake River storage facilities.

Stored water is physically maintained in the farthest upstream reservoir in the system while storage use is accounted for according to ownership and contracted space. As the reservoirs are refilling during the subsequent winter, having the water upstream from where it was originally accrued by storage right allows maintenance of streamflows as the water is physically delivered to the correct storage right reservoir.

Having the water upstream also allows water to revert to the rights of the reservoir in which it is held at a rate greater the actual inflow to the reservoir once senior storage rights have filled. If water was held downstream and these reservoirs were filled, runoff occurring below upper basin dams would have to be bypassed and would be lost to the basin.

Since water is held upstream, once the water rights are full, inflow can accrue to upstream storage at the rate of inflow to the downstream reservoir. Federal storage contracts provide for the storage of water from other reservoirs in otherwise empty space. Therefore, water held in the upstream reservoir does not require replacement (from the rental pool) unless it is subsequently diverted. This rarely occurred prior to 1987, however, this practice has been repeated recently and is becoming accepted as standard practice.

Once all reservoirs are full, all the storage rights, regardless of how the water physically got there, are full. Because reservoirs have filled in most years in the Upper Snake River some misunderstandings have developed. Mainly the notion that if American Falls fills, then Henrys Fork reservoirs are entitled to their entire contents has been accepted as fact by many observers.

A more accurate statement is, "once the American Falls water right is filled on paper, regardless of physical contents, then Henrys Fork reservoirs will accrue water to their rights at a rate in excess of their inflows."

When a succession of dry years causes Fremont-Madison Irrigation District canals to divert more storage than they are entitled to, the excess must be purchased from the Upper Snake River Rental Pool. The pool is operated so that irrigators who have water supplies surplus to their present needs can share with those who run short.

After the needs of irrigators are fulfilled remaining water is available to uses below Milner Dam which historically has been utilized by power interests. Irrigators supplying water to the pool may stipulate that their water will not be used below Milner.

Space from which water is used below Milner reverts to last priority in it's refill in the ensuing year because use below Milner is an expansion of the purpose for which the stored water was originally appropriated. This last to fill provision protects the rights of others including Fremont-Madison Irrigation District.

The surface irrigation systems in the Ashton-Rexburg area divert from the Henrys Fork, Falls River and the Lower Teton River as shown in Table 27.

The Crosscut Canal takes water from the Henrys Fork and provides one-third to one-half its flow to the Fall River Irrigation Co. The remaining Crosscut Canal water is diverted to the Teton River above most of the Teton River diversions. Crosscut Canal flows are accounted for in the canal of the ultimate use.

Supplemental Water Needs

The average water diversions for the recent good water years of 1983, 1984 and 1986 is assumed to represent a full water supply. 1988 was a low water year. A rough estimate of the 1988 supplemental water needs can be made by subtracting the actual 1988 diversions from the average good water year diversion (Table 27). A review of rental pool transactions for 1988 shows about one-third of the estimated needs were provided by rental pool leases.

The use of other mechanisms to reduce water use perhaps should be considered. For example, placing some grain ground in a year-to-year government program for payment when no crop is harvested may return nearly as much net income as harvesting a full crop. Grain still might be planted and the limited forage plowed under as a rotation for potatoes. The grain forage may or may not receive one early irrigation.

Another drought-year tactic is to only irrigate hay for the highest yielding first cutting and then market or otherwise use the higher-value, late-season water. A year like 1988 in which a number of companies did not have a full water supply occurs with some regularity (an average of two years in ten). A much greater shortage occurred in 1977. The basinwide shortage of 45 percent had not occurred since the water-short years of 1931 and 1934, which gives it a reoccurrence interval of one year in twenty.

To provide facilities which furnish a full water supply for all users in all years would be quite costly. The U.S. Bureau of Reclamation (USBR) uses a guideline of an allowable shortage of up to 50 percent in any one year, up to an accumulated shortage of 75 percent in two consecutive years, or up to an accumulated shortage of 100 percent in a consecutive ten-year period. The Henrys Fork basin, on average, has a sufficient water supply using this guideline.

The basic economic supply-demand curve provides a graphical view of the difficulty of supplying a 100 percent long-term water supply. The graph (Figure 10) is drawn in general terms in order to show the basic economic principle. The cost per acre-foot of water becomes very expensive as efforts are made to approach a 100 percent supply. At the same time, the willingness to pay for new water decreases as the total quantity approaches 100 percent. Where supply and demand balance is an estimate of economic reasonableness. This is rarely at a 100 percent supply. Figure 10 is drawn for illustration purposes only and is not intended to represent current Henrys Fork conditions.

Table 27. Lower Henrys Fork Basin Diversions (acre-feet)

	1986	1984	1983	Average 1983-84&86	1988	Average less 1988	1977	Average less 1977
Henrys Fork								
Dewey	6,700	4,378	3,658	4,912	4,681	231	2,360	2,552
Last Chance	27,300	27,900	23,300	26,167	26,321	0	12,850	13,317
Farmers Friend	44,300	55,100	44,600	48,000	27,336	20,664[a]	8,650	39,350
Twin Groves	34,700	57,800	53,300	48,600	24,157	24,443[a]	17,830	30,770
St. Anthony Union	161,400	164,800	156,400	160,867	155,166	5,701	115,370	45,497
Salem Union	64,300	66,900	61,500	64,233	61,339	2,894	41,250	22,983
Egin	109,300	121,600	105,800	112,233	103,624	8,609	80,360	31,873
St. Anthony U. Feeder	28,700	46,400	37,800	37,633	27,328	10,305[a]	29,210	8,423
Independent	106,500	114,600	122,400	114,500	121,740	0	28,000	86,500
Consolidated Farmers	78,800	91,500	96,600	88,967	69,910	19,057[a]	47,270	41,697
Crosscut Canal	55,600[b]	54,900[b]	63,600[b]	58,000[b]	128,100[b]	(70,100)[b]	78,900[b]	(20,900)[b]
Subtotal	662,000	750,978	705,358	706,112	621,602	91,904	383,150	322,962
Falls River								
Yellowstone	3,136	1,561	2,172	2,290	3,506	0	1,468	822
Marysville	30,300	27,100	27,300	28,233	24,523	3,710	24,250	3,983
Farmers Own	18,900	16,600	15,800	17,100	15,034	2,066	11,590	5,510
Conant Creek	3,463	1,613	3,187	2,754	3,919	0	2,696	58
Boom Creek	512	280	327	373	695	0	850	0
Squirrel Creek	2,158	2,269	2,596	2,341	1,755	586	1,092	1,249
Orme	123	79	234	145	815	0		145
Enterprise	20,000	20,700	22,700	21,133	25,004	0	20,100	1,033
Fall River	86,800	118,450	95,800	100,350	87,074	13,276[a]	66,800	33,550
Chester	15,100	25,700	25,600	22,133	8,376	13,757[a]	4,890	17,243
McBee	500	780	964	748	113	635	61	687
Silkey	4,748	3,717	3,453	3,973	5,855	0	3,650	323
Curr	17,200	16,600	13,300	15,700	12,135	3,565[a]	9,840	5,860
Subtotal	202,940	235,449	213,433	217,274	188,804	37,596	147,287	70,464
Lower Teton River								
Canyon Creek	5,845	6,659	6,159	6,221	4,050	2,171[a]	1,590	4,631
Wilford	42,200	51,200	69,500	54,300	33,840	20,460[a]	14,960	39,340
Teton Irrigation	23,100	16,100	21,500	20,233	22,102	0	18,140	2,093
Siddoway	1,388	0	0	463	2,477	0		463
Pioneer	2,860	2,660	3,810	3,110	2,959	151	282	2,828
Stewart	3,543	2,233	1,884	2,553	2,786	0	930	1,623
Pincock-Byington	2,817	4,846	3,697	3,787	1,806	1,981[a]	1,154	2,633
Teton Island Feeder	121,700	117,200	130,500	123,133	95,763	27,370[a]	55,690	67,443
North Salem	1,972	502	0	825	1,364	0	48	777
Roxana	5,006	4,098	5,000	4,701	6,087	0	2,610	2,091
Island Ward	7,817	5,617	7,884	7,106	7,711	0	3,130	3,976
Saurey-Sommers	4,046	4,229	4,157	4,144	6,087	0	3,090	1,054
McCormick-Rowe	345	329	272	315	464	0	103	212
Pincock-Garner	1,999	4,699	2,531	3,076	2,665	411	958	2,118
Bigler Slough	1,115	1,797	2,148	1,687	537	1,150[a]	80	1,607
Woodmansee-Johnson	2,462	3,364	2,586	2,804	1,705	1,099[a]	1,610	1,194
City of Rexburg	5,546	6,760	6,383	6,230	3,929	2,301[a]	2,450	3,780
Rexburg Irrigation	54,500	42,300	45,200	47,333	55,883	0	39,310	8,023
Subtotal	288,261	274,593	313,211	292,022	252,215	57,094	146,135	145,887
Total	1,153,201	1,261,020	1,232,002	1,215,408	1,062,621	186,594	676,572	538,836

[a] Significant 1988 Shortages.
[b] Crosscut Canal numbers not included in Henrys Fork subtotal.

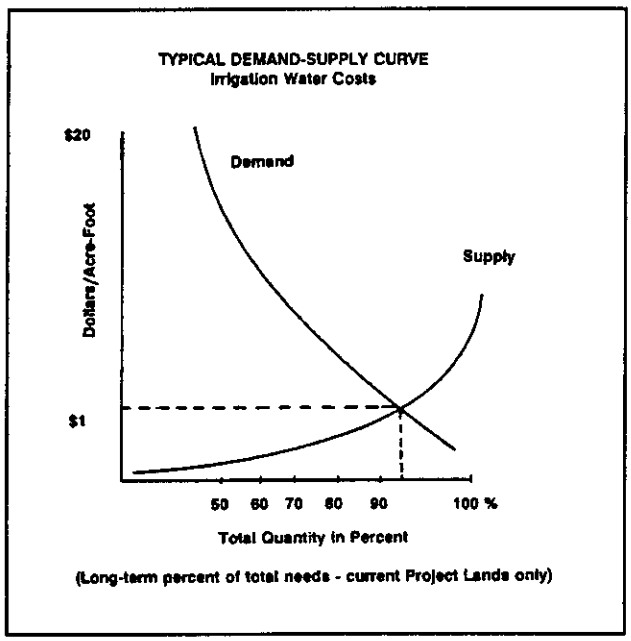


Figure 10. Typical Demand-Supply Curve

Various mechanisms have been proposed for the Henrys Fork Basin to provide a supplemental water supply. For years, the most discussed approach has been to construct new surface-water storage at the Teton damsite. Several other potential surface-water storage sites are discussed in the water supply chapter of this plan.

Recent reevaluations of the Teton site have indicated that costs would exceed benefits for any federal project likely to be built. Only limited project benefits could be credited to water used for supplemental irrigation. The same circumstances are likely to apply at other sites within the basin.

Another constraint on developing new water-storage sites is the lack of unappropriated water in the basin. Existing reservoirs downstream as far as American Falls on the Snake River would all have water rights senior to any new development. As opportunities to lease water from the water bank increase, the amount of water "carried over" in existing reservoirs will decrease. These senior reservoirs would have to fill before water for new storage would be available.

More efficient use of water (e.g. conversion to sprinkler) may result in reductions in the amount of water diverted from basin streams and reservoirs, perhaps making more water available for new storage. The Fremont-Madison Irrigation District, in cooperation with the Bureau of Reclamation, is currently reviewing their water use and operations. The review could lead to a quantification of supplemental irrigation needs and identify ways to improve water use efficiency. The impacts of new ground-water consumption within the basin will have to be considered. There may be a reduction in surface-water availability within the basin because of ground-water use.

Water Savings

Typical irrigated crops in the basin consume 20-30 percent of the water diverted. An enclosed water-delivery system would reduce water losses. Such a system would practically eliminate transportation losses from the open-ditch systems. Open-ditch transportation losses typically range from 20 percent to 30 percent of the river diversion amounts. This is a sizeable amount of water; although, on-farm losses are larger, ranging from 35 to 60 percent of the river diversions on a large canal system. Small amounts of the river diversions pass through the canal and return directly to the river. A small amount of water is consumed by water evaporation and phreatophytes. Any reduction in transportation losses would be beneficial during a dry water year. However, the cost per acre-foot of water saved would be quite high.

The Marysville, Yellowstone, Squirrel Creek, and Conant Creek irrigation companies investigated a joint gravity pressure distribution system in 1981. The proposed project assumed a zero interest loan from the U.S. Bureau of Reclamation, and separately funded hydroelectric facilities. Even with significant water savings and a revenue stream from power production, the likely benefits were not felt to justify the costs at that time.

Significant increases in the financial benefits from water conservation will require changes in Idaho water law. Provisions barring expansion of use, restricting the transfer of priority date, protecting third parties from damage, and loss of ownership through lack of use need to be addressed before conserving water will be truly attractive to water users in Idaho. Assuming that these questions will be addressed over time, there are opportunities in the basin for significant water savings.

Most analyses shows a more cost-effective method would be to provide for more efficient on-farm water application methods. A major shift to sprinkler irrigation has been occurring within the basin. Any increase in the financial incentives associated with water conservation would likely accelerate the shift to sprinklers in the basin. Water is a relatively inexpensive commodity in the basin, except during periods of prolonged drought. Few other non-farm water efficiencies are being adopted at this time.

Water Safety

Large open-ditch water transport systems are a very economical method of transporting water over long distances. There generally is no electric or other power need. Unfortunately, deaths in canals are a usual occurrence in Idaho. Seven lives were lost in 1988, and six more in 1989. Covered or fenced ditches would have been an impossible expense when these systems were built years ago. In most areas there have been few, if any, safety changes to these transport systems. In urban areas a few smaller ditches have been covered.

Fencing and covering ditches are practical safety measures in some areas. However, large laterals and canals are sometimes used for recreation. Fencing and covering these canals would restrict public access. If canal companies encourage recreational use, they could be subject to liability actions.

Another component of a water safety program is public awareness of irrigation ditch hazards. The Idaho Water Users Association has an Otto Otter elementary education program which largely centers on classroom instruction to third grade students. The school contact is arranged by the local irrigation organizations. Although this Otto Otter program is widely used in southwestern Idaho, it is little used in the Henrys Fork basin.

There are other public awareness approaches. Periodic public announcements of water safety hazards are important. The recreation chapter touches on a greater use being made of a learn-to-swim campaign. Part of the solution rests with the water delivery organizations and part of the solution rests with the public, including public officials and the school systems.

Potential for New Irrigation

The Henrys Fork Basin has a substantial amount of land suitable for irrigation development. The 197,000 acres shown in Table 28 is broken down by land class. In addition to soil suitability, the potential for irrigation development depends on the cost of water.

The soil classes identified in the table were evaluated about 25 years ago using criteria which do not fully reflect the economic feasibility of current sprinkler application methods. An updated classification would probably upgrade many of the Class III and IV soils.

Lands identified as Class IV (non-irrigable) may be developable with current technology. The 25 year old data show Class IV lands predominately in the Sand Creek-Camas Creek Plateau located

north of the Henrys Fork and northwest of St. Anthony. Recent U.S. Soil Conservation Service (SCS) mapping, which uses climate as a criteria, also placed these soils in a Class IV designation. This is also the case for some of the higher productivity silt-loam soils (#93 Fremont County). If the SCS did not use climate as a criteria, these soils generally would be mapped as Class III. Figure 17 results from the recent SCS mapping of Fremont County. For the entire county, if climate was disregarded, the classification generally would be upgraded one class rating and in a few places by two classes.

Table 28. Irrigable Acres by Class

	Class I	Class II	Class III	Total
Fremont	18,000	55,000	13,000	86,000
Madison	24,000	32,000	7,000	63,000
Teton	15,000	28,000	5,000	48,000
TOTAL	57,000	115.000	25,000	197,000

U.S. Bureau of Reclamation soils classification criteria do not downgrade soils because of climate. Because of the potential high economic return from these soils as illustrated by the current potato production in the adjacent Hamer area, these described SCS Class IV soils in the Sand Creek-Camas Creek area might more appropriately be shown as Class III soils.

Areas of currently irrigated and potentially irrigable land within the basin are shown on Figures 11-17. There are three areas that appear to have the greatest potential for further irrigation development. These are the Drummond-Lamont area, the Canyon Creek dryland farmed area and the Camas Creek Plateau area. In the higher elevation reaches of all these areas, potato production would primarily be for seed use.

The most extensive of these developable areas is the Drummond-Lamont dryland farmed area and its lower elevation westward extension. In this area ground water in sufficient quantities for irrigation appears to be difficult to develop. As mentioned in the water supply section, a ground-water study of the area is needed. Well enhancement techniques that are used in the petroleum industry have been used where water well yields are low, but water is highly valued. Future development in this area may require the application of such techniques (e.g. hydrofracing or using explosives).

The most obvious method of providing irrigation water to the Drummond-Lamont area is by supplying surface water via canal. Several off-stream storage sites as well as a Falls River site are discussed in the water supply section. An accompanying long-term lease of rental water would be needed.

A second small area that has potential for some additional irrigation development is in the Canyon Creek area. A few of these lands that lay just south of the Teton River could be served by high-lift pumping from the Teton River. Replacement water or new water developed upstream would be needed during most periods. Although highly controversial, one source might be ground-water pumped into the Teton River at the lower end of Teton Valley. Most of the higher ground would need an elaborate water supply. Some water is available for new storage from Canyon Creek; however, some imported water, probably from the upper Teton River, would need to be placed in off-stream storage for use on these lands.

The third area that has potential for further irrigation development is on the Sand Creek-Camas Creek Plateau. As described previously, these lands were identified as Class IV lands. That classification is because the soil has a higher than standard amount of sand. These generally are

loamy sand and sandy loams. The contradictory nature of the classification is that this soil generally is very good for the growing of high value potatoes under sprinkler irrigation. Water can be provided directly from underlying ground water, although consumption here may impact the Mud Lake area. No extended arrangements need be made for canal systems, storage reservoirs or for exchange arrangements.

The main controlling factors are the adequacy of the water supply effect on other users, public interest criteria, and the cost for power to lift the water. Much of the area appears to have water lifts in the 300 to 600 foot range (see the depth to ground-water map located in the water-supply section). The overlying land generally is controlled by the Bureau of Land Management. A transfer into private ownership would be needed.

In addition, there currently is a moratorium on approving new wells within the Sand Creek-Camas Creek Plateau. The moratorium will last at least until 1993 when a U.S. Geological Survey (USGS) study of the impacts of new development on the water available at Mud Lake is completed. It would have been useful if the study also investigated the impact on Mud Lake of reduced gravity irrigation in the Egin Bench-Rexburg area. This might be helpful as a sequel to the study.

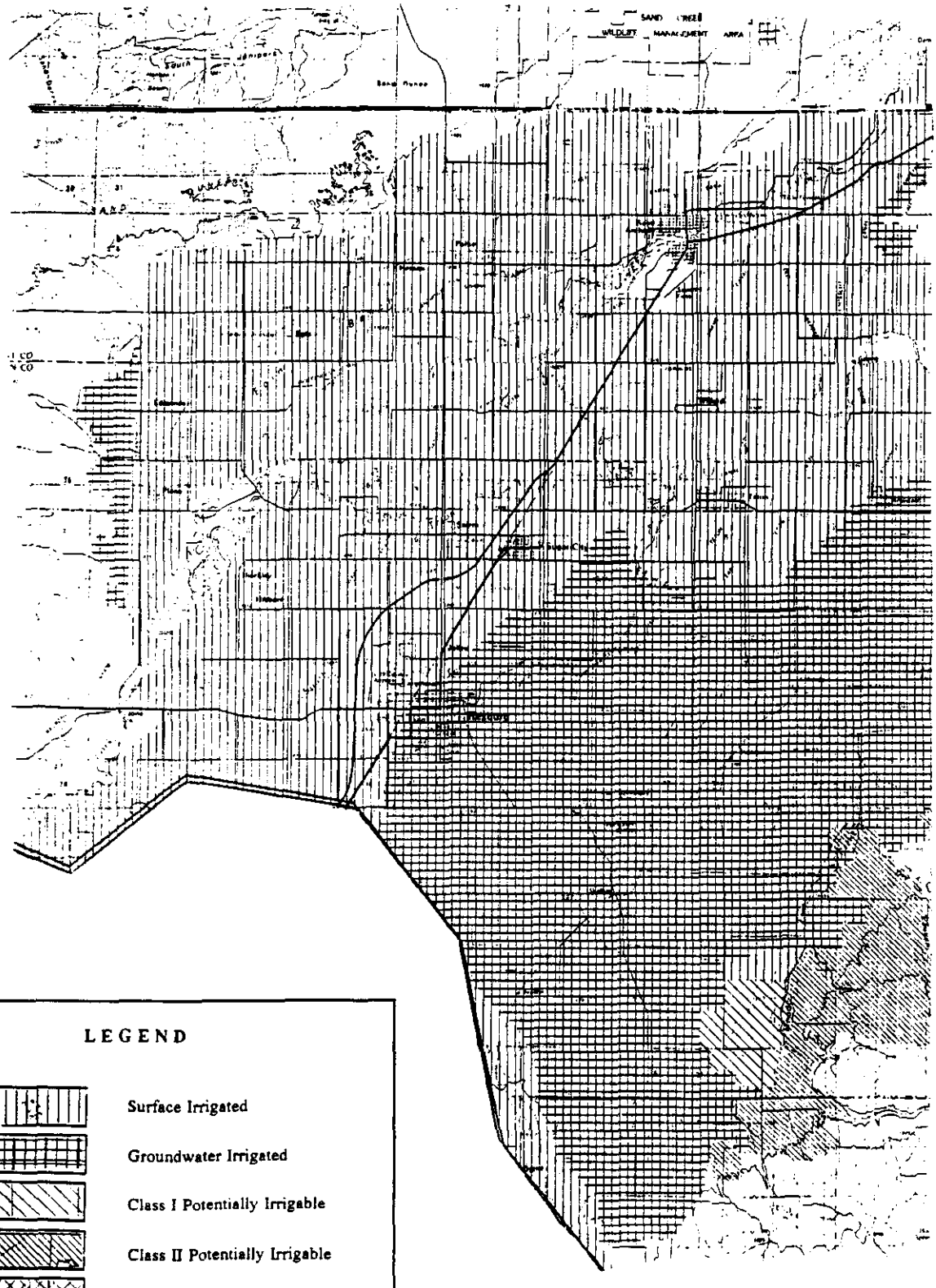
Perhaps of lessor importance, but still a barrier to development, is the trust water area set-aside as part of the Swan Falls Agreement (Idaho Code 42-203C). The Swan Falls impact area includes all ground water tributary to the Snake River below Milner Dam including the Thousand Springs source water. This source area extends into the Henrys Fork Basin (Figure 8). The criteria for allowing ground-water development in the trust water area, including water wells in the Lower Henrys Fork Basin, is whether the development affects the minimum stream flow at the Murphy gage below Swan Falls Dam. Additionally, development per year in the trust water area is limited to no more than 80,000 acres in any four year period. Public interest criteria which must be considered include the direct and indirect benefits to the economy, the project economic impact upon electric rates and the cost of alternate energy sources as well as the promotion of the family farming tradition.

On May 15, 1992 the Idaho Department of Water Resources established a moratorium on the processing and approval of permits for new consumptive uses of ground or surface water in the Snake River Basin above Weiser, Idaho. The moratorium does not apply to applications for domestic purposes. This action is in response to six consecutive years of drought, and will likely be withdrawn when streamflows return to normal levels.

Recommended Action

1. Encourage the development of new irrigation where environmental concerns can be met.
2. Promote new irrigation development on the Class IV lands north and northwest of St. Anthony which appear to overlay an excellent supply of ground water.
3. Encourage ground-water development where conjunctive use problems with surface water do not arise or where the conjunctive use problems can be mitigated.
4. Support incentives for the efficient use of water.
5. Encourage increased irrigation canal safety, through structural improvements, through public awareness and through learn to swim programs.
6. Develop measures and identify funding sources to provide supplemental irrigation water.
7. Quantify the need for a supplemental water supply for water short years on presently irrigated lands for each irrigation company. For shortages not capable of being met from the rental pool, a cost analysis of methods to meet the shortages should be developed.
8. Educate the public about existing water use practices in the basin and the water law that constrains both use and changes in use.

Figure 11: Irrigated and Potentially Irrigable Land - Egin Bench, Rexburg-Wilford, and Rexburg Bench



LEGEND

- Surface Irrigated
- Groundwater Irrigated
- Class I Potentially Irrigable
- Class II Potentially Irrigable
- Class III Potentially Irrigable

Figure 12: Irrigated and Potentially Irrigable Land - Canyon Creek and Eastern Rexburg Bench

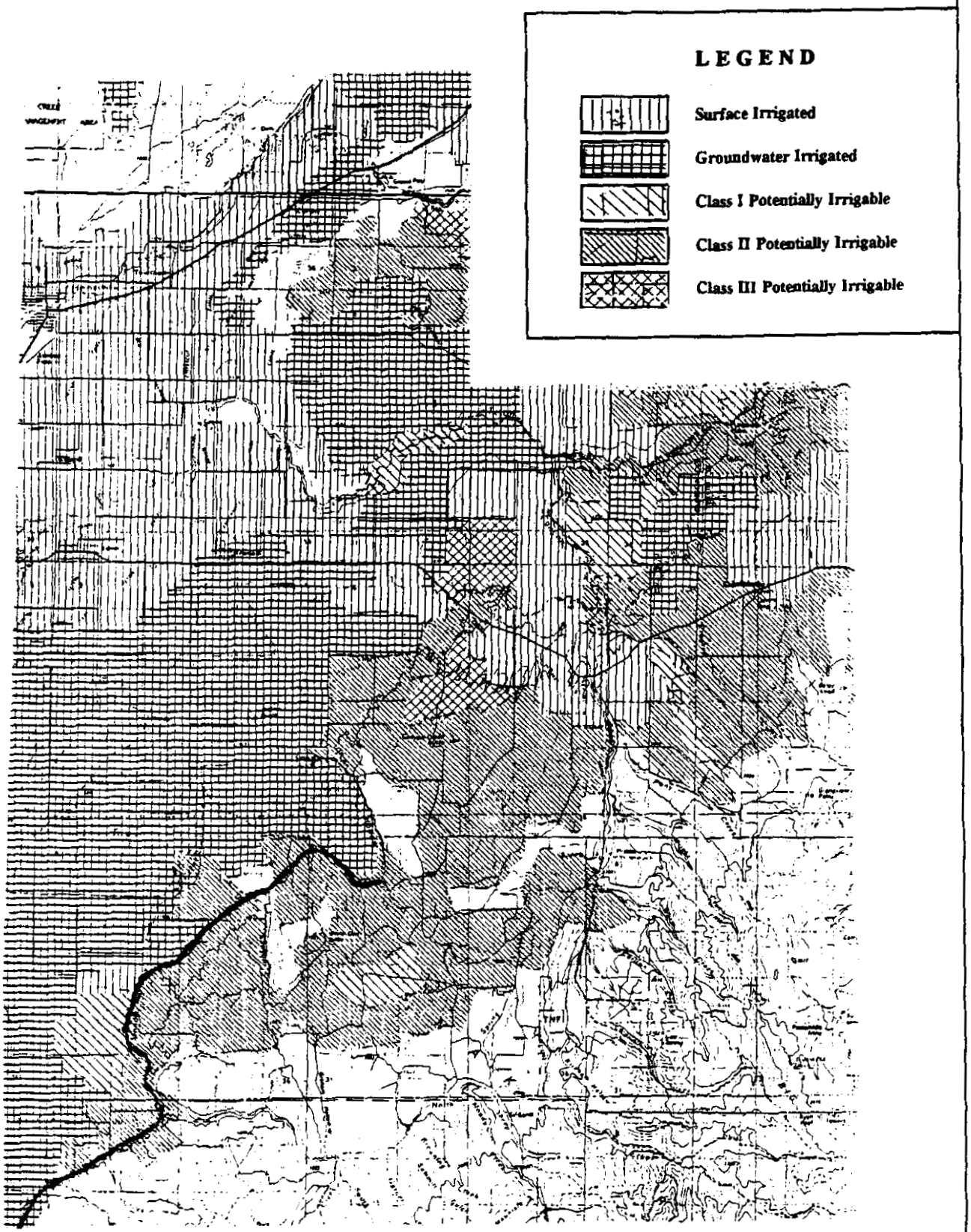
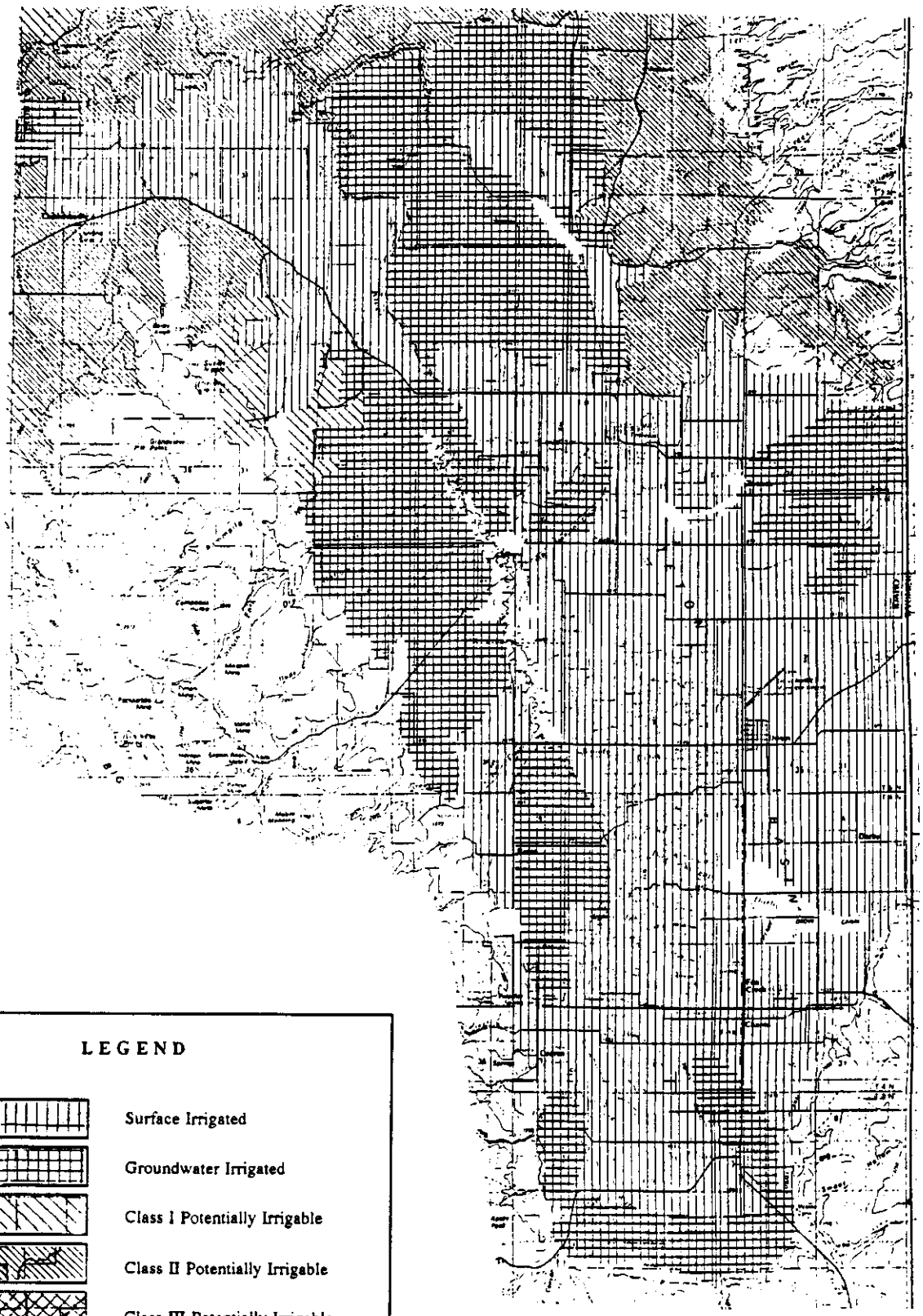


Figure 13: Irrigated and Potentially Irrigable Land - Teton Basin



LEGEND

- Surface Irrigated
- Groundwater Irrigated
- Class I Potentially Irrigable
- Class II Potentially Irrigable
- Class III Potentially Irrigable

Figure 14: Irrigated and Potentially Irrigable Land - Ashton and Drummond-Lamont Plateau

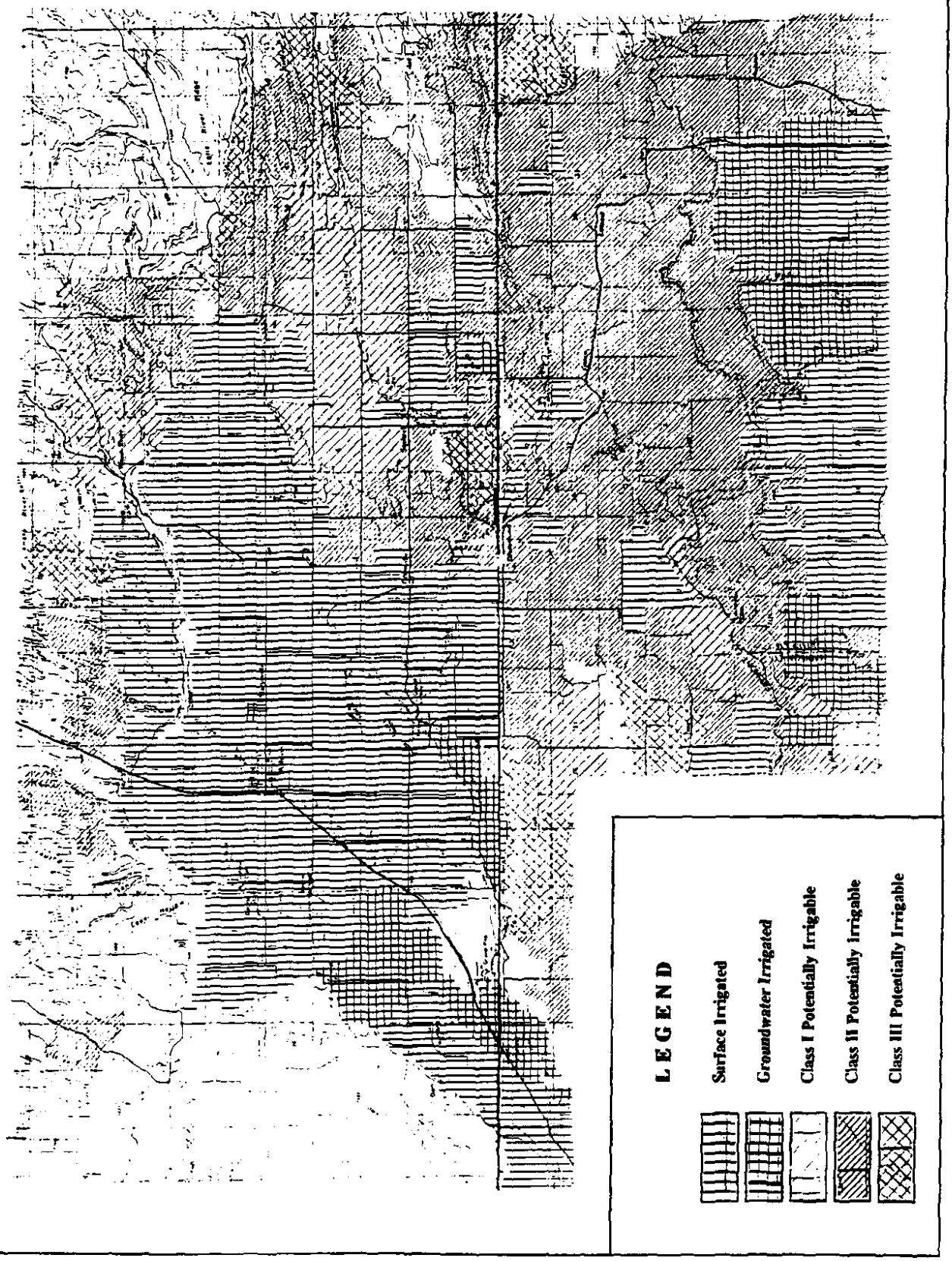


Figure 15: Irrigated and Potentially Irrigable Land - Island Park Reservoir

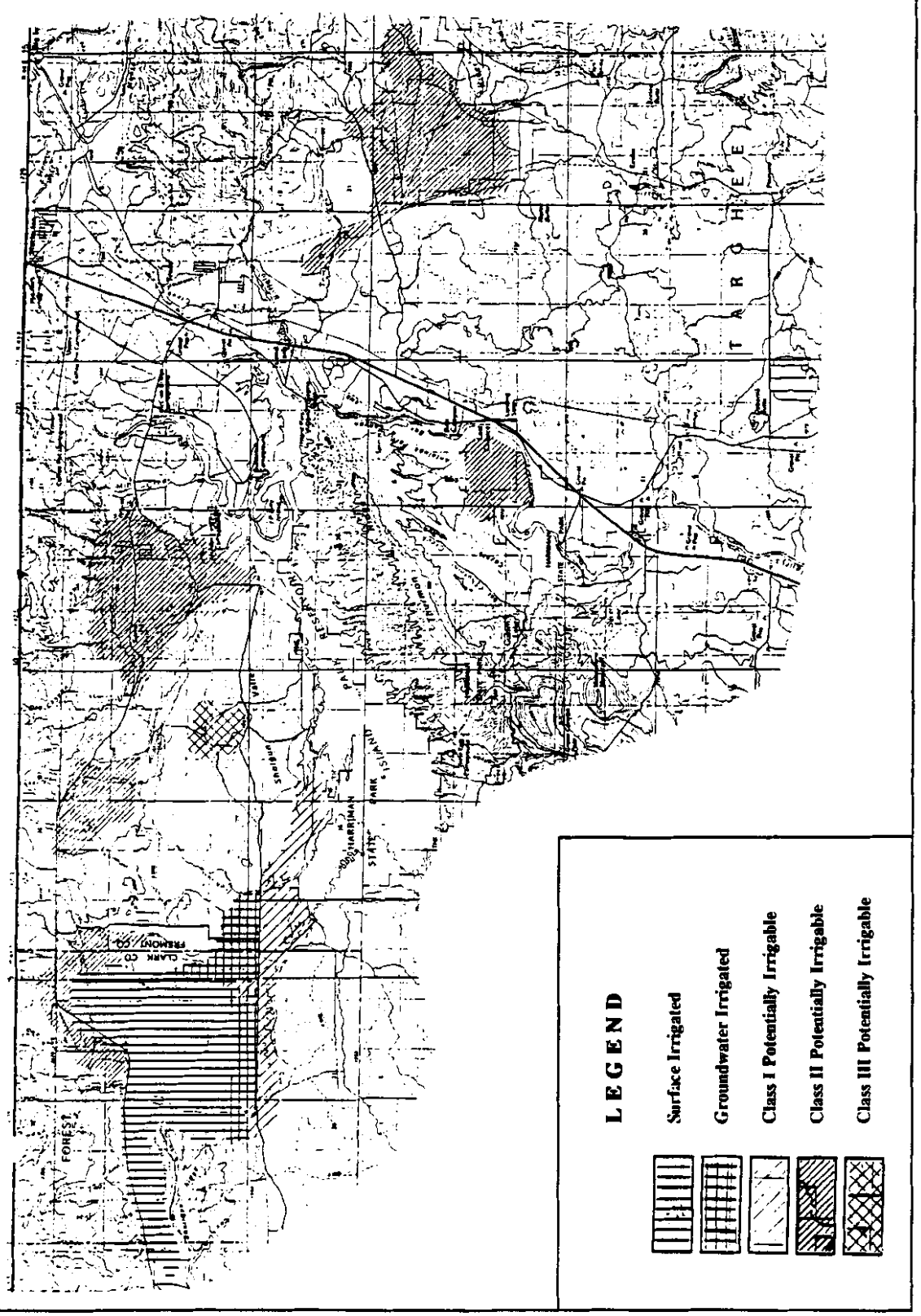


Figure 16: Irrigated and Potentially Irrigable Land - Henrys Lake

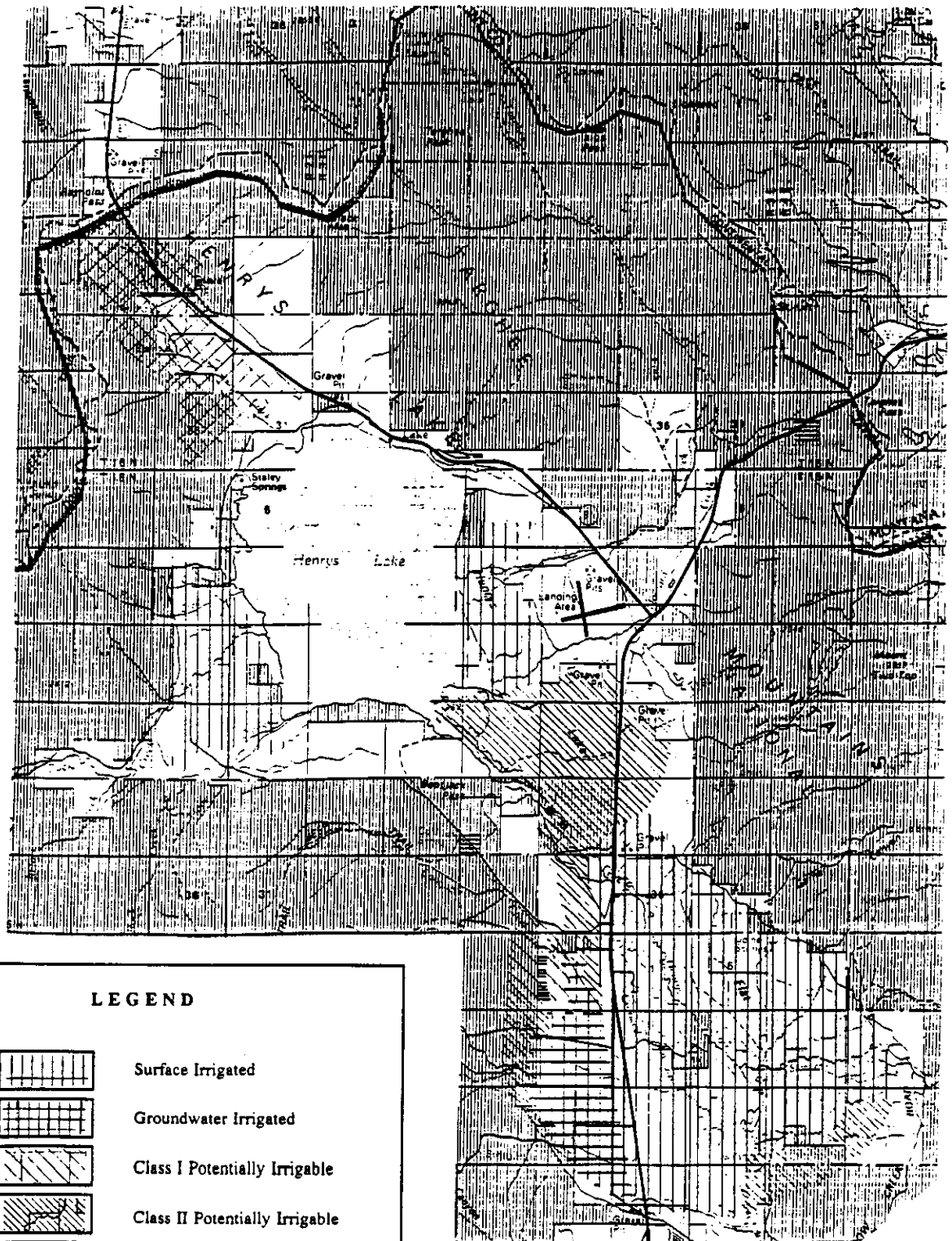
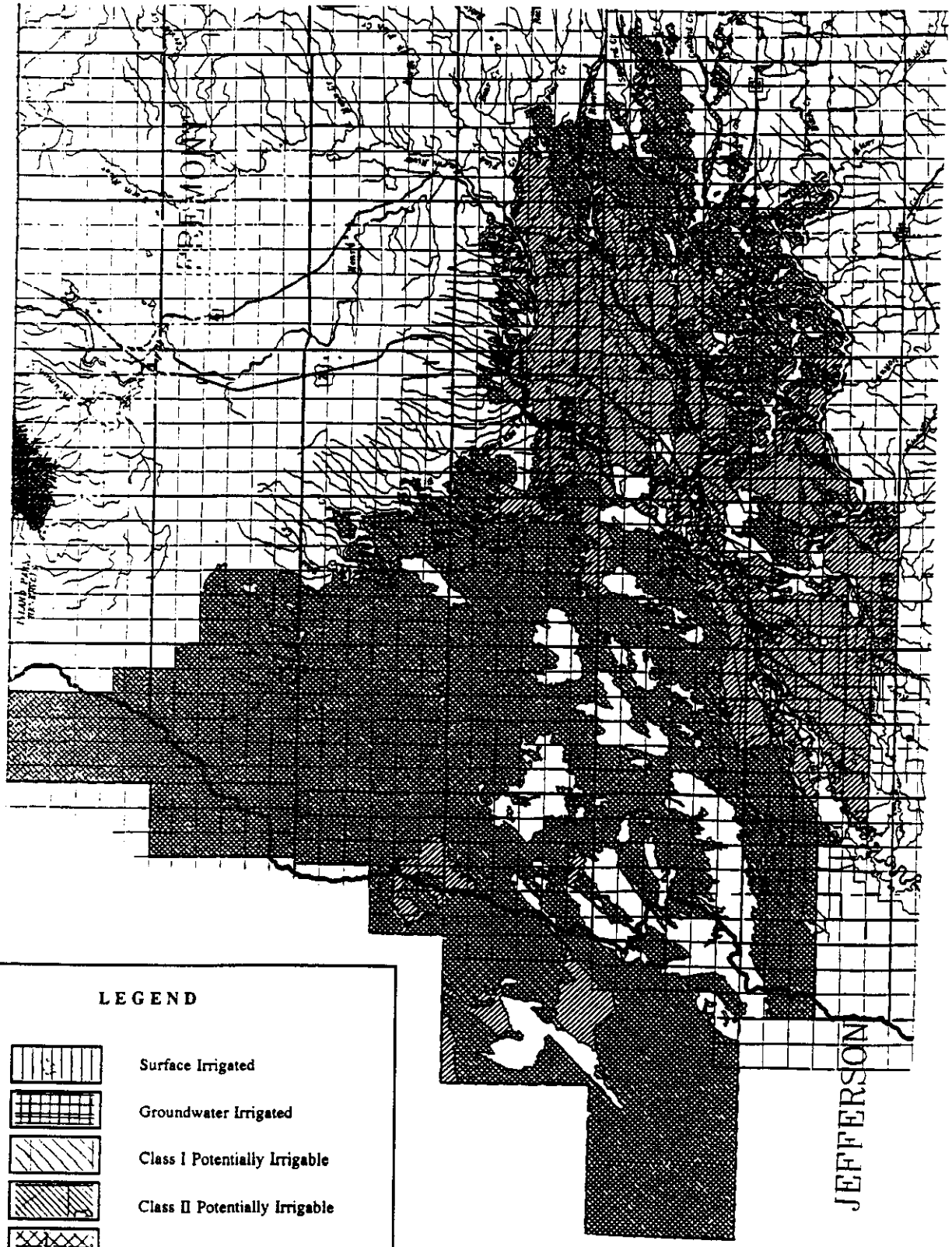


Figure 17: Irrigated and Potentially Irrigable Land - Sand Creek and Camas Creek Plateau



LEGEND

- Surface Irrigated
- Groundwater Irrigated
- Class I Potentially Irrigable
- Class II Potentially Irrigable
- Class III Potentially Irrigable

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Livestock Water

The 1988 inventory of livestock in the basin is shown in Table 29. As a general rule, the State of Idaho allows 12 gallons of water per day per head for beef cattle, horses, and mules. Up to 35 gallons per day per head may be appropriated for dairy cows. Four gallons per day may be used for each hog, while goats and sheep are limited to no more than two gallons per day per head. A more conservative, and perhaps more realistic estimate of stockwater use (USGS Circular 1001) assumes summer water use for cattle is nine gallons per day with winter use at one-half that amount. The average water use, therefore, is three-fourths the summer use (6.75 gpd). Feeder cattle and calf use is reduced to three-fourths of that amount (5 gpd) because of their reduced average size from adult cattle. The equivalent of five sheep and hogs per cow for water use is assumed. Sheep and hog usage also is reduced by one-quarter because of the inclusion of all age groups in the numbers given. One sheep or hog, therefore, needs approximately one gallon per day. The total livestock water usage shown in Table 29 for 1988 was 440 acre-feet per year. A consumptive use rate of 86 percent (USGS Circular 1001) gives a consumptive use of 380 acre-feet.

Table 29. 1988 Livestock Numbers and Water Usage

	Beef Cows	Dairy Cows	Feeders & Calves	Sheep	Hogs
Madison	9,800	2,200	15,000	3,900	1,090
Fremont	8,700	1,800	11,500	11,000	630
Teton	4,900	1,700	5,900	15,000	30
TOTAL	23,400	5,700	32,400	29,900	1,750
Present water usage in AF	177	43	184	34	2
Total = 440 AF					
Future water usage in AF	236	57	245	68	4
Total = 610 AF					

Current Idaho cattle numbers are about 75 percent of the peak for the last 15 years, while sheep and hog numbers are less than one-half the previous high. It is possible livestock numbers could return to these peak values. Future water use is projected to be equal to the historic high. This gives a Henrys Fork Basin livestock water use of 610 acre-feet per year or a consumptive use of 520 acre-feet.

Livestock water use is very low relative to other uses. For accounting purposes, the Idaho Department of Water Resources assumes livestock consumptive use to be inconsequential. Using the U.S. Geological Survey's numbers, current livestock consumption might increase by 140 acre-feet to a total of 520 acre-feet.

Recommended Action

1. Encourage livestock operators to file a claim for instream watering rights where there are or potentially will be upstream water users.
2. Educate livestock operators on the requirement that any stream-bank construction to alter the natural drinking pattern done after 1971 requires a water right.
3. Provide for instream watering of livestock in such a manner as to limit erosion, pollution and interference with instream recreation.

Sources

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Mining

There are some potentially commercial mineral deposits in the Henrys Fork Basin, however commercial production currently occurs only on a sporadic basis other than for sand and gravel extraction. The primary use of sand and gravel is for road construction. The 40 to 60 developed deposits, appear to be sufficient to serve local needs. Two quarries located east of Rexburg also provide crushed basalt for road aggregate. To produce asphaltic concrete, some nonconsumptive water is used for washing the crushed aggregate. Local construction also uses a minor amount of sand, gravel, and water for concrete production.

Local coal deposits have been mined sporadically in open-pit operations. The best quality deposit in Idaho occurs at the headwaters of Horseshoe Creek, located ten miles west of Driggs. The coal ranges from subbituminous to bituminous and is low in ash content. Lower grade coal, known as lignite, is found in thin beds in several Idaho areas, primarily in southwest Idaho. Lignite is better used for gasification or for carbonization instead of as a heat source. Carbonization is an initial step in the production of ammonia, synthetic fibers, and asphalt.

The Horseshoe Creek coal deposit is about five miles long and two miles wide, and is part of the Teton Basin coal field which extends nearly 15 miles in a southeast direction along the Big Hole Mountain Range. Nine separate beds over 14 inches thick have been described in this formation. The two largest beds are five and nine feet thick, although the nine-foot layer has an inner layer of sandy clay about one foot thick. The beds are extensive, but the coal grades to a lower quality to the southwest near the Pine Creek campground outcrops (Sec. 24, T3N, R44E). Because the coal beds dip steeply to the southwest, open-pit mining is limited. However, there is some potential for future development of this deposit. There likely will be no direct consumptive water use for coal mining. Even short distance movement to a valley floor-plant use would probably be by conveyor instead of with a slurry pipeline.

Similar to coal in origin, the small peat deposits located along the Teton River near Driggs and Victor also have had past commercial uses. Other locations in Idaho, Bear Lake (near Montpelier) and the Kootenai River area, have more extensive deposits. The Teton River deposits have some potential for soil conditioner use.

Another potential mineral resource in the basin is phosphate. Most Idaho phosphate deposits are located south of the Henrys Fork Basin. However, there are phosphate deposits within the Big Hole Mountain Range in the same sedimentary rock formation as the coal deposits previously described. These deposits extend into southeast Madison County with levels up to 18 percent phosphatepentaoxide (P_20_5). Additionally, there are phosphate deposits in the Centennial Mountain Range. About 1700 acres currently are under lease four miles north of Sheridan Reservoir, northwest of Island Park Reservoir at the Idaho border. A limited amount of phosphate ore has been taken from this deposit to reduction facilities outside the basin, but mining has not continued. Phosphate rock is also found east of Henrys Lake around Howard Creek. A by-product of phosphate mineral producing is vanadium, largely used in hardened steel. All of these phosphate deposits evidently dip to such a degree that open-pit mining is not feasible. This reduces the economic potential of these deposits relative to other Idaho deposits.

Oil and gas potential in the basin centers in the same Big Hole Mountains where coal and phosphate deposits are located. The geologic structure in the Teton Basin-Big Hole Mountains-Snake River Range area is an extension of the overthrust belt of Wyoming. In Idaho some of the potential reservoir rocks are too highly fractured to make good traps for oil and gas. Recent volcanism is an additional negative influence upon the collection of oil and gas into reservoirs. Federal land between the Teton Basin and the Snake River is covered with oil and gas leases. Several exploratory holes have been drilled within this area with no success.

Some oil shales in the Big Hole Mountains-Snake River Range have yielded as much as 38 gallons of oil per ton. However, these oil shale beds are thin, of limited areal extent, and generally dip steeply making open-pit mining difficult.

There is one known decorative building stone quarry located north of Island Park Reservoir in the Tin Cup Creek area. The only other minable product in the basin is gem stones. While the potential

economic importance of gem stones is not great, for the part-time collector there are a few noteworthy occurrences of gem stones in the Henrys Fork Basin. The best source of jade in Idaho appears to be in the bedrock of Bitch Creek, perhaps extending down as far as the canyon mouth of the Teton River. The quality is poor to medium with an occasional piece of "excellent" gem quality.

Variscite, a mineral with similar characteristics to turquoise but with a rich yellowish-green color, has been reported in a private claim in the Mount Two Top area, east of Henrys Lake. This mineral results from phosphate-impregnated water seeping through aluminous rocks.

With various coloring, chalcedony is a translucent relative of crystalline quartz found in pegmatities, a large-grained, slow-cooled granite. Agate is chalcedony, with impurities causing patterns and bands, of a quality suitable for gem cutting. Jasper is an impure opaque variety of chalcedony. These chalcedony minerals have from time to time been reported in Fremont County, however, good prospecting sites may only be located outside the Henrys Lake Basin. The naming of Crystal Butte located 23 miles north of St. Anthony relates to these chalcedony minerals but the current availability of the mineral is questionable.

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Navigation

There is no commercial navigation in the Henrys Fork Basin. Waterway use for recreational purposes does take place and is discussed in the recreation section.

Title to the beds of all navigable bodies of water was granted to the State of Idaho at statehood. Only in rare exceptions has this title been transferred. With title, "The State will exercise its authority over beds of navigable lakes and streams in their present location as far as use of the beds are concerned to provide for their commercial, navigational, recreational or other public uses," Kootenai Environmental Alliance v. Panhandle Yacht Club, 105 Idaho 622, 671 P.2nd 1085 (1983).

Title rests with the State for Henrys Lake, the Buffalo River (mouth through Sec. 21, T13N, R44E (above Buffalo Springs)), and the Henrys Fork (mouth to Henrys Lake including Big Springs). In addition, for streams capable of floating six-inch diameter cut timber during normal high water, a public right-of-way below the ordinary high-water marks must be allowed (Idaho Code 36-1601). This allows for public use of the above listed water areas, but also all the other main water courses in the basin. Such use does not include access across private land.

Discussion of navigation related goals, objectives, and recommendations is within the recreation section.

Recreation

Recreational opportunities in the Henrys Fork Basin cater to local residents and visitors from throughout the United States. Proximity to Yellowstone and Grand Teton National Parks contributes to recreational use, but the basin charms visitors with its own outstanding attractions: Big Springs, Mesa Falls, Harriman State Park and fishing in Henrys Lake or the Henrys Fork of the Snake River. Sightseeing, nature study, fishing, boating and winter sports attract thousands of people annually to the basin.

The 1987 Idaho Leisure Travel and Recreation Study estimates that nine percent of all Idaho leisure travelers visit or travel through Region VI, which includes the Henrys Fork basin. (Region VI is composed of Fremont, Teton, Bonneville, Madison, Jefferson and Clark counties.) Only about one third of the travelers are visiting the Region as a major destination; two-thirds of the travelers to the Region are passing through, on their way to other destinations. Twenty percent of all Region VI travelers are headed for Yellowstone or Grand Teton National Park (Harris et al., 1988). The Henrys Fork basin, however, provides annually more than 1,000,000 visitor days of recreation use. A visitor day is defined as 12 visitor hours, e.g., one visitor spending 12 hours or 12 visitors spending one hour involved in a recreation activity. Recreation visitor days in the basin average an annual 1.4 percent increase, with dispersed use growing more rapidly than the use of developed facilities. Approximately 50 percent of the recreation visitors to the basin are from out-of-state. About three-quarters of the Idaho users are from the local counties (USFS-BLM, 1980; IDPR, 1983; 1989; U.S.F.S., TNF, 1985; 1989; Harris et al., 1988; Nellis, 1989b).

Federal agency personnel estimate and record recreational use on federal lands as Recreational Visitor Days (RVDs). To estimate RVDs, a sample is taken by patrol personnel. Table 30 describes and estimates recreational use in the basin, and separately estimates recreational use along three river segments. Recorded RVDs do not reflect total recreation use. Visitor use estimates are unavailable for all activities and areas of the basin.

Estimated use suggests a significant difference between summer and winter use as do entrance data for Yellowstone National Park (see Table 31). The 1987 Idaho Leisure Travel Study indicates that the largest proportion of travel to the region occurs in the summer (about 40%), with equal proportions (about 20%) spread across the other three seasons (Harris et al., 1988).

Recreation is a primary use of the northern portion of the basin, generally upstream of the town of Ashton, and the upper Teton basin. Camping and sight-seeing are the most popular summer activities. Fishing, boating, and swimming are the largest direct water-use activities. In the fall over a third of the leisure travelers to the basin are hunting, and almost 60 percent of all winter travelers participate in winter sports (Harris et al., 1988). Water-based recreation averages a five month season, from May to the first week of October. Table 32 summarizes 1987 Region VI resident and tourist surveys of recreation activity.

Accessibility

Recreational use is a function of access to points of interest. In the basin, recreational use is greatest at attractions near major roadways. U.S. Highway 20/191 traverses the basin, and is a main artery for traffic to the Henrys Fork, Island Park Reservoir, Henrys Lake and Yellowstone National Park. National Park Service (N.P.S.) records indicate that 40 percent of all visitors to Yellowstone

Table 30. Recreation Use - Henrys Fork Basin

Summer

Developed Sites	Close to Island Park Reservoir, Henrys Lake, Henrys Fork, Moose Creek, Buffalo River, Warm River, Rock Creek
Undeveloped Sites	Close to streams and rivers - widely distributed
Dispersed Activities:	
Hiking/Backpacking	Lionhead Mtn. Area, Two-Top Mtn. Area, Henrys Fork, Warm River
ORV Riding	Roads throughout the basin, Sand Mountain
Boating/Swimming	Henrys Fork, Teton River, Falls River, Warm River, Bitch Creek, Henrys Lake, Island Park Reservoir
Fishing	Lakes, rivers, and streams throughout the basin
Viewing	Along primary roadways and rivers

Winter

Developed Sites	Grand Targhee (in Wyoming)
Concentrated Use	Island Park Siding, between Coffee Pot Rapids & Island Park Reservoir, Big Springs Area
Dispersed Activities:	
Skiing (X-C)	Warm River Trail, Bear Gulch, Buffalo River, Harriman State Park
Snowmobiling	Trails and roads throughout the basin

Source: USFS-BLM, 1980

Estimated Use and Annual Recreational Visitor Days

Activity	Percent of Total Use
Dispersed:	
Driving for Pleasure	20
Trails	6
Reservoirs & Lakes	7
Rivers & Streams	6
Backcountry	16
Subtotal	55
Developed:	
Boating	1
Campgrounds	18
Picnic Areas	1
Hotel, Lodge-Resort	3
Private Organization Sites	5
Recreation Residence	6
Winter Sports	8
Other	3
Subtotal	45

Activity	RVDs
Sight-Seeing	172,800
General Day Camping	140,800
Snowmobiling*	87,800
Fishing	80,000
Picnicking	63,100
Recreation Cabin Use	57,200
Boating, Swimming and Water Play	34,000
Hunting**	29,000
Motorcycle/Trail Riding	27,200
Horseback Riding	21,500
Hiking and Walking	18,100
Organization Camping	10,200
Skiing and Snow Play*	9,000
Bicycling	4,400
Sand Mtn. ORV Riding	4,000
Nature Study	3,800
Other	29,600
TOTAL	792,000

* Primarily Winter	12½%	97,000
** Primarily Fall	3½%	29,000
Mostly Summer	84%	666,000

Source: U.S.F.S., Targhee National Forest, 1985; U.S.F.S., TNF, 1990 - RVD estimates for 1988; IDPR, 1990 - Henrys Lake and Harriman State Parks attendance records for 1989 and 1990; U.S. BLM, Medicine Lodge Wilderness EIS 1988, - estimate of Off-Road Vehicle RVDs at Sand Mountain.

Estimated Recreational Visitor Days in River Corridors

	Henrys Fork Big Springs to the Warm River 1987	2000	Warm River Warm River Springs to Henrys Fork - 1987	Falls River Yellowstone Park Boundary to Targhee NF Boundary - 1987
Camping: Developed	69,500	100,000	11,400	4,500
Dispersed	9,400	14,000		
Boating/Water Play	2,000	2,000	3,800	
Fishing	24,900	36,500	6,700	2,000
Hiking	1,000	1,500	1,200	3,500
Viewing/Scenery	35,600	41,500	17,200	11,500
Snowplay		5,500		
Total	142,400	201,000	40,300	21,500

Source: U.S.F.S., Targhee National Forest, Wild and Scenic Rivers Preliminary Study, 1989.

Table 31. Yellowstone National Park-West Gate Entrance (1989):

January	11,000	May	77,000	September	141,000
February	16,000	June	146,000	October	46,000
March	8,000	July	224,000	November	6,000
April	14,000	August	197,000	December	9,000

travel through the West Yellowstone gate, and will therefore cross the Henrys Fork basin. Entrance through West Yellowstone in 1989 was 895,000 visitors (N.P.S., Yellowstone National Park, 1990). National Park visitors use facilities in the Henrys Fork basin on their way to and from Yellowstone and Grand Teton, or as an alternative camping or lodging base when the Parks are crowded. Preliminary figures for 1991 indicate an annual increase of approximately seven percent since 1989.

The road network and access to Henrys Lake, Island Park Reservoir and the Henrys Fork, between Big Springs and Riverside Campground, is fairly extensive. U.S. Highway 20/191 crosses the river at Macks Inn and Osborne Bridge, and parallels the river for a short distance at Last Chance. Access to the upper Teton drainage, Canyon Creek and Moody Creek is provided by state Highways 32 and 33, and county and Forest Service gravel or dirt side roads. A Forest road off of Highway 33 also provides access to the Grand Targhee ski resort. The ski resort is located above Alta, Wyoming, just across the state line, but the only road access is through Driggs, Idaho. Numerous Forest roads, both all season and paved, provide access to developed recreation sites both on public and private lands. Spur roads head to the Centennial Mountains and the adjacent Madison River drainage. U.S. Highway 20/191 meets the Henrys Fork again near St. Anthony, and below St. Anthony rural roads provide frequent access to the river.

Access to the Henrys Fork between Riverside Campground and the Warm River confluence is limited. From Riverside Campground to the Targhee Forest boundary, the Henrys Fork is accessed in six places with unimproved roads and foot trails. Undeveloped trails, resultant from big game and fisherman use, parallel both sides of the river from Riverside Campground to Lower Mesa Falls. The Targhee National Forest plans to develop a hiking trail parallel to the Henrys Fork from Osborne Bridge to the Warm River confluence, to improve access to the river along this stretch (U.S.F.S., TNF, 1989).

In 1989 State Highway 47 was classified as the Mesa Falls National Scenic Byway, by the U.S. Forest Service. The paved two-lane road provides an alternative scenic loop to U.S. Highway 20/191 between Ashton and Harriman State Park. The road provides access to the Falls River, the Warm River, and the Henrys Fork between Ashton and the Warm River confluence. Recreation use and

traffic is expected to increase in the area with designation of the Scenic Byway, planned developments at Upper and Lower Mesa Falls and an overlook facility at Sheep Falls (U.S.F.S., TNF, 1989).

Table 32. Activity Participation Rates for Region IV Residents and Travelers

Activity	Percent of Resident Households with at least One Participant	Occasions per Household*	Annual Activity Occasions	Percent of Resident Travelers	Percent of Non-resident Travelers
Fishing from Boat	39	2.6	291,500		
Fishing from Bank/Dock	59	3.7	411,300		
Fishing (Lakes/Reservoirs)				32	32
Fishing (Streams/Rivers)				75	77
Swimming (Beach)	18	1.1	122,800		
Swimming (Lakes)				8	8
Swimming (Rivers)				24	8
Visiting Beach (not swimming)	15	0.5	60,200	12	15
Power Boating (River)	7	0.1	15,200		
Power Boating (Lake)	18	0.6	67,000		
Power Boating				23	2
Water Skiing	15	0.8	88,600	3	0
Non-Motorized Boat (Lake/Reservoir)	12	0.7	80,200		
Non-Motorized Boat (River/Stream)	16	0.9	98,500		
Rafting				19	11
Canoeing				15	21
Other Tubes/Boats				19	3
Nature Study	85	8.5	947,400	50	60
Hiking/Walking	88	35.6	3,960,700	39	30
Camping	64	5.8	642,500	28	32
Snow Activities	49	8.5	946,000		
Skiing				35	43
Snowmobiling				41	23
Snow Play				18	41
ORV Driving	44	4.5	504,500		
4 x 4 ORV				70	30
Motorcycle/ATV				29	70
Bicycling/Horseback Riding	61	12.7	1,412,900		
Bicycling				21	56
Horseback Riding				79	44
Sight-Seeing	88	21.4	2,374,700	71	79
Hunting	50	7.7	854,500		
Big Game Hunting				89	55
Waterfowl Hunting				8	39

* Four month period

Source: Idaho Department of Parks and Recreation. *1989 Idaho Outdoor Recreation Plan.*

The Falls River has good access from its mouth upstream to Yellowstone Dam, located two miles above the Targhee Forest boundary. Two graveled roads parallel the river, the Cave Falls Road, and the Ashton-Flagg Ranch Road. These roads are not kept open during the winter, but are groomed for snowmobile use. From Yellowstone Dam upstream past the Idaho border the only access is by trails.

Much of the lower portion of the Warm River is visible from Idaho State Highway 47, located near the canyon rim. The highway is only kept open to Bear Gulch during the winter, however, this plowed stretch provides spectacular views of the river during that time. Warm River is generally inaccessible by road, however, a two lane dirt road accesses the Warm River Spring. The river may also be accessed by foot via the abandoned Yellowstone Branch of the Union Pacific and Oregon Short Line Railroad. The rail bed parallels the river, and now serves as a high-standard recreation

trail. In summer the trail is managed for non-motorized use and in winter it is used by snowmobiles and cross-country skiers.

There are extensive well maintained all-season forest access roads throughout the plateau between the Henrys Fork and Yellowstone National Park. These roads allow for sightseeing in the area. Most Forest Service Roads and county roads, located on the plateau above Ashton, are not kept open during the snow season.

Fishing

The sport fishery of the Henrys Fork above St. Anthony attracts fishermen from throughout the nation with a reputation as one of the best trout fishing areas in the United States. With an annual use of nearly 80,000 visitor days in the basin the net economic value of the Henrys Fork fishery is estimated at $2.8 million (Loomis, 1985). The Henrys Fork above Ashton is possibly the most important fishing stream in the State of Idaho. Angler hours vary by segment and year in response to regulations and fish population fluctuations. Despite variability, total angler hours increased over 27 percent from 1976 through the 1980s, (U.S.F.S., TNF, 1990; IDFG, 1990; Angradi and Contor, 1989; Brostrom, 1987; Rohrer, 1984; 1981; Moore et al., 1983; Jeppson, 1982; 1981; Coon, 1977; 1978). Angradi and Contor (1989) found that approximately 45 percent of the anglers surveyed on the Henrys Fork were Idaho residents, and 55 percent were nonresidents. Ninety-one percent of the Idaho residents were from eastern Idaho.

Outfitters use the Henrys Fork and the Teton River extensively for commercial fishing/float trips. To date nine outfitters are licensed to operate on the Henrys Fork, and six outfitters are licensed to operate on the Teton River by the Idaho Outfitters and Guides Licensing Board.

Sorg et al. (1985) found that the net economic value (consumer surplus) of a fishing trip on the Henrys Fork was worth $37. This means the typical angler would be willing to pay an additional $37 per trip over and above current expenditures. The gross value is the sum of expenditures (transportation, lodging, food, tackle) and the consumer surplus, which totaled $82 per trip for the Henrys Fork. The gross value for Henrys Lake totaled $160, and $107 for fishing on Island Park Reservoir in 1982. Comparative estimates of gross value for other Idaho fishing areas are listed in Table 33.

Table 33. Comparative Values of Coldwater Fishing (1982 Survey)

Henrys Fork	$ 82
Teton River	73
Henrys Lake	160
Island Park Reservoir	107
Snake River (above Am. Falls)	63
Swan Valley	73
Blackfoot River	59
Blackfoot Reservoir	78
American Falls Reservoir	55

Source: Sorg et al., 1985 Net Economic Value of Cold and Warm Water Fishing in Idaho

Hunting

The Idaho Department of Fish and Game estimated 40,000 hunter days for 1989 in the Game Management Units of the basin. Bird hunting estimates totaled an additional 16,900 hunter days in

the three basin counties (IDFG, 1989). The total number of hunter days in Idaho has increased approximately five percent annually since 1983 (IDFG, 1990). Consecutive annual estimates for hunting in Units 60, 61, 62, 64 and 65, Management Units of the basin, indicate annual fluctuations in deer and elk hunter days (see Table 34). Units 60 and 61 are the most used while Unit 65 is the least used (see the following map). The variability in hunter days is due to fluctuations in big game populations and controlled hunt permits. The net economic benefit for deer and elk hunting in the basin is over $2,000,000 based on a $50 per day value (Sorg and Nelson, 1986; U.S.F.S., TNF, 1985).

Table 34. Big Game Hunter Days Estimate

Year	Unit 60	Unit 61	Unit 62	Unit 62A	Unit 64	Unit 65	Total Estimate
1983	15,550	17,400	6,210	6,270	5,410	1,760	52,600
1984	9,150	12,190	3,430	3,480	4,750	1,250	34,250
1985	13,210	17,940	4,240	3,820	6,650	2,260	48,120
1986	15,730	11,240	6,030	4,800	7,120	3,330	43,250
1987	15,430	16,310	5,760	3,920	7,330	2,360	51,110
1988	15,770	17,410	6,420	4,670	6,000	3,160	53,430
1989	11,520	11,930	4,840	4,410	5,130	2,280	40,110

Source: Idaho Department of Fish and Game Harvest Estimates

Wildlife Observation

Great opportunity for wildlife observation is available in the Henrys Fork basin. The basin is rich in prime wildlife habitat and sanctuaries. Nature study ranks high in Region VI recreation activity surveys (see Table 32). The Idaho Leisure Travel surveys (1987) also indicate that nature study is a popular activity in the region year-round (Harris, et al., 1988). The Idaho Department of Fish and Game estimates over 1,400 visitor days annually for wildlife education, photography and viewing at the Sand Creek and Cartier Wildlife Management Areas (see Table 35). Harriman State Park is popular with bird watchers and offers environmental education programs to approximately 2,000 local school children each fall.

The Idaho Department of Fish and Game owns and manages recreation areas in the Henrys Fork basin. IDFG Managed Access Areas are listed below, and are located on Figure 18.

Henrys Fork

Sand Creek Wildlife Management Area	Camping, fishing, waterfowl, upland bird, and big game hunting
Ashton Reservoir	Camping, boat ramp, fishing
Chester Reservoir	Camping, fishing
Davenport Island	Fishing
Warm Slough	Camping, boat ramp, fishing, waterfowl, upland bird and big game hunting
Cartier Wildlife Management Area	Fishing, waterfowl, upland bird and big game hunting

Moody Creek — Fishing

Teton River

Badger Creek	Fishing
Harrops Bridge	Fishing
Cache Bridge	Boat ramp, fishing
Raineer	Camping, boat ramp, fishing, waterfowl hunting
Bates Bridge	Boat ramp, fishing
Teton Creek	Boat ramp, fishing
Fox Creek West	Camping, boat ramp, fishing, waterfowl hunting
Fox Creek East	Camping, fishing, waterfowl hunting

Table 35. Wildlife Management Area User Days

Use	Sand Creek User Days	Cartier User Days
Fishing	10,000	90
Hunting	5,920	310
Education and Scientific	60	200
Photography	50	–
Wildlife Observation	400	20
Sight-seeing	600	120
Other Recreation Activities	6,240	10
Total	23,000	700

Source: Idaho Department of Fish and Game, Region 6 Wildlife Management Area Plans 1986-1990

Walking, Hiking, and Trail Riding

Recreational visitors make use of maintained hiking, skiing and snowmobiling trails in the basin. Trails frequently follow basin streams, however, developed trails along the Henrys Fork and the Falls River on Forest Service land are limited. Two short trails parallel the Henrys Fork: one at Upper Coffeepot Campground and another at Box Canyon Campground. Another short trail between Big Springs and Big Springs Boat Launch is planned for the near future. Undeveloped trails, resultant from big game and fisherman use, parallel both sides of the Henrys Fork from Riverside Campground to Lower Mesa Falls. Developments being studied for the Henrys Fork from Osborne Bridge to the Warm River confluence include a hiking trail paralleling the river (U.S.F.S., TNF, 1989).

Other developed trails following streams include the Targhee Creek Trail, in the northeast corner of the basin, the Moose Creek, Bitch Creek and Canyon Creek trails, and along the Warm River an abandoned railroad right-of-way trail (U.S.F.S., TNF, 1989). In the Teton Basin, several trails extend up drainages and over the mountain passes into Grand Teton National Park. Warm River is generally inaccessible by road, however, the abandoned Yellowstone Branch of the combined Union Pacific and Oregon Short Line Railroad company parallels the river, and now serves as a high standard recreation trail. In summer the trail is managed for nonmotorized use and in winter it is used by snowmobiles and cross-country skiers.

Camping

Numerous campgrounds situated along basin reservoirs, lakes and rivers, afford visitors opportunity for an intimate lakeside or riverside experience, and often provide easy foot access to the water. Over 22 public, developed recreational sites, containing picnic tables and campsites, are available in the basin. Existing facilities are generally operating within or below capacity, but some campgrounds are over-utilized during summer weekends. The most popular campgrounds are located adjacent to major water courses. Public campgrounds containing picnic tables and campsites are located on Figure 18 (U.S.F.S., TNF, 1985; 1989). Public campground sites and estimated use are listed in Table 36. Small city parks are located in several local communities and private recreation facilities: lodges, inns, resorts and restaurants, are common along reservoir and lake shorelines and major roadways.

Fremont County maintains the William Frome County Park on the northwest side of Henrys Lake. The site provides an open area for camping, parking, a boat ramp and dock facilities. Two State Parks are located in the basin: Henrys Lake and Harriman. The principal activities at Henrys Lake (680 acres) are fishing and camping. Harriman State Park (4,060 acres along the Henrys Fork, 11,700 acres total holdings) attracts fishermen, bird watchers, hikers, horseback riders and cross-

country skiers to its wildlife preserve. Attendance figures for Henrys Lake and Harriman State Parks are shown in Table 37. Expansion is planned at Henrys Lake Campground to 50-60 units (IDPR, 1990).

The Targhee National Forest operates 16 developed sites in the basin. Four campgrounds are at Island Park Reservoir, six along the Henrys Fork (three above and three below Island Park Reservoir), one on the Buffalo River, one at Howard Spring, two in the upper Teton drainage, and two on the Warm River.

Warm River Campground is unique in offering wheelchair and other handicapped visitors exceptional access to the river. This 285 person capacity campground is often full during the summer months. The campground is also used as a snowmobile and cross-country skiing trailhead during the winter. The Warm River Fish Hatchery has been dismantled and the site is slated for development as a trailhead, picnic, and scenic attraction area by the Targhee National Forest.

Along the Falls River the Cave Falls Campground, located in Wyoming, is receiving increased use over time. This campground has 23 units plus a group use site. Yellowstone National Park has developed an overlook, trail system, and picnic facilities just above the campground and up to Cave Falls.

There are no developed recreation facilities on BLM land in the basin, but the BLM has designated the sand dune area west of St. Anthony as a special recreation management area for off-road vehicles (ORVs). Most BLM land is used at times for such dispersed activities as hunting, fishing, camping and rock climbing. The BLM does not have reliable estimates of the total recreational use of its lands in the basin, but annual use of the Sand Mountain dunes area is estimated at 4,000-5,000 Recreational Visitor Days. Two developments, a campground and a day-use facility, are planned for the Sand Mountain recreation area. The campground would contain 40-50 units for overnight camping and would be located north of the Sand Hill Resort. The day-use facility would consist of a parking area to provide access to the open sand dunes. It would be located south of the Sand Mountain recreation area boundary (BLM, 1988).

Figure 18:
Campgrounds, Sportsman Access, and Boating Access Points

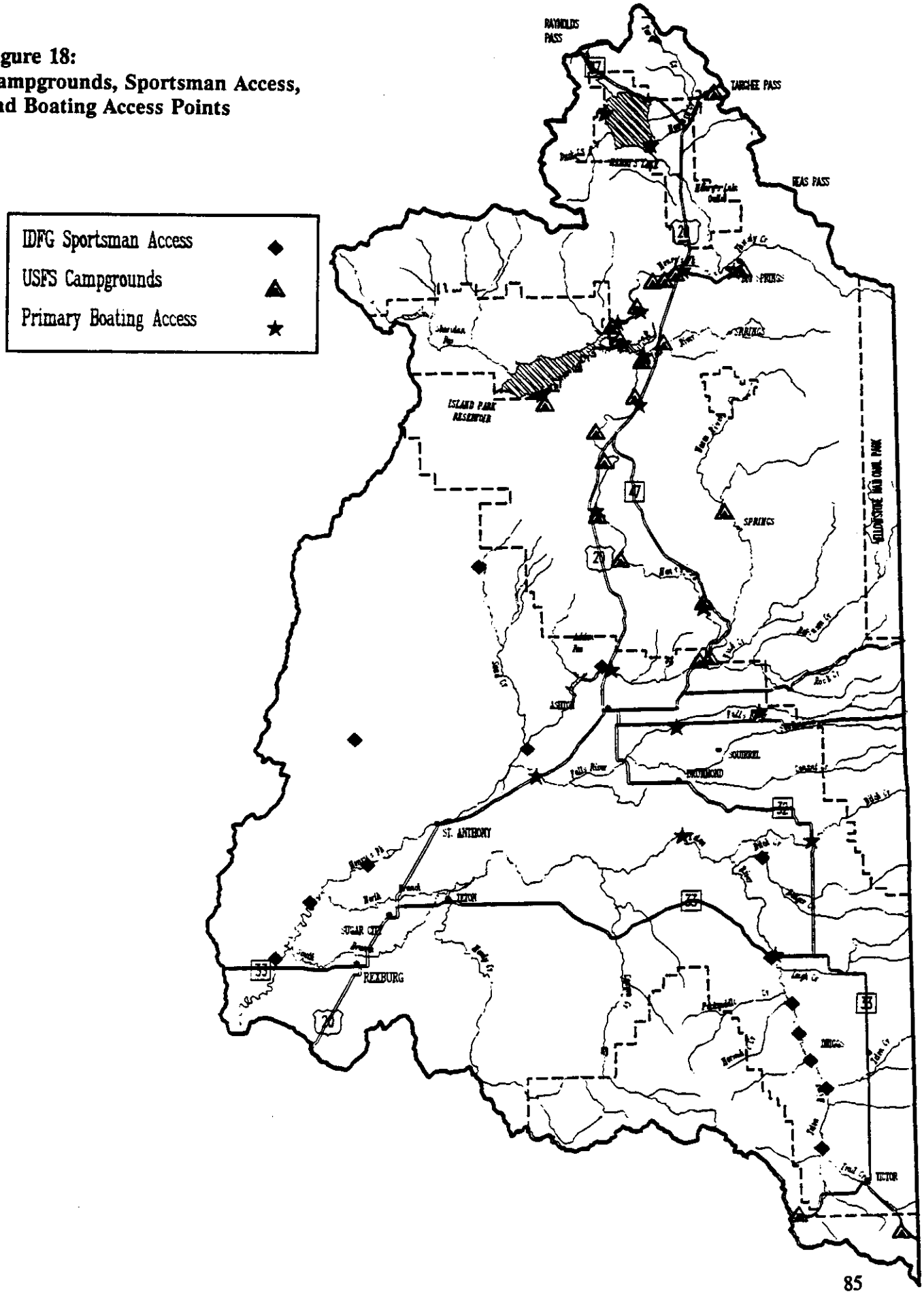


Table 36. Henrys Fork Basin Developed Public Campgrounds

	Units	Visitors	RVDs	
State of Idaho				
Henrys Lake	33	28,860	20,590	
Harriman	Group Camping	28,210	16,130	
Targhee National Forest (1988)				
Buttermilk	66	12,850	19,280	
Mill Creek	12	2,220	3,330	
McCrea Bridge	25	5,970	8,960	
West End	25	8,780	13,160	
Howard Spring		19,380	400	(Picnicking)
Big Springs	15	2,190	3,280	
Flat Rock	45	10,240	15,370	
Upper Coffee Pot	14	5,520	8,270	
Buffalo	127	22,760	33,170	
Box Canyon	19	4,200	7,370	
Riverside	55	9,700	7,470	(Picnicking)
Pole Bridge	20	2,300	4,600	
Grandview	5	650	1,300	
Warm River	12	5,600	11,200	
Pine Creek	11		1,340	
Mike Harris	12		2,560	
Fremont County				
William Frome	Open Camping			

Source: Targhee National Forest - Island Park Ranger District, Gene Hardin; Ashton Ranger District, Doug Muir; Teton Basin Ranger District, Linda Merigliano Nellis, 1989b; Idaho Department of Parks and Recreation, 1990.

Table 37. Henry's Lake and Harriman State Parks Attendance Figures

	Campers			Day Users		
Henry's Lake State Park	**Resident**	**Non Resident**	**Total**	**Resident**	**Non Resident**	**Total**
1980	3629	4596	8225	7915	4362	12277
1981	4041	4629	8643	4098	2016	6114
1982	3410	4227	7647	2685	999	3684
1983	4092	4822	8914	5232	769	6001
1984	5154	4389	9543	9908	3648	13556
1985	5016	4389	9405	12892	4367	17259
1986	4492	4484	8976	15917	5672	21589
1987	9664	4730	14394	12208	5384	17592
1988	3785	4266	8051	7143	3139	10282
1989	4372	1789	6161	17571	5127	22698
	Campers			**Day Users**		
Harriman State Park	**Resident**	**Non Resident**	**Total**	**Resident**	**Non Resident**	**Total**
1982	-	-	-	9146	2910	12056
1983	-	-	-	8235	3546	11781
1984	-	-	-	8376	4964	13340
1985	417	62	479	12895	10434	23329
1986	665	332	997	13562	10361	23923
1987	853	70	923	15043	10164	25207
1988	1487	584	2071	15746	8654	24400
1989	1484	540	2024	16025	10158	26183

Source: Idaho Department of Parks and Recreation, 1990.

Boating/Floating

In 1981 approximately four miles of the Henrys Fork, from the Big Springs boat ramp to the U.S. Highway 20/191 crossing at Macks Inn, were designated as a National Recreation Trail by the U.S. Secretary of Agriculture. Termed the Big Springs Water Trail, this trail is the first water trail in the National Recreation Trail System, testifying to its unique float-boating opportunity. This calm water stretch of the Henrys Fork offers abundant opportunity for wildlife viewing. The area is administered by the Island Park Ranger District of the Targhee National Forest. During the summer, the Macks Inn Resort rents canoes, rafts, tubes and paddle boats, and offers a shuttle service between Macks Inn, the Big Springs boat ramp, and Upper Coffee Pot Campground. Because of its close proximity to several resorts, a corridor highway, and summer homes, and its relatively short floating time and easy access, the Big Springs-McCrae Bridge stretch of the Henrys Fork receives recreational use throughout the week during the summer. The Targhee National Forest has plans to improve their launch site on the upper end of the Big Springs Water Trail with a parking lot, small boat ramp and toilet facilities (U.S.F.S., TNF, 1989).

Boating surveys done in 1983 and 1989 indicate an increase in boating recreation from Island Park Dam to the Last Chance Resort Village. This Whitewater Class II segment runs through a basalt canyon. Fir trees and a dense undergrowth of shrubs line stretches of the river through the canyon until it opens near Last Chance. Because the rim of the canyon is much higher than the water, developments on top cannot be seen by boaters. Boaters and fly fishermen have potential conflicts in this area, and for the next several miles, where there is easy access to the river. After passing Last Chance, the river enters the boundaries of Harriman State Park. There are no boating access points within the Park, however, several access points are available both above and below the Park. Local businesses provide boats for rent. The Targhee National Forest plans a parking lot, small boat ramp and toilet facilities for the Box Canyon and Last Chance boat launch areas (U.S.F.S., TNF, 1989).

Kayaker on the Falls River.

Below Riverside Campground the Henrys Fork enters a deep steep-sided canyon. This reach of the river offers a challenging float-boating experience characterized by steep rapids, rocks, and pools. Because of steep undisturbed slopes and the general lack of vehicle or trail access, the 18 miles of canyon to Sheep Falls affords visitors the solitude often associated with a primitive recreation experience. Boaters who go beyond Riverside Campground must plan ahead as there are few access points downstream, and they must take out before Upper Mesa Falls. In the first few miles below Lower Mesa Falls there are several Whitewater Class II+ and III rapids, including a seven-foot waterfall. This lower area has significant boating use. The river then becomes progressively easier going downstream. This section of the river is floated by commercial fishing guides in drift boats. Primary put-in and take-out points along the Henrys Fork are shown on Figure 18.

The primary recreation activity on both the Warm River and the Falls River is fishing. The Falls River has not been popular for floating above the Targhee Forest boundary because of the numerous waterfalls and cascades. Near the Warm River Campground floating is very popular. Most of the water play activities occur below the cascades, in the first 4.5 miles upstream of the campground. There has not been significant conflict between fishing and water play activities because fishing activity is concentrated around the early morning and late evening hours. Falls River, Bitch Creek and the Teton River are cited for boating potential in whitewater literature (Moore and McClaran, 1989). The last two miles of the Buffalo River, below Elk Creek, and one mile of Elk Creek, from the reservoir to its mouth, have good canoeing potential. The 4.5 mile section of the Upper Buffalo River, from Buffalo Springs (SW1/4, Sec. 21) to just below the old railroad grade, has good floating potential.

Henrys Lake, Island Park Reservoir, Ashton Reservoir and smaller lakes and reservoirs within the basin provide flat-water boating opportunities. Boat counts at Henrys Lake (IDPR, 1980-1990) indicate a 100 percent increase over 1980 figures. Most boating is associated with fishing. Data is not available for Island Park and Ashton Reservoirs. The east end of Island Park Reservoir has high boating use because of nearby summer home facilities.

Optimum instream flows for boating vary with the reach and the craft. Kayaks, rafts, driftboats and canoes are used on the Henrys Fork and tributaries. Motorized boats are used primarily at Island Park Reservoir, Henrys Lake and Ashton Reservoir. Irrigation releases from Island Park Reservoir enhance late summer boating on the Henrys Fork below the reservoir. Optimum stream flow and craft categories are listed in Table 38 by reach.

The non-motorized boating estimate for the Henrys Fork basin is 10,200 Recreational Visitor Days. Motorized boating is approximately 15,000 RVDs, primarily at Island Park Reservoir, Henrys Lake and Ashton Reservoir (U.S.F.S., TNF, 1990; IDPR, 1990). Most boating activity occurs between March and September, dependent on snowmelt variability and reservoir release schedules. Annual Outfitter and Guides Licensing Board reports and the 1983 and 1989 boater surveys, conducted by the Idaho Department of Parks and Recreation (IDPR), estimate boater use of the specific reaches shown in Table 39. Boaters responding to the IDPR survey (1983) said they chose boating on the Henrys Fork because of its accessibility, fishing opportunity, and scenery.

According to the IDPR 1989 boating survey, Idaho residents comprise 54 percent of the weekend boaters and 39 percent of the weekday boaters on the Henrys Fork from Big Springs to Island Park Reservoir. From Island Park Dam to Hatchery Ford, 63 percent of the weekend boaters and 45 percent of weekday boaters are Idaho residents. Ninety percent of the Idaho boaters are from eastern Idaho.

Launches on the Henrys Fork seem evenly split between weekends or holidays (47%) and weekday use (53%). Weekend use increased 17 percent over 1983 (IDPR, 1983; 1989). The IDPR Survey seems to indicate a drop in the number of boaters on the Big Springs Water Trail. However, IDPR personnel believe the drop may be due to a shorter survey day (hours/day) in 1989. Surveyors spent a longer day on the river in 1983.

Table 38. Optimum Stream Flow for Boating

	Optimum cfs	Craft
Big Springs to Island Park Reservoir	500-1750	Canoe, raft, kayak, powerboat, tubes
Island Park Dam to Hatchery Ford	1000-3000	Canoe, raft, kayak, drift boat
Lower Mesa Falls to Ashton Reservoir	1000-3000	Raft, kayak, drift boat
Ashton Dam to St. Anthony		Canoe, drift boat
Teton River	500-1000	Raft, kayak, drift boat
Falls River	500-2000	Canoe, raft, kayak, drift boat
Buffalo River	Unknown	Canoe, Kayak

Source: G. Moore and D. McClaran, 1989. Idaho Whitewater.

Table 39. Outfitter Reports and Boating Estimates

	1989		1988		1987		1986		1983
	Res	NonRes	Res	NonRes	Res	NonRes	Res	NonRes	
Henrys Fork: Big Springs to Island Park Reservoir									
IDPR Survey Estimate	3,130	3,640							8,377
Henrys Fork: Island Park Dam to Hatchery Ford									
Outfitters Total	48	613	27	619	86	509	41	636	
IDPR Survey Estimate	1,872	1,602							2,375
Total Estimate	1,920	2,215							2,375
Henrys Fork: Mesa Falls to St. Anthony									
Outfitters Total	25	764	32	707	76	375	29	259	
Henrys Fork: St. Anthony to Confluence									
Outfitters Total	55	31	47	8	30	14	-	-	
Teton River: Upper Put-in to Cache Bridge									
Outfitters Total	7	317	10	185	14	70	0	64	
Teton River: Cache Bridge to Harrop Bridge									
Outfitters Total	230	396	236	164	230	173	0	36	
Teton River: Harrop Bridge to Henrys Fork									
Outfitters Total	2	26	8	257	10	10	0	4	

Outfitters Total from Idaho Outfitters and Guides Licensing Board.
IDPR 1989 Boater Estimates are based on weekend and weekday averages for 12 surveyed weekends and 24 surveyed weekdays for the season May 29 to September 10, 1989 minus Outfitters.
IDPR 1983 Boater Estimates are based on weekend and weekday averages for 7 surveyed weekends and 14 surveyed weekdays for the season May 25 to September 3, 1983.

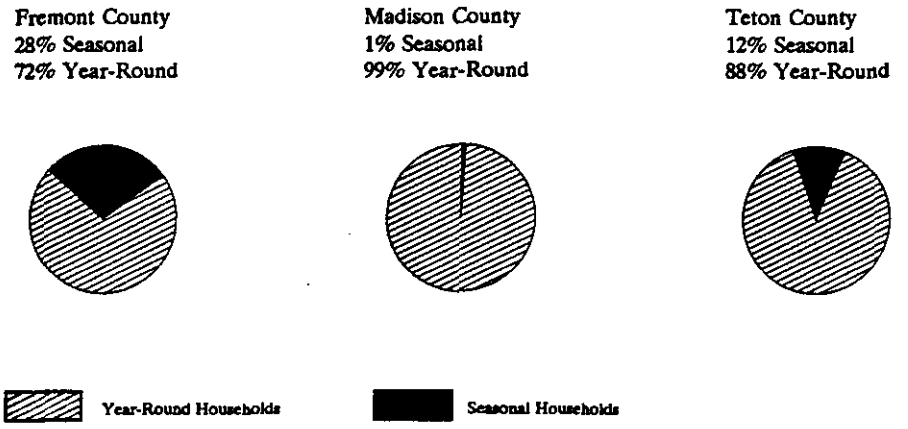
Special Recreation Use and Winter Sports

Special recreation uses in the basin include camping sites for large groups run by religious and scout organizations, second homes and the operation of winter sports areas. Private camps are scattered throughout the northern portion of the basin. Most of the recreation homes are adjacent to the Henrys Fork and U.S. Highway 20/191, or near West Yellowstone, Island Park Reservoir, or Henrys Lake. There are six recreation home areas located along the Henrys Fork: Big Springs, North Fork, Macks Inn, Box Canyon, Last Chance and Pinehaven. Moose Creek also has a developed summer home area. New recreation home building is prevalent at Henrys Lake, Island Park Reservoir and near Victor, in Teton County (Idaho Statesman, 1990;1989a)(see Figure 19).

With the increased popularity of winter recreation in the basin, many recreation homes are being used year-round (USFS-BLM, 1980).

Although Rexburg is not a major tourist center, it has developed an unusual travel economy. In the summer approximately 800 to 1,000 couples, largely from Sun City, Arizona, stay in empty student housing in and around Ricks College. Residents have been encouraged to develop events to keep the "sunbirds" coming back (Idaho Statesman, 1989b). The summer residents travel extensively throughout the basin and adjacent areas in day and extended-day trips.

Figure 19:
Secondary/Recreational Housing by County



Source: 1980 Housing Census, U.S. Department of Commerce

Recreation and the Economy

The 1987 Leisure Travel Survey found that the average expenditure of a group traveling to the northeast section of the state as a major destination was $143 for a two-day period. This average is greater than three other Idaho regions, but significantly less than expenditures in the Boise and Sun Valley areas (See Table 40, Harris et al., 1988). Nellis (1989a) reports that recreation-tourism dollars average 20 percent of total sales for Fremont and Teton counties (see Table 41). The tourism impact appears greater in Teton County because of its low population base. Activity centers on spill-over from high-priced development at Jackson, Wyoming, and the adjacent Grand Targhee ski resort.

The basin's winter recreation popularity appears to grow yearly. The Two Top Snowmobile Trail on the Targhee National Forest is now a designated National Recreation Trail. The Warm River Campground is a trailhead for snowmobiles and cross-country skiing along the abandoned river railway. Two roads along the Falls River are groomed for snowmobile use. Fremont County and the Targhee National Forest have cooperated to establish over 500 miles of groomed snowmobile trails in

the basin. Winter weekend use in the basin often exceeds 2,000 snowmobiles per day (USFS-BLM 1980; Nellis, 1989b). Cross-country skiing is popular at Harriman State Park, Bear Gulch and Warm River. Two developed alpine ski areas are adjacent to the basin: Grand Targhee near Driggs, and Kelly Canyon located east of Ririe. Teton County is particularly dependent on Grand Targhee Ski Area tourism, although receipts from the ski resort are registered in Teton County, Wyoming (Nellis, 1990).

As a growth driving industry, tourism in the Henrys Fork basin has not done as well as Sun Valley, McCall, Coeur d'Alene, and Jackson, Wyoming. One reason for the lack of comparable growth may be lack of a focal point for the recreation industry. The Fremont County recreation area is large. A focal point that could be emphasized more is Henrys Lake. A successful major development near the lake could have spin-off effects throughout the Island Park plateau. Major winter season use, such as a ski development, would assist in providing a good growth foundation.

Table 40. Average Traveler Expenditures

Region	Average Group Expenditure - 2 days
1 Lakes	$116
2 Clearwater	109
3 Southwest	172
4 South-Central	153
5 Southeast	133
6 Northeast	143
7 Sawtooth/Salmon	256

Source: The 1987 Idaho Leisure Travel and Recreation Study: Analysis for Region VI.

Table 41. Comparative Sales in Tourism-Related Sectors: FY 1989

Sector County	% Sales in Idaho	% Fremont County	% Teton County	% Madison
Eating and Drinking Places	7.1	9.0	9.9	.1
Lodging	2.1	3.8	4.9	.01
Amusements and Recreation Facilities	1.8	4.9	1.5	.01
Outfitters and Guides	.02	--	4.1	--
Service Stations	1.1	2.2	2.4	.01
TOTAL	12.3	19.9	22.7	.12

Note: Sales from service stations do not include the sale of fuel. Service stations are included to cover truck stops and convenience stores that sell meals, groceries, and similar items to travelers.
Source: Nellis, 1989a.

The recreation economy in the basin also appears, in many respects, to be an immature industry. In comparison to the typical four-stage life-cycle of an industry: introduction, growth, maturity and decline, the Henrys Fork basin might be said to be only in a late introduction stage. There are many small operators attempting to provide services, but recreation needs are not being met, particularly for the large out-of-state market. As the basin's recreation industry moves through the growth stage, managers will develop new services, greater experience, and financing in order to capitalize on recreational opportunities.

Market expenditures do not reflect the full value or net economic benefit to consumers, do not account for any external costs associated with production, and ignore resource intangibles, for example, wildlife, scenic beauty, water quality, and recreational opportunity. This divergence between economic and market values requires the careful measurement of net economic benefit in evaluating resources. Input/output models, used to estimate impacts on revenues, wages, and taxes, etc., measure levels of economic activity, but not net benefit from that activity.

The economic net benefit to society is a sum of the producer's surplus (profit) plus the consumer's surplus (willingness to pay above the price). The net benefit measures the addition to

well-being (welfare) in society from the use of a resource. To estimate the value of recreation, or the willingness to pay, it is necessary to rely upon methods of implicit pricing. Two standard methods used for this purpose are the travel cost method (TCM) and the contingent valuation method (CVM). Sorg and Loomis (1984) reviewed empirical estimate studies for recreation amenities. These studies, along with fishing and hunting surveys conducted in the Henrys Fork basin, report the net willingness to pay for recreational opportunities by participants (Sorg et al., 1985; Sorg and Nelson, 1985).

Recreation net benefits consist of user benefits and intrinsic or preservation value. User benefits are derived directly by recreationists in the course of on-site recreation activities like camping, fishing, boating, hiking, etc. In addition, people realize intrinsic or preservation value for the recreational opportunities of an area. Many people who do not currently participate in recreational use of an area, derive value from the existence of the natural quality of the region, from the opportunity to visit the site in the future, and from the knowledge that their children will be able to enjoy the natural resource in the future. The nonuser's willingness to pay for this existence value (Krutilla, 1967), option value (Weisbroad, 1964) and bequest value (Walsh et al., 1984) measures satisfaction with preservation of the natural quality of the area and the recreation opportunities it provides. Together these values are referred to as intrinsic value or preservation value, and they should be regarded in natural resource decision making (Weisbroad, 1964; Krutilla, 1967; Walker, 1990). Research has found that this intrinsic value accounts for 81 percent of the total willingness to pay for natural/recreational rivers (Walsh et al., 1984) or natural areas.

The most likely estimate of recreation benefits anticipates growth in recreation use at rates approximately equal to recent trends. RVDs are projected to increase at 1.4 percent annual rate, the same as the trend for developed recreation in the Targhee National Forest (U.S.F.S., TNF, 1985).

In 1989 dollars, real net benefit from recreation is approximately $100 million annually (see Table 42 and Table 43). Recreation net benefit estimates may err because the basin is not completely surveyed for recreation use. Without data to support an adjustment, no arbitrary compensation for unsurveyed activity was attempted. Recreation is potentially a major use of the Henrys Fork basin with large net benefits likely to accrue to residents of the region. Recreationists and tourists may also impact public facilities and services in any community. Visitors to the Henrys Fork basin sometimes need the assistance of local public safety services. The demand for public safety services could be much higher than normally expected in the area based solely on resident population.

Table 42. Estimated Net Value of Recreation Use in the Henry's Fork Basin (Real 1989 $)

Activity	Current Use Value $/Day	Hours/Day	Current Use Value $/RVD	RVDs	Current Use Value $/Year	Current Use Plus Preservation Value[a]
Sight-Seeing	3.47	4	10.42	172,800	1,800,576	9,476,716
General Day Camping	10.42	12	10.42	140,800	1,467,136	7,721,768
Snowmobiling	21.77	6	43.54	87,800	3,822,812	20,120,063
Fishing	21.30	4	62.65	80,000	5,012,000	26,378,947
Picnicking	10.79	4	32.37	63,100	2,042,547	10,750,247
Recreation Cabin Use	10.42	-	10.42	57,200	596,024	3,136,968
Motorcycle/Trail Riding	8.61	4	25.83	27,200	702,576	3,697,768
Hunting						
Big Game	48.72	7	83.53	24,200	2,021,426	10,639,084
Upland Bird	44.59	3	155.54	4,800	746,592	3,929,432
Boating						
Motorized	17.99	5	43.18	15,000	647,700	3,408,947
Non-motorized	23.77	7	40.75	10,200	415,650	2,187,632
Horseback Riding	14.58	-	14.58	21,500	313,470	1,649,842

Hiking and Walking	14.58	-	14.58	18,100	263,898	1,388,937
Organization Camping	10.42	-	10.42	10,200	106,284	559,389
Skiing and Snow Play	14.58	-	14.58	9,000	131,220	690,632
Swimming and Water Play	13.18	6	26.36	8,800	231,968	1,220,884
Bicycling	8.61	5	20.66	4,400	90,904	478,442
Sand Mtn. ORV Riding	13.30	5	31.92	4,000	127,680	672,000
Nature Study	3.47	4	10.42	3,800	39,596	208,400
Other	10.42	-	10.42	29,600	308,432	1,623,326

Table 43. Potential Increase (Likely Growth) in Net Value of Recreation (Real 1989 $)

Activity	Growth Rate % per Year	Use Value $ per Year [b]	Use Plus Preservation Value [a,b]
Sight-Seeing	1.4	2,297,534	12,982,278
General Day Camping	1.4	1,872,065	9,852,976
Snowmobiling	1.4	4,877,908	25,673,200
Fishing	1.4	6,395,312	33,659,536
Picnicking	1.4	2,606,289	13,717,315
Recreation Cabin Use	1.4	760,527	4,002,771
Motorcycle/Trail Riding	1.4	896,487	4,718,352
Hunting			
Big Game	1.4	2,579,339	13,575,471
Upland Bird	1.4	952,651	5,013,954
Boating			
Motorized	1.4	826,465	4,349,816
Non-motorized	1.4	530,369	2,791,417
Horseback Riding	1.4	399,988	2,105,198
Hiking and Walking	1.4	336,734	1,772,283
Organization Camping	1.4	135,618	713,781
Skiing and Snow Play	1.4	167,437	881,246
Swimming and Water Play	1.4	295,991	1,557,848
Bicycling	1.4	115,994	610,492
Sand Mtn. ORV Riding	1.4	162,920	857,472
Nature Study	1.4	50,524	265,918
Other	1.4	393,559	2,071,364

a - Use Plus Preservation Value is based on the assumption that use value equals 19% of total use plus preservation value (Walsh, Sanders and Loomis, 1984)
b - Levelized annual value over 40 year period with 3% real discount rate

Recommended Action

1. Encourage opportunities for dispersed recreation in primitive or natural areas.
2. Preserve access to outstanding scenic/recreational attractions and identify where additional access may be needed including access through private lands.
3. Seek a study of the recreational carrying capacity of the Henrys Fork from Big Springs to St. Anthony.
4. Designate state natural and recreational rivers in outstanding fish and wildlife, recreational, geologic or aesthetic areas.
5. Having adopted a plan for the Henrys Fork Basin, the State will oppose actions by any other entity which do not recognize and are not compatible with this plan.
6. Protect the quantity and quality of water that maintains and enhances good quality recreational experiences while providing for other water uses.
7. Encourage private sector commercial recreation development adjacent to public lands, or on suitable public lands if public need warrants.
8. Promote safety for all outdoor recreation including public campaigns relating to water safety, including learn to swim programs.

9. Encourage consideration of recreation as a significant planned use in new public and private water development projects.

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Timber, Grazing, and Dry Farming

Logging, grazing, and dry farming are land based activities generally guided or regulated by other agencies. Acreage in the basin, by category, is shown in Table 44. Water-related issues are water yield and water quality.

Table 44. Land Areas (in acres)

	Forest	Grazing	Irrigated	Dry Farming	Other Land and Water	Total
Fremont	518,000	418,000	124,000	87,000	63,000	1,220,000
Madison	46,000	76,000	113,000	63,000	16,000	306,000
Teton	60,000	96,000	84,000	47,000	9,000	294,000
	624,000	590,000	321,000	197,000	88,000	1,820,000

(Irrigated land and dry-farming land (potentially irrigable) acreage updated to 1990 acreage from 1976. Deduction made to grazing land in Fremont County for 9,000 acres.)

Timber

Of the forested land, approximately 55.5 percent, 347,000 acres, are classified as commercial (able to produce 20 cubic feet of wood per acre per year). Just under one-half of the commercial acreage is lodgepole pine while Douglas fir with some subalpine fir and spruce accounts for the other half. There also is a small amount (8%) of aspen acreage.

The 1988 North Fork fire in Yellowstone National Park burned about 20,000 acres of high plateau forested lands in the Henrys Fork drainage. The epidemic kill of most of the lodgepole pine forest by the mountain pine beetle has resulted in large timber sales to salvage mature and drying trees. Lodgepole pine stands will continue to deteriorate and be salvaged for the next 20 years. Timber harvests are administered by the Targhee National Forest, the Bureau of Land Management, the Idaho Department of Lands, and private owners.

Water Yield

The management of vegetation can impact runoff. For example, rangeland brush control will increase the water yield. The replacement of forest cover with a grass cover gives considerable increased water yield. This method of increasing water yield is a planning consideration on federal lands in the southwest states, but water yield is a limited consideration in the Northwest.

In the Henrys Fork basin the economic value of timber production and other forest uses relative to a limited need for additional water, other than in drought years, makes water yield a low consideration in forest management. For rangeland management the same is true.

The mountain pine beetle epidemic in lodgepole pine allows for a temporary increase of water yield. Estimates of the increased water yield are about seven percent. This increase will gradually

diminish as new timber stands become established. For an average water yield of eight inches over 400,000 acres, the increased yield would be approximately 20,000 acre-feet. For the 20,000-acre North Fork fire with 20 inches of precipitation, a seven percent yield increase would be 2,000 acre-feet. A negative impact is that the runoff peak occurs earlier in the year.

Water Quality

On National Forest lands there appear to be good management practices in the Henrys Fork basin. For example, erosion and sedimentation are controlled with buffer strips next to streams. Riparian vegetation slows sediment transport and scouring, helping to modify and alleviate turbidity and bank erosion. State and federal water quality regulations control the amount and type of logging immediately adjacent to streams and rivers.

Grazing

On grazed land the maintenance of a good level of grass productivity will minimize sheet erosion or general soil erosion. Water quality is also impacted by the grazing of stream banks by cattle. Sheep are believed to do less damage because they are continuously controlled by a herder. The land management agencies appear to balance ecological and economic concerns in their grazing management practices.

Dry Farming

Best management practices established by the local Soil Conservation Districts provide guidelines for erosion control. Best management practices associated with soil tillage greatly reduce erosion and sedimentation. Soil Conservation District personnel have been educating growers about these tillage procedures. Most growers have been using soil conservation methods for several years. New techniques are being developed, such as chemical weed control for summer fallow land and no-till planting. These practices, as they become more accepted will, in turn, further reduce sediment runoff from dry-farmed land.

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Energy Conservation

Conservation, the more efficient use of electricity, is a key resource for meeting future electrical energy needs. Conservation resources are measures that enable residential and commercial buildings, appliances, and industrial and irrigation processes to use energy more efficiently. Less electricity is used to support the same level of amenity or production that existed before the conservation measure was implemented. For example, buildings that cut down heat loss through insulation and tight construction require less electricity for heating. Conservation also includes measures to reduce electricity losses in generation, transmission and distribution systems.

Conservation is a uniquely flexible resource. If the economy grows rapidly, the conservation resource expands quickly, but if the economy slows, the conservation resource grows slower. Some conservation programs automatically match growth in electrical demand. Such is the case when new buildings are mandated by code to be energy efficient. Each new building adds load to the electrical system, but also can save energy if it is better insulated. In this regard, cost-effective conservation resources may be lost if not secured at the appropriate time. For example, if new buildings do not incorporate conservation measures at the time of construction, it is much more costly, and sometimes impossible, to retrofit them.

The Northwest Power Planning Council estimates that 7,692 megawatts of cost-effective electric power are achievable region-wide through conservation and high efficiency operations. The estimate is based on a high electric-demand scenario through the year 2010. The Northwest Power Planning Council believes energy codes are the most effective means for securing savings from new buildings. It is, however, also emphasizing utility incentive programs to gain energy savings rather than relying entirely on regulatory authorities (NPPC, 1990).

Residential Sector

Space heating is by far the largest single use of electricity in the residential sector; water heating is second followed by refrigerators and freezers. About 60 percent of potential residential energy conservation would come from reducing the energy required to heat homes. Energy savings can be achieved by improving insulation, adding storm windows, and reducing air leakage. Table 45 provides representative thermal savings and cost data as an example of possible energy savings.

Table 45. Representative Thermal Data for 1,350 Square Foot House Located in an Idaho Mid-Level Mountain Valley. Costs for Retrofitting.

Features	Incremental Cost	Cumulative Cost	Annual Use Kwh/yr	Levelized Costs Cents/Kwh
Northwest Power Planning Council New Construction Standards if Adopted by a City or County				
Ceiling R-0 to R-19 (6 inch)	$ 651	$ 651	33,032*	0.179
Walls R-0 to R-11 (4 inch)	841	1492	25,949	0.513
Air Changes Per Hour 0.6 to 0.4	109	1601	23,874	0.718
Ceiling R-19 to R-30 (10 inch)	222	1823	22,658	0.787
Crawl Space R-0 to R-19 (6 inch)	1094	2917	16,762	0.801
Single to Triple Pane Windows	1898	4815	12,193	2.400
Ceiling R-30 to R-38 (12 inch)	163	4978	11,919	2.566
Idaho Residential Energy Standards (required for new construction after January 1, 1991)				
Wood to Insulated Outside Metal Doors	615	5593	11,359	6.344
Crawl Space R-19 to R-30 (10 inch)**	947	6540	10,751	6.727
Ceiling R-38 to R-49 (16 inch)				
Walls R-11 to R-19 (6 inch)				
Wall R-19 to R-26 (6 inch with foam boards and advanced framing)				

* Without any insulation, use is 48,709 Kwh/yr.
** The cost of this feature includes an estimate for extending the joist to accommodate R-30 insulation.

Source: 1989 Supplement to the 1986 Northwest Conservation and Electric Plan, Volume II, Northwest Power Planning Council, p. 3-21.

NOTE: The residential rate within the Fall River Rural Electric Cooperative service area is 4.8 cents per Kwh for usage above 1400 Kwh/month; a typical usage for electric heated house. For Utah Power and Light the cost is 5.8 cents.

For new residential buildings other than mobile homes, the meeting of specific conservation standards is being encouraged by the electric supply utility through lump sum payments to the owner or builders. Both utilities serving the Henrys Fork Basin, Fall River Rural Electric Cooperative and Utah Power & Light Co., are participating in the program. Idaho Residential Energy Standards

required for new construction after January 1, 1991 will result in energy savings for most kinds of site-built homes.

Water heating energy savings are next in importance. Energy savings accrue from better insulated water heaters, pipe wraps and more efficient appliances that use hot water as well as the use of these appliances (for example, clotheswashers, dishwashers). For refrigerators and freezers, the National Appliance Energy Conservation Act was enacted in 1987. It sets an initial maximum energy consumption level for refrigerators and freezers (plus other home appliances) sold in and after 1990. The federal law also requires a review of the initial standards in 1990. California has set for implementation in 1993 more stringent standards that the Department of Energy is expected to generally follow after 1990.

Commercial and Industrial Sectors

Space heating, space cooling, and lighting dominate commercial energy consumption. Office buildings and retail stores consume almost 50 percent of the electricity used in the commercial sector. The energy conservation potential in commercial buildings is felt to equal that of residential buildings.

In the Henrys Fork Basin the primary industrial user of electricity is food processing. Since each industrial plant is different, it is difficult to estimate the exact amount of energy savings. However, cost-effective energy conservation appears possible since past reviews of similar industrial plants show considerable energy saving potential.

Irrigation Sector

Because of the large amount of irrigation in the Henrys Fork Basin, there are considerable energy savings available through the use of more efficient water application systems, and through water scheduling improvements. This savings is largely from system improvements in existing sprinkler systems but also in the design of new sprinkler systems for conversion from gravity to sprinkler irrigation. Many new systems are installed each year in order to improve labor and water efficiency. Worn bowls in deep well pumps, excess water use from worn sprinkler nozzles, main lines installed in a less than efficient size, and operating pressures all contribute to larger irrigation electric-use loads.

Total Conservation Potential

The Northwest Power Planning Council staff has made a region-wide estimate of the amount of cost-effective electric power conservation achievable by year 2010. The potential savings were calculated with a high electric-demand scenario. The following projected savings would be less with any of the four lower demand scenarios: medium high, medium, medium low, or low. Energy conservation potential in the basin has been estimated through the use of population ratios for the residential and commercial sectors, the employment ratio for the industrial sector, and the ratio of irrigated acres for the irrigation sector. Achievable electric energy conservation in the Henrys Fork basin, by the year 2010, is estimated at 12,800 kilowatts (average) in the following amounts per sector: Residential - 4,400 KW, Commercial - 4,200 KW, Industrial - 1,000 KW, and Irrigation - 3,200 KW. This compares with 23,000 KW of average generating capacity for present and active proposed power plants in the Henrys Fork basin.

Recommended Action

1. Encourage the development of programs to retrofit for heat conservation of existing residences, commercial buildings and businesses.

2. Encourage county and city governments to adopt Northwest Power Planning Council standards for new construction, including commercial and business buildings.
3. Support continued research and education programs on energy-efficient design of new irrigation systems.
4. Continue programs to make irrigators aware of irrigation energy conservation financing programs.

Source

1989 Supplement to the 1986 Northwest Conservation and Electric Power Plan, Volume One, pp 23-39, Northwest Power Planning Council.

Geothermal

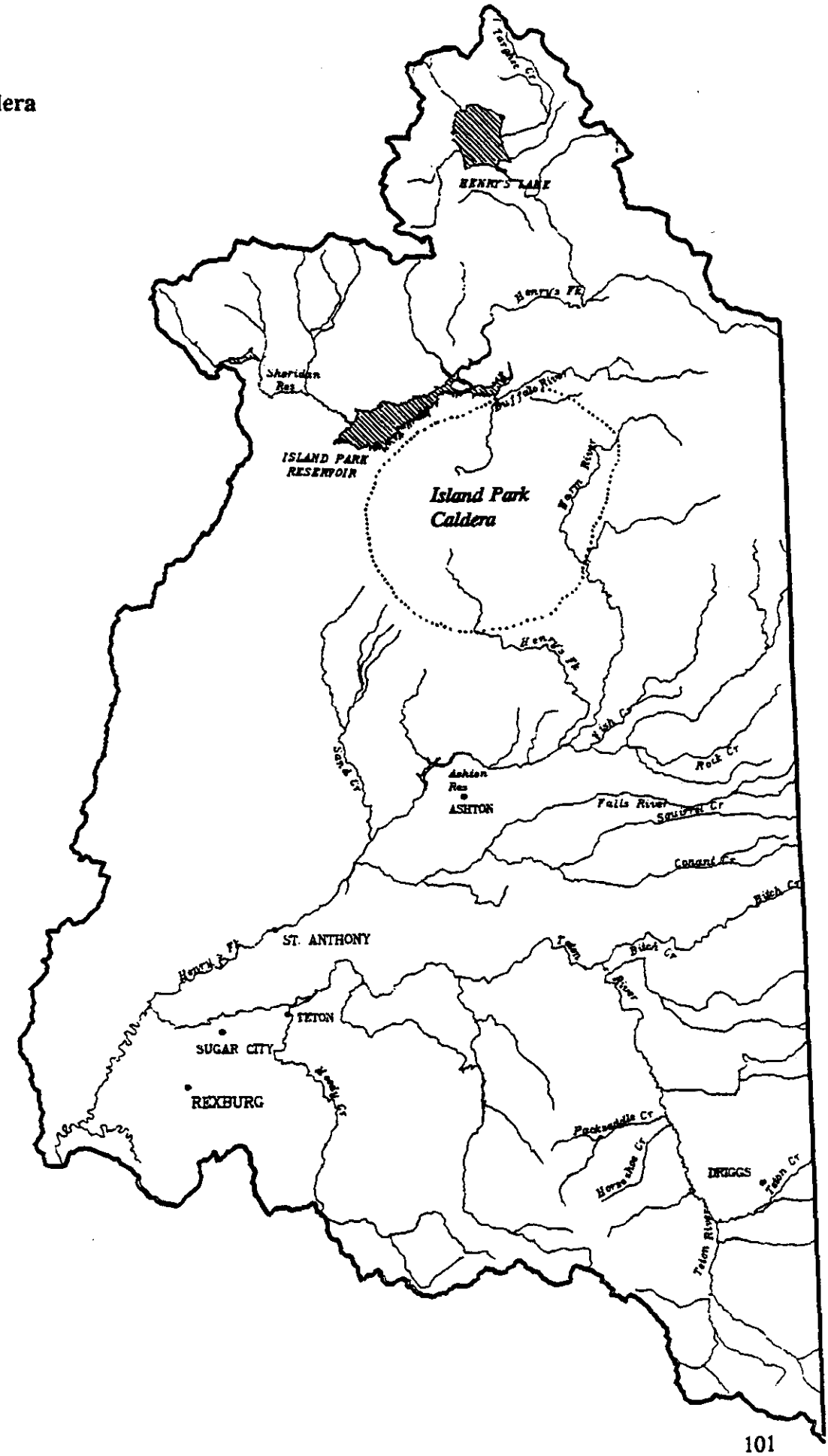
The geology of northern Fremont County suggests geothermal development potential. The Island Park caldera, a collapsed shield volcano, is somewhat egg shaped with a general north-south axis. The caldera extends from Island Park Reservoir south to Sheep Falls. The Henrys Fork flows south through, and just west of, the center of the caldera, then flows over the volcanic rim in a series of falls and rapids including Upper and Lower Mesa Falls (see Figure 20). The Island Park caldera generally has filled with sediment and appears as a level plateau.

In the vicinity of most volcanos, there are good geothermal prospects. In the Island Park area, the general absence of hot springs suggests an old geothermal system. Geophysical survey data implies that the caldera has cooled with little rock alteration, so the area is not now a very promising geothermal exploration target (see Hoover and Long, 1975).

Approximately ten years ago there was considerable interest in leasing areas near Island Park for geothermal purposes. In the early 1980's there were 200 lease applications within the caldera and east to the Yellowstone Park boundary. The Forest Service, after going through an environmental impact analysis, stated they will not consent to geothermal leases until the Department of the Interior shows that Island Park geothermal development will not adversely affect the Yellowstone National Park geothermal features, or the habitat of threatened or endangered wildlife, and that a valuable geothermal resource exists. Industry has not pursued further research in the area.

Geothermal potential exists south of Rexburg, and in the Newdale and Ashton areas. Chemicals in solution measured in selected samples in these areas indicated temperatures near 170°F. For direct home heating, water temperatures as low as 100°F have been used. With deep drilling, direct space heating potential may be available over wide areas of the lower Henrys Fork basin. Ground-water heat pumps may be used with normal depth wells, especially in the south Rexburg and Newdale areas where water in existing wells is around 80°F. The water chemistry suggests warmer water with

Figure 20:
Island Park Caldera



deeper drilling. Ground-water heat pumps are highly efficient with water in the 70° to 100°F range and are quite economic with normal ground-water temperatures.

Recommended Action

1. State and local government should encourage the use of ground-water heat pumps for space heating, especially for rural properties and others that have an existing well and for buildings located near known warm water sources.
2. Deep drilling for high-temperature water or for large uses of low-temperature geothermal water on the Island Park plateau is to be discouraged unless no damage to the Yellowstone thermal system can be shown.
3. A geothermal study in the Rexburg area as a basis for the development of a district heating project is encouraged.

Sources

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Mitchell, John C., Linda L. Johnson and John E. Anderson, Geothermal Investigations in Idaho, Part 9, Potential for Direct Heat Application of Geothermal Resources, Idaho Water Resource Water Information Bulletin No. 30, 1980. Also see separate plate 1 map.

Power Development

Hydropower has been the electric generator of choice in the Henrys Fork basin as it has for the state. The basin contains active hydroelectric generating plants, projects that are actively being pursued, and a number of potential sites that do not seem feasible at this time. Significant barriers to new hydropower development exist in that except for the Island Park project, federal law prohibits new projects on the Henrys Fork River. Minimum stream flows are in place on Warm River, Teton River, Bitch Creek, and the Henrys Fork. This comprehensive water plan will designate river reaches in the basin as state protected rivers where new hydropower projects are prohibited by state law.

The following listing serves to identify potential hydropower sites in the basin. Their identification does not constitute an endorsement or mean that they are proposed for development. Indeed, many of these projects will likely have additional barriers to development created by this plan.

Existing Power Plants

St. Anthony (FERC #2381) - This 500 KW power plant is located in Sec. 1, T. 7 N., R. 40 E, along the Henrys Fork in downtown St. Anthony. The plant was constructed in 1915. The design head is 18 feet. This project is owned by Utah Power and Light Co., a recently acquired division of Pacific Corporation of Portland, Oregon. The average annual generation has been 3,900 MWH for an average of 450 KW. Average generation is 90 percent of capacity. There is more capacity at this

site. In 1982 the City of St. Anthony applied for a preliminary permit to construct an adjacent facility that would more than double the capacity (650 KW would be added). The filing, #6956, is no longer active.

Ashton (FERC #2381) - This power plant is located at Ashton Reservoir on the Henrys Fork, two miles west of the town of Ashton. The plant was originally constructed in 1917 with generating units number two and three added in 1925. The total nameplate rating is 5,800 KW with a total head of 56 feet. The power plant is owned by Utah Power and Light Co. Average generation is 4,000 KW from an annual average generation of 35,000 MWH (69 percent of capacity). There is a proposal to upgrade the oldest of the three generators from 1,300 KW to 3,400 KW. This would give a total plant rating of 7,900 KW. The upgrading of one generator would likely require some powerhouse rebuilding, but this is still a low cost improvement.

Felt (FERC #5089) - This is a recently enlarged power plant located on the Upper Teton River, just past where the river enters the canyon below Teton Valley and about 10 miles northwest of Tetonia. The power plant was built in 1921 using an actual head of 90 feet (80 feet design head). The original powerhouse contained three generators, one rated at 150 KW and two rated at 250 KW, with a single tunnel. In 1947 a 500 KW and a 720 KW generator were added in an adjacent new powerhouse with two new tunnels. In 1968 the original three units ceased operation. In 1980 generation was increased to 2,000 KW. In 1985 two more generators, totaling 5,500 KW, were added in a third powerhouse located 1500 feet downstream. The design head was increased to 159 feet and the facility used the two tunnels built in 1947. The original tunnel was routed to the 2,000 KW generating units. Total generating capacity is 7,500 KW. Total usable water flow is 884 cfs. The average generation is 3,400 KW (29,000 MWH) which gives a plant capacity of 44 percent. Fall River Rural Electric Cooperation of Ashton has leased the project to Hydro Valley Development, Inc., a subsidiary of Bonneville Pacific Co. of Salt Lake City.

Ponds Lodge (FERC #1413) - This 200 KW power plant with a 30-foot head is located at the mouth of the Buffalo River just below Island Park Dam on the Henrys Fork (Sec. 33, T. 13 N., R. 43 E., at the U.S. Highway 20 crossing of the Buffalo River). With a 1939 water right, production started in 1940. The electric power was used at the lodge. The power plant was damaged by lightening and fire in 1986 and is not now in production. In 1989 the Federal Energy Regulatory Commission license was transferred from Island Park Resorts Inc. to Buffalo Hydro Inc. The project must be rebuilt by October 31, 1993 to retain its license.

Briggs (FERC #8083) - This 300 KW power plant built about 1987 is located in Sec. 31, T. 7 N., R. 41 E. adjacent to the north side of the settlement of Teton. About two miles upstream of the powerplant, water is diverted from the Teton River into the Teton Irrigation and Manufacturing Canal (Teton Canal). From the canal the water drops about 20 feet back into the Teton River. The estimated average annual generation is 1,800 MWH or an average of 200 KW. The owner is Turbine Generator Service Inc. of Salt Lake City but they provide royalties to Robert and Carla Olson of Idaho Falls. The project has received exemption from licensing.

Potential Developments - Active FERC Filings

Island Park (FERC #2973) - This 4,800 KW power plant is to be located at the existing Island Park Dam where 74 feet (45 to 79) of head is available. The average annual generation is estimated at 26,900 KWH for an average of 3,100 KW. Fall River Rural Electric Cooperative, Inc. of Ashton is the project owner, while Bonneville Pacific Corporation of Salt Lake City is the project operator. The FERC license stipulates that project construction must start by October 17, 1992

Falls River (FERC #9885) - This proposed 7,500 KW power plant is located on the Falls River. The 46,000 MWH estimated annual generation would provide an average generation of 5,000 KW. The diversion point would be the existing Marysville Canal diversion from the Falls River in Sec. 35, T. 9 N., R. 44 E., two miles below the National Forest boundary. The powerhouse would be located six miles downstream where the canal is still within one-half mile of the river, and the drop to the river is about 130 feet. Enlargement of the canal is proposed to enable power production year-round. A reduction in power generation may occur during midwinter high icing conditions. The owner is Grant Durtschi, Environmental Energy Co. of Riverton, Utah. This project has been approved by FERC for construction with the requirements that construction start by May 24, 1993 and be completed by May 24, 1995.

Upper Teton River (FERC #10613) - This proposed 4,500 KW power plant is located on the Teton River. The 25,000 MWH of estimated annual generation would provide a 2,800 KW average. The diversion would be located just below the Tetonia dam site in Sec. 3, T 6 N., R. 44 E., just after the Teton River leaves the Teton Valley northwest of Tetonia. The proposal locates the powerhouse about two miles downstream in Sec. 33, T. 7 N., R. 44 E. The developer is Lower Patterson Inc. managed by Richard L. Graves of Gooding, Idaho.

Other Potential Hydropower Sites

The following discussion of potential hydropower plants only addresses the physical potential of hydraulic head and water flow (Table 46). Legal, environmental, and social issues have not been addressed and may preclude many of the identified potential projects. Total potential installed capacity in the basin is about 200 MW (200,000 KW). The 200 MW of installed capacity compares to a single coal-fired generating plant sized at 1,000 MW. Potential average generation basin-wide is 134 MW (134,000 KW) with an estimated annual generating plant factor of 67 percent. Probable installed sizes of potential hydropower projects range from 30,000 KW to very small installations. For comparison purposes, the Grace and Cove powerplant capacity in Caribou County is 40,500 KW while the present Ashton power plant is 5,800 KW. Table 46 lists potential hydropower sites in the basin.

All potential projects on the Henrys Fork from Henrys Lake (including Big Springs) to Ashton Reservoir are prohibited unless specifically approved by congress. This restriction is contained in PL 99-495, Section 15A(C), October 16, 1986.

Warm River - See "Surface Water Storage Sites" under "Water Supply" for information on this site.

Mesa Falls - Several development alternatives have been proposed for hydroelectric power in this area of the Henrys Fork. Preliminary indications are that an average of 18,000 KW (158,000 MWH) might be generated using three miles of the river for a 320-foot drop. As currently envisioned there are large environmental conflicts associated with such a development. Mesa Falls is a heavily used scenic attraction during much of the warm-weather recreation season.

Table 46. Potential Hydropower Sites - Henrys Fork Basin

Site	Stream	Usable Storage if any in ac-ft[1]	Conduit Length in miles[1]	Average Annual Flow in cfs[2]	Power Head in feet[1]	Average Annual Generation in avg. KW[1]
Warm River	Henrys Fork	75,000	-	1,440	220	22,000
Mesa Falls[4]	Henrys Fork		3	950	320	18,000
Lookout Butte	Henrys Fork		12	870	300	18,000
Teton	Teton R.	200,000	-	710	295	14,000
Anderson	Falls R.		6	745	260	(13,000)[3]
Sheep Falls	Falls R.		4'& 200' dam	430	400	12,000
Last Chance	Henrys Fork		7	≈900	190	11,000
Squirrel	Falls R.		-	745	140	(7,000)[3]
Judkins	Bitch Cr.		≈6	140	525	5,000
Tetonia	Teton R.		-	390	140	4,000
Warm River Butte	Warm R.		6	170	320	4,000
Partridge	Warm R.		3	150	270	3,000
Boone Cr.	Trib. to Falls R.		2.5	≈10	560	3,000
Lower Ashton	Henrys Fork		26' drop	≈1,500	25	2,000
Victor	Teton R.		4 & 120' dam	≈80	400	2,000
Canyon Cr.	Canyon Cr.		6 & 200' dam	≈40	675	2,000
Fish Cr.	@ Warm R. Butte		12	≈100	440	2,000
Buffalo R.	Buffalo R.		100' dam	≈190	175	≈2,000
Upper Badger	Badger Cr.		12 & 130' dam		440	≈2,000
Ashton (enlarge)				≈1500		≈1,400
Cross-Cut Diversion	Cross-Cut Canal		10' drop		10	1,200
Coffee Pot Rapids	Henrys Fork		45' drop	≈350	45	≈1,000
Enterprise	Falls River				100	600
St. Anthony Canal	St. Anthony Canal		1	250		≈400
Marysville Drop[2]	Marysville Canal		1	40	66	200
					Total	129,000
Present and Active Proposed Powerplants						23,000
Grace & Cove (for comparison)	Bear R.					18,000
C.J. Strike (for comparison)	Snake R.					79,000

[1] Water Power Resources of Idaho by USGS
[2] Tudor Report
[3] May be developed by an active proposed power plant
[4] Several options for same area

Hatchery Ford/Riverside Campground Diversion - A second proposal for the Mesa Falls area would pick water up below Hatchery Ford, and move it south into a small off-stream holding area. Water could be pumped into the holding area at night and removed for generation during peak demand periods. From the holding area, the water would be moved to Ashton Reservoir, a total distance of 7.5 miles with a net drop of 730 feet (see map at the end of "Water Supply").

An alternate method of developing the powerhead is to make the initial diversion at a point one-fourth mile below Riverside Campground. After a lift of 80 feet, the water would be moved southwest five miles to a reregulating reservoir at the north base of Big Bend Ridge. A three-fourths mile tunnel and a six-mile penstock would allow the development of 880 feet of net head at Ashton Reservoir.

The average generation might be near 30,000 KW or about 50 percent of nameplate rating. The in-place regulating capability at Ashton Reservoir would reduce construction cost over similar peaking projects elsewhere since a re-regulating reservoir would not be needed. Summer time minimum flow rights held by the Idaho Water Resource Board (1,000 cfs - April 1 to September 30) could prevent

most natural flow diversions, however, releases from Island Park reservoir apparently would be available for diversion.

Lookout Butte - The five miles above the Riverside Campground generally has a very easy gradient. Ambitious development proposals would capture the river drop in this five mile reach with a 20-30 feet high diversion dam placed just above Riverside Campground. From the diversion dam a seven-mile parallel canal and/or penstock would move the water to Upper Mesa Falls. About 300 feet of gross head would be developed. The estimated average annual generation for the total reach could be 18,000 KW. The generators would be somewhat larger.

Teton - See "Surface Water Storage Sites" under "Water Supply" for this project.

Anderson - This project on the Falls River would divert water for a distance of approximately six miles. Roughly 260 feet of head would be developed. Average annual generation would be approximately 13,000 KW.

Sheep Falls (Falls River) - This project, identified in Waterpower Resources of Idaho, would have a 200-foot dam on the Idaho border in Sec. 17, T. 9 N., R. 46 E. From the reservoir a canal would extend downstream four miles. Average generation is estimated at 12,000 KW. An altered non-dam project would be a river level diversion two miles above the Idaho border, just below Cave Falls Campground. A ten-mile canal could extend downstream to the Yellowstone diversion. The canal would need to be a buried conduit to reduce wildlife disturbance.

Last Chance - The seven-mile reach of the Henrys Fork from Island Park Dam to the Osborne Bridge has 190 feet of drop with a fairly consistent grade, although the upper area is slightly more steep. Lower gradient hydroelectric potential is usually developed by diverting a portion of the river into an adjacent canal to keep a level gradient until dropped to the powerhouse. A total potential of 11,000 KW of average annual energy may exist in this river reach.

Squirrel - See Yellowstone Hydro, the Yellowstone Hydro project would develop the Squirrel proposal.

Judkins - See site labeled "Bitch Creek" under "Surface Water Storage Sites" in the "Water Supply" section.

Tetonia - See "Surface Water Storage Sites" under "Water Supply Section."

Warm River Butte - In Waterpower Resources of Idaho, this site would develop the power head between elevations 5,800 and 5,480 or 320 feet on the Warm River. The diversion point would be in Sec. 3, T. 10 N., R. 44 E., and a six-mile conduit would move the water to a powerhouse in Sec. 32, T. 10 N., R. 44 E. This would develop an average 4,000 KW of energy. Picking the water up only 15 feet lower would shorten the conduit length one mile and would allow using flow from Warm River Springs.

An alternative potential development could lift water about 200 feet, to the top of the plateau, from a point just above the cascades. At a distance of one and one-half miles, a net drop of 370 feet down Bear Gulch into the Henrys Fork would allow for the development of about 1,500 KW (3,000 KW peaking). About 70 cubic feet per second are available above the state designated minimum flow.

Cross-Cut Diversion - This site is located at the Henrys Fork diversion dam into the Cross-cut Canal (Sec. 14, T. 8 N., R. 41 E.), seven miles northeast of St. Anthony. A power plant could use a ten-foot drop at the diversion dam located just below the mouth of the Falls River. The estimated annual generation is 11,000 MWH or an average generation of 1,200 KW. By using two miles of the canal a total gross head of about 35 feet appears to be available. This design would require a three-fourths mile penstock.

Enterprise Hydroelectric - This site is located at the Enterprise Canal siphon crossing of the Teton River, about three miles northeast of Newdale. Annual generation is estimated at 5,500 MWH, a 600 KW average. Water from the Enterprise Canal would drop 100 feet. The water would be diverted from the Falls River, about five miles above its mouth, to the Enterprise Canal. The power plant could use only excess irrigation water so power generation would be higher in April or August than in June, a month of high irrigation use. The canal could also be used during the nonirrigation season except during maintenance periods or when icing problems cause difficulty.

Partridge - As identified in Waterpower Resources of Idaho, water would be diverted to a conduit at the confluence of Warm River and Partridge Creek in Sec. 20, T. 11 N., R. 44 E and moved three miles to a powerhouse at Sec. 33, T. 11 N., R. 44 E. The 250 feet of head would be developed between elevations 6,050 and 5,800. This project could develop an average 3,000 KW of energy.

Boone Creek - See "Surface Water Shortage Sites" under "Water Supply."

Lower Ashton - This project has been identified in a short reconnaissance report by the Corps of Engineers. A 25-foot drop through a structure on the Henrys Fork would average 3,000 KW or about 22,000 MWH of energy. A reservoir 2.4 miles long would be created immediately below Ashton Reservoir. The project was estimated at 55 mills per KWH with an interest rate of 12 percent.

Victor - This project would use water from Trail, Moose and Game Creeks located southeast of the town of Victor in Teton County. Waterpower Resources of Idaho suggests an average of 2,000 KW can be generated through 400 feet of drop at this site. This area now has a gravity sprinkler system using this water during the irrigation season. The need to maintain sprinkler pressure cuts in half the amount of potential generation during the irrigation season. There are two pressure reducing stations in this irrigation system. The pressure reducing stations would have some generating capacity other than during peak flow times. Nonirrigation season use of this system generally would only be possible for about 250 feet of elevation drop in the steel pipe portion of the system that takes water from Game Creek. The asbestos pipe used in other parts of this system is better used only for warm weather operations. New facilities would be needed to use Trail Creek water during the nonirrigation season.

Canyon Creek - See "Spring Creek" under "Surface Water Storage Sites" in the "Water Supply" section.

Fish Creek - Water could be diverted by canal at the 5,800 feet elevation level on Fish Creek. This would give 440 feet of head down to the 5,360 elevation level on Warm River. To make a project economical, water also would need to be collected from Robinson, Snow and Rock creeks at the 5,800 feet elevation level. Two one-mile tunnels would significantly shorten canal routes, however, five miles of canal would still be needed. The average annual generation is estimated at 2,000 KW with a power plant nameplate rating of 4,000 KW.

Buffalo River Hydro - See "Surface Water Shortage Sites" under "Water Supply."

Upper Badger - See "Surface Water Storage Sites" under "Water Supply."

Coffee Pot Rapids - About 45 feet of river drop within a distance of one-half mile on the Henrys Fork at Coffee Pot Rapids could be developed. The average annual energy available is estimated at 1,000 KW. Flows vary from about 250 cfs to near 600 cfs although average flows appear to be about 350 cfs.

St. Anthony Canal - At the Henrys Fork diversion dam, located about three miles east of St. Anthony, water could be taken into the St. Anthony canal. On the north side of the river, the water would move about one mile then drop 13-15 feet back to the river. Potential generation would be about 5,500 MWH from 800 KW generators.

Marysville Drop - A drop of nearly 66 feet in the upper end of the Marysville Canal, Sec. 36, T. 9 N., R. 43 E., is a potential hydropower site. The project could be used only during the irrigation season. The Falls River (FERC #9885) project has prior water rights during the nonirrigation season. This project could generate an average of 200 KW of electricity with a reported 40 cfs of water. This site is listed in the Tudor report.

Yellowstone Hydro - This potential 4,500 KW power plant is located on the Falls Rivers above the earlier described Falls River project. The 28,000 MWH estimated average annual generation would provide an average 3,200 KW. The diversion point would be the existing Yellowstone Canal diversion from the Falls River in Sec. 23, T. 9 N., R. 45 E., two miles upstream of the National Forest boundary. The powerhouse would be four miles downstream where the estimated drop from the canal to the river is 110 feet. This powerhouse location is just upstream of the Marysville Canal and the Falls River hydroelectric project. As with the Falls River project, enlargement of the canal would allow for power plant operation most of the year.

Other Projects - There are other potential hydropower sites in the basin. For example, the Henrys Fork drops 100 feet from Warm River to Ashton Reservoir, 60 feet between Ashton Reservoir and the Falls River, 90 feet between Falls River and St. Anthony, and 140 feet from St. Anthony to the Teton River, South Branch. The Falls River drops 350 feet between the Falls Hydroelectric Project powerhouse at the Reclamation Road river crossing and the Falls River mouth.

Recommended Action

1. The Idaho Water Resource Board makes no recommendation for specific project development at this time.
2. The Water Resource Board's policy concerning hydropower is: that energy conservation and efficiency improvements are the most desirable methods to provide additional power, that new hydropower resources be developed at existing structures whenever feasible, and that new projects should be carefully evaluated to insure that the benefits to the state outweigh any negative consequences.
3. Where state protected river designations prohibit new hydropower development, the Water Board will consider petitions to amend the comprehensive state water plan on a case-by-case basis. Where the benefits outweigh any negative consequences the Board will initiate the amendment process and seek public input.

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Flood Control

Within the Henrys Fork Basin there are two areas which exhibit significant flood problems -- the Lower Teton River (both the north branch and the south branch) and the Lower Henrys Fork below Ashton Reservoir. The highest flood peaks are caused by winter rain and low elevation snowmelt over frozen ground, but the more common flooding is from springtime snowmelt which may be augmented by rain.

Only a relatively small portion of the total land area is susceptible to flooding. However, many of the flood-prone areas are located in the more intensively settled areas. Generally, these areas are narrow strips along the stream and include good farmland, rural settlements and urban strips. Floods seldom cause loss of life but often result in damage to land and buildings, highways, railroads and irrigation facilities.

Large floods on the Teton River have an average reoccurrence interval of every four years, although, recently, they have been more frequent. General Teton River inundation occurs with a discharge over 4000 cubic feet per second (cfs) which is exceeded about one year in four. Normal bank full capacity appears to be 2000 cfs, which is exceeded almost every year. Strengthening of the

partial flood control levees as a part of the emergency follow-up work after the Teton Dam flood, has increased river capacity in urban and other selected areas. However, these levees do not provide complete protection, and in many areas there are no levees. On the Teton River the particularly hazardous period is early spring when ice jams are common. Ice jamming is accentuated by natural stream obstructions and poorly designed bridges and irrigation weirs.

Instantaneous flow near the town of Teton from a periodic flood of a 10 year, 50 year, 100 year and 500 year interval are respectively: 4,800 cfs, 9,000 cfs, 13,000 cfs, and 21,000 cfs. The highest flow of record is 11,000 cfs on February 12, 1962 except for the Teton Dam failure (1,700,000 cfs). Most years the maximum flow occurs in May or June. Estimates are that 60 percent of the flow moves through the South Branch Teton River and 40 percent of the flow moves through the North Branch.

Given the relative low flows that cause inundation outside the stream channel (2000 cfs) there is a high frequency of flooding. The 100 year floodway area is 11,000 acres for 23 miles of stream along two branches. At a purchase value of $1,500 per acre, including buildings, the total property value would be just over $16,000,000.

There are nine bridges over the Teton River with bridge beams so low that there is a damming of water for a 100 year flood (ACE, 1977; FEMA, 1990). Most of the bridges are county-owned. The worst three bridges have such low beams even a ten year flood appears to cause a water rise of four to five feet. This damming raises the river level at these constrictions and accentuates the flooding of surrounding land. The constriction in turn allows for some riverbed filling, generally on the upstream side of the bridges.

Even bridges repaired after the 1976 Teton Dam failure are a problem. The bridges may not have been raised sufficiently to clear a 100 year flood or even a 50 year flood. Flood control from the Teton Dam project was assumed when a state-owned bridge, built just prior to the Teton Dam flood, was designed. The flood left the bridge but washed out the approach road which was replaced. Another state bridge was built with lower flood flow criteria than those used by the Corps of Engineers. This bridge shows a gouging of the riverbed which suggests constriction at the bridge, with a resulting upstream water level rise and adjacent flooding.

A bridge design with closely spaced piers can similarly contribute to flooding because they collect brush and/or ice blocks. Winter ice-jam floods are more common at higher elevations. Railroad bridges are examples of the closely spaced pier design. The design of some water diversion structures also may need to be reviewed to make sure there is not unnecessary damming or brush collection during flood conditions.

A review of the river profile shows several county bridges have riverbed gouging under the bridge, or a significant drop in the riverbed just downstream from the bridge. Both are a major indication of constriction which results in an increase in upstream flooding. The following table lists the Teton River bridges, the distance the beams are under water in a 100 year flood, and the amount of water level rise from the downstream to the upstream side of the bridge. All county bridges are in Madison County except as noted. On the Lower Henrys Fork there is one state bridge (Highway 33), one Madison County bridge, one Fremont County bridge and one railroad bridge for which flood constriction flow data is not available. Further study is needed to determine flood levels on the lower Henrys Fork.

Proper bridge design will pass a 50-year flood with two feet of clearance below the beams, and pier spacing and river channel width limit water level rise to one foot. A 100 year flood generally increases the river level rise an additional one foot over the 50 year flood so the 50-year flood design criteria will generally pass a 100-year flood. (A 500-year flood generally raises the water level only an additional foot over the 100-year flood.)

Table 47. Teton River Bridges

Bridge Location	Depth Bottom of Bridge Under 100 Year Flood	Water Level Rise Downstream to Upstream Side of Bridge in 100 Year Flood
South Branch (Fork) Teton River		
County Bridge - Two miles west of Rexburg then north ¼ mile	5½ feet	2½ feet
County Bridge - Secondary system one mile west of Rexburg then 3/4 mile north - Hibbard-Egin Road	4 feet	3 feet
U.S. 20 - Two bridges	¼ foot	zero
Union Pacific Railroad - North side of Rexburg	½ foot	2 feet (very close pier spacing)
State-U.S. 33 - North edge of Rexburg - Current data	1 foot	1½ feet
County - Sugar City road two miles east of Rexburg then ¼ mile north	4 feet	1½ feet
County - Secondary system - Moody Road - Two miles north then two miles west of Rexburg	2½ feet	6 feet
County - Three miles north then two miles west of Rexburg	6 feet	6 feet
State - Idaho 33 - Current data	3 feet	5 feet
Fremont County - Teton Road - Secondary system-One-half mile north of Teton	½ foot	1 foot
North Branch (Fork) Teton River		
County - Secondary system - One Mile west then three miles north of Rexburg	zero	minor
County - Secondary system - Salem- Parker Road - Kilgore Road - Four miles north of Rexburg	zero	minor
County - One mile east then one mile north of Salem	zero	zero
U.S. 20 - Two bridges	zero	zero
Union Pacific Railroad	zero	minor (very close pier spacing)
County - One-half mile north, one mile east and three-fourths mile north of Sugar City	zero	minor
Madison and Fremont Counties - One mile west of Teton then one mile north	4 feet	2½ feet
Fremont County - Teton Road - Secondary system one-half mile north of Teton	½ foot	minor
Falls River - Fremont Count - one and one-half miles north of Chester	2 feet	zero
(Elevation data not available on other Falls River Bridges)		

A flood relief channel known as the Newdale Diversion has been proposed for the Teton River. In Sec. 15, T. 7 N., R. 41 E., a diversion structure would be placed in the river at the mouth of the canyon, just above the Newdale Road crossing three miles north of Newdale. A 10-foot dam would divert a major portion of Teton flood water to the Henrys Fork in the vicinity of St. Anthony. Further study would determine the best alignment of an approximate four-mile canal. Accompanying levees may be needed at the Henrys Fork junction with the Teton River. Drilling done as part of a preliminary study for a 23,000 acre-foot reservoir at this site, indicates heavy water losses through the south bank. Water loss will be much less without a storage structure.

For the Henrys Fork the flood hazard starts just below Ashton Reservoir, north of St. Anthony. The critical area appears to start further downstream at a point located four miles below St. Anthony. Similar to the Teton River, ice-jam flooding associated with spring snowmelt appears to be the major problem. At the Henrys Fork, Rexburg gage the bank-full river capacity is about 4500 cfs (generally exceeded two years out of three), while the largest flood of record is 16,400 cfs. A U.S. Corps of Engineers Special Flood Hazard Report is not available for this lower Henrys Fork reach so the periodic flood level peaks are not known.

There is minor control of the Henrys Fork at Island Park Reservoir and at Henrys Lake. These reservoirs provide only limited flood control since they are in the upper third of the drainage basin.

In addition, flood control operation criteria for the reservoirs provides a very low amount of dual flood control-irrigation space, 23,000 acre-feet at Island Park and none at Henrys Lake Reservoir.

Recommended Action

1. A reconnaissance flood control study on the Lower Henrys Fork below St. Anthony is needed. The study should include a USBR/IDWR review of the feasibility of more dual flood control-irrigation space being provided in upstream reservoirs and exchanged for irrigation space in main-stem Snake River reservoirs.
2. Encourage the Corps of Engineers to undertake flood control studies on the Lower Teton River. A first phase would be to determine the current channel capacity.
3. Bridges within the basin should be reconstructed to current design standards. Low bridges can cause water level increases during flood conditions. Such construction would reduce any possible liability for flood damages.
4. Any new public or private water storage reservoir, including off-stream reservoirs, should have some flood control space combined with the other uses of the reservoir.

Sources

Columbia-North Pacific Region Comprehensive Framework Study of Water and Related Lands, Appendix VII, Flood Control, Pacific Northwest River Basin Commission, June 1971.

Flood Insurance Study. Fremont County, Idaho Unincorporated Areas, Federal Emergency Management Agency, Preliminary, March, 1990.

Flood Insurance Study. Madison County, Idaho and Incorporated Areas, Federal Emergency Management Agency, Preliminary, January 1, 1990.

Special Flood Hazard Information, Teton Rivers Vicinity of Rexburg and Sugar City, Idaho, U.S. Corps of Engineers, December 1976 and Supplement February 1977.

Water Quality

In general, the groundwater quality of the Henrys Fork basin appears to be good in both the highlands and the agricultural valleys. The exception might be warm water areas where fluoride may be high. In the Ashton area and near the mouth of the basin, the bicarbonate and calcium levels that govern water hardness are higher than in most other areas of the basin. A concern with groundwater in the basin is bacterial levels. In a 1979 study of the Eastern Snake River Basin, 20 percent of tested wells exceeded total coliform standards, and 11 percent exceeded fecal coliform standards. Coliform bacteria are bacteria that live in the intestinal tract of living organisms. Fecal coliform bacteria live in the intestinal tract of warm-blooded animals. Not all fecal coliform are disease causing bacteria, however, they are an indicator of the possible presence of disease causing bacteria and viruses. More stringent control of well construction since 1979 may have reduced the problem. (See "General Water Quality" in the Appendix.)

Much of the highland groundwater eventually becomes surface water at springs or streams. Surface water in the basin, most of the time, is of quite good quality. In the upper basin plateau areas the few exceptions relate to a marginally high fluoride condition in Big Spring Creek, the Buffalo River, Warm River, and the Falls River. There also are some summer periods when there is such a significant inflow of nutrients (phosphorous and nitrogen) that there is considerable aquatic

growth in surface waters. Much of this nutrient inflow appears to be natural, although septic tank effluent may be contributing a significant amount. Further study is needed to distinguish the contribution from each source. The aquatic growth reduces the clarity of the water, but provides a food base for fish. In the lower reaches of the basin irrigation return flow, as well as early season spring runoff from tilled agricultural land, adds nutrients, sediment, and related organic matter to the streams.

General Contaminants

The two water-born chemicals that allow for algae growth in water are the plant nutrients phosphorous and nitrogen. Phosphorous is common in several rock types in the upper Henrys Fork basin. The phosphorous is available as a dissolved mineral but the larger source is sediment with attached phosphorous. With so much phosphorous available in basin rock, a major goal is to keep down soil erosion. In water having a total phosphorous concentration greater than 0.025 mg/l, algal densities are high enough to significantly reduce water clarity.

Nitrogen is usually present in the soil, particularly in biological matter. Some nitrogen may enter the basin from precipitation, chiefly from snow (see R. G. Wetzel, Limnology, W. B. Saunders Co., 1975). Excessive concentrations of nitrate and ammonia (NH_3) in water generally result from leaching of organic and inorganic material. Nitrate does not enter into ion-exchange reactions so it tends to stay in solution and does not attach itself to soil particles. This can result in relatively high concentrations in groundwater, particularly near agricultural areas where fertilizers may contribute to nitrate concentrations unless special slow release types of nitrogen fertilizers are used. Ammonia does break down but attaches to soil particles. Biologic organisms further breakdown ammonia to nitrites and then to nitrates, both nonattaching.

Since both phosphorus and nitrogen are essential to normal plant growth, dense undesirable algae "blooms" occur in water bodies that receive excessive amounts of these nutrients. Warm water temperatures (over 68°F) also contribute to heavier algae growth. The Henrys Fork is nitrogen limited and therefore more responsive to changes in nitrogen levels.

Excessive algae growth occurs in shallow, wide, unshaded river reaches during the summer. Some algae growth is needed to provide food for macroinvertebrates. Excessive algae growth, however, detracts from visual enjoyment of the water, and sudden algae decomposition depletes dissolved oxygen. Dissolved oxygen is an indicator of the ability of a stream to sustain fish populations. The State of Idaho has set water quality standards for cold water fisheries. Dissolved oxygen levels must be above 6 mg/l, and the maximum daily average temperature is limited to 19°C (66°F). For salmonid spawning dissolved oxygen must be above 6 mg/l or exceed 90 percent saturation, whichever is greater, with a maximum daily average water temperature below 9°C (48°F).

Related to the negative impact of excessive algae growth in water is the impact of turbidity. Turbidity is a cloudiness of the water caused by suspended solids or sediments. As with algae growth, turbidity detracts from the visual enjoyment of the water body. Suspended solids greatly reduce the amount of sunlight needed to produce the instream vegetative matter used by macroinvertebrates. Consequently, there is a reduction of lower-level organisms and a reduction in available fish, especially of the salmonid family. Suspended materials settle out on the stream bottom in areas of reduced flows such as pools, backwaters, and in-between gravels. This causes fish spawning redds to be covered by sediments, which in turn suffocates the developing fry. Additionally, the sediments fill in gravel areas on the stream bottom which are hiding and reproduction areas for macroinvertebrates. This directly reduces the numbers and kinds of food salmonids

feed upon. Other minor impacts caused by sediments include gill abrasion, increased stress, and lack of feeding caused by an inability to see the target food.

Idaho water quality requirements contain three different standards for fecal coliform levels in both primary contact and secondary contact waters. A geometric mean limits actual count to 200 colonies per 100 milliliter (ml) sample for secondary contact recreation such as water skiing and 50/100 ml for primary contact recreation such as swimming. In addition, primary contact waters are not to have actual counts more than 500 colonies per 100 ml at any one time, nor can they contain 200 colonies per 100 ml in more than 10 percent of the samples taken over a 30-day period. Secondary contact waters are not to have actual counts more than 800 colonies per 100 ml at any time, and no more than 400 colonies per 100 ml in 10 percent of the samples taken over a 30-day period.

Water used for domestic water supplies have standards generally relating to man-caused contaminants. Most of these are positively-charged cations. These cations and the anions cyanide, fluoride, and nitrate with their maximum allowable concentrations in mg/l are:

Arsenic	0.05	Barium	1.00
Cadmium	0.01	Chromium	0.05
Cyanide	0.20	Fluoride	1.40 - 2.40
Lead	0.05	Mercury	0.002
Nitrate	10.00	Selenium	0.01
Silver	0.05		

Similarly, standards in mg/l have been established for the following pesticides in open water bodies:

Endrin	0.0002	Lindane	0.004
Methoxychlor	0.10	Toxaphene	0.005
Trihalomethane	0.10	2,4-D	0.10
2,4,5-TP silvex	0.01		

As part of a regulations program, about 50 additional pesticides can be monitored in drinking water after it leaves a treatment plant or moves into a distribution system. Regulatory control is not currently set by specific maximum allowable concentrations but by general control criteria. In addition, groundwater used for public drinking supplies shall not exceed the following standards in mg/l. If these standards are exceeded, new water delivery systems must treat the water to reduce these chemicals:

Copper	1.00	Chloride	250.00
Hydrogen sulfide	0.05	Iron	0.30
Manganese	0.05	Sulfate	250.00
Zinc	5.00	Alkyl benzene sulfonate (ABS - plastic)	0.50
Phenols	0.0001		
Benzene	0.005	Vinyl chloride	0.002
Carbon tetrachloride	0.005		
Total dissolved solids	500		
Temperature	80°F		
Color	15 units		
Odor	3 units		
General bacteria	500/ml		

A maximum ground-water source turbidity standard, regardless of treatment, has been established at five nephelometric turbidity units. New requirements on coliform bacteria have been adopted by the Federal Government. The new requirements state the ground-water source shall contain no coliform bacteria. Treatment will be required on any public drinking water source having coliform contamination.

Maximum contamination levels have also been established for specific radioactive chemicals and radioactive particles in drinking water systems. On the Island Park plateau, outside the Caldera area, and along the Big Hole Mountains, and in other areas over felsic (rhyolite) material, the potential

exists for the occurrence of radium-226 in groundwater. Only community water systems are now sampled for this hazard. Community systems in general are not located in these areas. Individual wells located in areas with rhyolitic bedrock should be tested for radium.

Nonpoint Source Pollution

Both surface water and groundwater quality control has centered on controlling "point source" discharges, such as from a municipality or an industrial plant. Nonpoint source pollution comes from many sources and is carried into the stream by runoff.Primary nonpoint source impacts to water quality in the Henrys Fork watershed are from agricultural activities including irrigated crop production, pastureland, rangeland and minimal amounts of non-irrigated crop production. There are additional impacts from forest practices, on-site wastewater systems, channelization, riparian vegetation removal, streambank modification and flow modification (IDHW, 1988). Cold water biota and salmonid spawning are only partially supported in many of the tributaries to the Henrys Fork and Henrys Lake Outlet. In the Henrys Fork below St. Anthony primary and secondary contact recreation are potentially at risk. The primary pollutants are sediment from agricultural activities and hydrologic/habitat modifications, nutrients and bacteria from agricultural activities, and wastewater systems.

The Teton River watershed, above its divergence, is impacted by irrigated and non-irrigated crop production, rangeland activities, channelization, dam construction and riparian vegetation removal. Tributaries to the Teton are impacted by pastureland, flow modification, riparian vegetation removal and streambank modification. From Trail Creek to Highway 33, the Teton River and its tributaries, only partially support cold water biota and salmonid spawning. From Bitch Creek to the Teton damsite cold water biota and salmonid spawning are either not supported or only partially supported. Primary and secondary contact recreation are potentially at risk. The primary pollutant in the Teton River is sediment from agricultural impacts and hydrologic modification. Additional problems are thermal modification and flow alteration.

Agricultural impacts from irrigated crop production, pastureland and rangeland are the primary sources of nonpoint source pollution after the Teton River diverges into its North and South Forks. Non-irrigated crop production and some animal holding areas contribute additional nonpoint source impacts, primarily from channelization of streams. The primary pollutants from nonpoint source activities are nutrients, sediment and bacteria from agriculture. Cold water biota and salmonid spawning are only partially supported in this river segment. Primary and secondary contact recreation are potentially at risk.

Shallow aquifers in the lower Henrys Fork and in the Teton Valley are of special concern because of the considerable use of the aquifer for drinking water, the shallow depth to water, the application of significant amounts of chemicals and the relatively porous nature of the subsoil.

A number of new regulations have been adopted on nonpoint source discharges. Among those which have an impact on the Henrys Basin are the Forest Practices Act (Title 38, Chapter 13, Idaho Code), and the Idaho Surface Mining Act (Title 47, Chapter 14, Idaho Code).

Specific Water Bodies

Island Park Reservoir - In 1981 water quality was impaired somewhat by algal blooms and occasional high fecal coliform bacteria counts. Algae blooms provide conditions which aggravate ammonia toxicity; excessive algae decomposition depletes dissolved oxygen below the stratified zone.

Island Park Reservoir has a relatively shallow depth (generally less than 50 feet) with little stratification because of wind action during the ice-free months.

Algae blooms in Island Park Reservoir are stimulated in the summer by a natural occurring phosphorus concentration of 0.04 mg/l. A USBR study suggests, septic tank drainage from recreation areas does not contribute significantly to reservoir phosphorous loading (Zimmer, 1981). The dissolved orthophosphorous (non-biological in origin) concentration was exceptionally high (0.60 mg/l) in springs emerging from both developed and undeveloped shorelines. Ground-water flows and bank storage thus appear to play a dominant role in the phosphorous dynamics of the reservoir.

The occasional high counts of fecal coliform bacteria may originate with livestock operations or inadequately treated sewage at recreation facilities in the area. The installation of adequate sewage treatment facilities will hopefully solve this problem.

Henrys Lake - The lake is less than 30 feet deep so there is little temperature stratification during the ice-free period, largely because of wind action. Reduced oxygen levels occur with depth due to decomposing aquatic vegetation in the fall. Once ice covered, dissolved oxygen levels may be very low. Efforts are underway through a state Clean Lakes Project to address water quality problems. The Yellowstone Soil Conservation District will address the impacts of erosion on private agricultural land bordering the lake and its tributaries. Fremont County and the Division of Environmental Quality are assessing the impact of septic tanks on the lake.

Henrys Fork and Tributaries - Water quality of the Henrys Fork and major tributaries is high when sampled above irrigated agricultural areas. Temperatures are cold enough (less than 66°F) to support coldwater fisheries year-around. Dissolved oxygen has exceeded the 6.0 mg/l minimum for the period of record.

Bacteria counts seldom exceed State standards except for the reach below Macks Inn on the Henrys Fork. Immediately downstream of Macks Inn, total coliform exceeded Idaho standards on all sample dates except one (Holte et al. 1973). Seasonal recreational use of the upper Henrys Fork and subsequent sewage loading lowers water quality to the point of precluding water contact recreation. Much of this area has recently been sewered. Wastes are pumped to a sewage treatment plant. Water quality in the reach should be much improved.

The nutrient content of the Henrys Fork and its tributaries is moderately high. Mineral content increases with progression south through the basin. Nutrient content sharply increases where irrigation return flows enter the streams. Between St. Anthony and Rexburg (23 miles), hardness increases 60 percent, sulfate increases 30 percent, nitrate increases 15 percent and total phosphorous increases 30 percent. Most phosphorous loading to the Henrys Fork is from Island Park Reservoir. Turbidity increases also, but sporadically. Mean turbidity at Rexburg is only slightly above upstream concentrations. Maximum summer temperature does not seem to increase downstream perhaps because downstream reaches are partially recharged with cold groundwater flows below irrigated areas in the lower basin. Summer temperatures are adequate for salmonid rearing throughout the Henrys Fork. Dissolved oxygen is suitable for salmonid rearing throughout the reach although summer lows approach 6.0 mg/l at Rexburg.

In the upper basin nutrient supplies are balanced for good attached benthic algae and aquatic macrophyte growth, but excessive growths do not usually occur in the free-flowing river because of turbulence and low water temperatures. Slowing waters sufficiently will cause algae blooms, particularly where the river is unshaded, wide, and shallow.

Special Resource Waters

Waters of the State may be designated "Special Resource Waters". Special Resource Water designations predate Idaho's anti-degradation legislation, and are aimed primarily at protecting beneficial uses against point source pollutants. Designation recognizes at least one of the following characteristics:

1. The water is of outstandingly high quality, exceeding both the criteria for primary contact recreation and cold water biota; or
2. The water is of unique ecological significance; or
3. The water possesses outstanding recreational or aesthetic qualities; or
4. Intensive protection of the quality of the water is in the paramount interest of the people of Idaho; or
5. The water is a part of the National Wild and Scenic River System, is within a State or National Park or wildlife refuge and is of prime or major importance to that park or refuge.
6. Intensive protection of the quality of the water is necessary to maintain an existing, but jeopardized beneficial use.

In the Henrys Fork basin the general criteria listed above were applied to designate the following rivers and streams as Special Resource Waters:

- Henrys Fork from its source to its mouth
- Buffalo River from its source to its mouth
- Warm River from its source to its mouth
- Falls River from its source to its mouth
- Teton River from its source to the North and South branches.

No new point source can discharge, and no existing point source can increase its discharge, above the design capacity of the existing wastewater treatment facility to any water designated as a Special Resource Water, or to a tributary of or to an upstream segment of a Special Resource Water, if pollutants in that discharge can or will result in a reduction of the water quality of the special resource water. As long as a point source discharge is regulated by an order, decree, compliance schedule, or valid discharge permit, the discharge or facility will not be subject to additional restrictions.

Nonpoint source activities that are being conducted in accordance with rules, regulations, and best management practices, or in the absence of referenced best management practices, conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts, will not be subject to conditions or legal actions. If water quality monitoring and surveillance show that water quality criteria are not being met, or that beneficial uses of special resource waters are being impaired as a result of a nonpoint source activity by itself, or in combination with other point and nonpoint source activities then the Director of the Idaho Department of Health and Welfare may prepare a compliance schedule or institute administrative or civil proceedings.

The following are approved best management practices for the purpose of Idaho Department of Health and Welfare Rules and Regulations:

Idaho Forest Practices Rules
Idaho Department of Health and Welfare Rules Governing Solid Waste Management

Idaho Department of Health and Welfare Rules Governing Subsurface and Individual Sewage Disposal Systems
Rules and Regulations and Minimum Standard for Stream-Channel Alterations as adopted by the Water Resource Board

Stream Segments of Concern

Idaho Executive Order 88-23 provides for designation of Stream Segments of Concern through public nomination and the Water Quality Advisory Working Committee. Designated Stream Segments of Concern will receive priority for water quality management and monitoring by state and federal agencies. A coordinated water quality monitoring program will be implemented to provide current and ongoing data, report on the status of beneficial uses and monitor the effectiveness of Best Management Practices in meeting water quality standards and protecting existing beneficial uses. Designated Stream Segments of Concern in the Henrys Fork basin are:

Henrys Lake
Falls River - Headwaters to Henrys Fork
Warm River - Warm River Springs to Henrys Fork
Robinson Creek - Yellowstone NP to Warm River
Fish Creek - Headwaters to Robinson Creek
Porcupine Creek - Headwaters to Robinson Creek
Rock Creek - Yellowstone NP to Porcupine Creek
Teton River - Headwaters to Bitch Creek

Recommended Action

1. Study the impacts upon the fishery of phosphorous and nitrogen loadings to Henrys Lake, Island Park Reservoir, the Upper Henrys Fork and the Upper Teton River. Studies should consider all sources including livestock. Administrative entities are encouraged to take early action to implement corrective measures.
2. Determine the impact of lessening and of increasing the level of nutrients introduced from ground-water movement to surface water of homesite waste water near the above water bodies.
3. In the lower Henrys Fork basin and in the upper Teton River basin, determine the best method to eliminate or reduce bacteria levels in each rural drinking water well.
4. Determine radium-226 levels in each rural well located in rhyolitic rock areas.
5. In the lower Henrys Fork basin, study the impact of agriculture nitrogen movement into the perched water system and subsequently into the Henrys Fork and Teton River. Similarly, determine the impact of pesticide movement in the water system.
6. To provide control of sheet erosion in sloping cropped land, agricultural agencies should maintain their research and educational programs for improved best management practices.
7. Develop methods to reduce the sediment load of irrigation field and dryland farm runoff to improve fishery resources in the lower Henrys Fork and lower Teton rivers. These methods may enhance aquifer recharge which benefits out-of-basin areas. Tail water pump-back systems may be part of the solution. Cost-share methods of implementation should be developed to carry out this objective.

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Water Supply and Water Conservation

Current Water Supply

Average precipitation varies greatly from less than 10 inches in the lower valley near the mouth of the Henrys Fork, to over 70 inches in the Teton peaks. Precipitation at the higher elevations varies from 25 to 40 inches (Figure 21). Weekly long-term temperature and precipitation data for Ashton, Idaho Falls, and Island Park Dam are in the Appendix. Table 48 is a water budget for the basin based on watermaster records and estimates of other water use. Precipitation averages 24.1 inches over the entire 3,220 square miles of the basin (including the Wyoming portion). This translates into 4,139,000 acre-feet of water.

For the areas covered by watermaster records, consumptive use is 27 percent of diversions. Ground-water recharge is 64 percent of the diversion. Return flows average 9 percent of the diversions. River outflow from the basin averages 1,400,00 acre-feet. The watermaster's records indicate approximately 700,000 acre-feet of diverted water percolate to the subsurface and recharge the groundwater. An additional 500,000 acre-feet are estimated to recharge the aquifer either directly from precipitation or as leakage from surface water. Approximately 200,000 acre-feet of this annual

recharge are pumped and consumptively used within the basin. The remaining precipitation (1,000,000 acre-feet) evaporates or is used by vegetation.

Table 48. Water Budget - Henrys Fork Basin

Drainage Area	3,220 square miles	
Average Precipitation	24.1 inches	4,139,000 ac-ft
Average River Outflow	2,100 cfs	1,407,000 ac-ft
Surface Diversions:		
Madison and Fremont Co.- Watermaster Records		1,100,000 ac-ft
Irrigation Consumption	300,000 ac-ft	
Return Flow	100,000 ac-ft	(100,000 ac-ft)
Ground-water Recharge	700,000 ac-ft	
Other Madison and Fremont Co. Consumption		100,000 ac-ft
Teton County Consumption		100,000 ac-ft
Ground-water Consumption (all counties)		200,000 ac-ft
Natural and Dryland Evapotranspiration plus Ground-water Recharge		1,300,000 ac-ft

Table 49 shows the estimated annual flow based on 1985 conditions at various gages for the low flow year of record, 1934; a recent low flow year, 1977; the average flow, and for a high flow year, 1984. Graphs of maximum, average, and minimum daily flow for two stations on the lower Henrys Fork and Teton Rivers are also presented (Figure 22). These graphs show the extreme variation in flow throughout the year. A bar-chart of annual flows for the Henrys Fork near Rexburg shows a great variability from the 1,400,000 acre-feet average. The yearly surface outflow varies from 600,000 to 3,000,000 acre-feet. Gages at Ashton and on the Teton River at St. Anthony do not show comparable variability. River diversions are fairly constant (Figure 23). Water storage in the basin is provided by the reservoirs listed in Table 50.

Table 49. Annual Flows (Adjusted to 1985 Development Levels)

	(1000 acre-feet)			
	1934	1977	Average	1984
Henrys Fork near Lake	33	37	39	82
Henrys Fork below Island Park	290	460	429	785
Falls River near Squirrel	357	385	564	831
Henrys Fork near Ashton	722	1087	1068	1714
Teton River above damsite	289	338	561	921
Teton River near St. Anthony	320	356	575	931
Henrys Fork near Rexburg	436	1019	1407	3001

There is some storage on the Henrys Fork, although, Henrys Lake Reservoir is located so high in the headwater area that the average runoff into the reservoir is only about 40,000 acre-feet. Island Park, Grassy Lake and Sheridan reservoirs generally fill even if emptied the previous year. The reservoirs owned by the Idaho Department of Fish and Game are used for fish and wildlife purposes so storage water generally is not released. For the Teton River drainage there is no storage, while for the similar-sized Falls River there is only minor storage available.

Table 50. Water Storage Reservoirs in the Henrys Fork Basin

Storage Reservoir	Owner	Built	Active Capacity in Acre-Feet	Stream
Island Park	USBR	1938	127,000	Henrys Fork
Henrys Lake	Private	1923	90,000	Henrys Fork
Grassy Lake (Wyoming)	USBR	1939	15,000	Falls R. Trib.
Sheridan	Private	1947	3,398	Sheridan Cr.
Silver Lake	IDPR	1915	2,548	Thurman Cr.
Lower Arcadia	Private	1912	882	Sand Cr. Trib.
Blue Cr. #4	IDPR	1960	390	Sand Cr. Trib.
Golden Lake	IDFG	1915	360	Thurman Cr.
Upper Arcadia	Private	1912	300	Sand Cr. Trib.
Bergman (Wyoming)	Private	1953	201	Squirrel Cr. Trib.
Blue Cr. #3	IDFG	1965	168	Sand Cr. Trib.
Upper Blue Cr.	IDFG	1950	166	Sand Cr. Trib.
Upper Mikesell	Private	1945	130	Sand Cr. Trib.
Blue Cr. #2	IDFG	1940	77	Sand Cr. Trib.
Lower Mikesell	Private	1940	70	Sand Cr. Trib.
Blue Cr. #1	IDFG	1977	56	Sand Cr. Trib
TOTAL			230,000 AF	

In order to better understand the low percentage of consumptive use in the basin (27 percent of diversions) a canal-by-canal listing of water diversion, use, and groundwater recharge is provided in Table 51 for a full water supply year, 1986, while Table 52 illustrates a poor water year, 1977. Figure 24 is a schematic of the basin's canal system. Irrigated land is broken down into three water supply sources. A summary of water use is shown in Table 53.

A great deal of water is diverted from the Henrys Fork. Diversion is 16.6 acre-feet per acre (662,000 acre-feet) in a good water year and 9.5 acre-feet per acre (383,150 acre-feet) in a very poor water year. The historic method of irrigation in this area has been by subirrigation. Several of the canals have some water in them year-round. This water almost entirely moves into and raises the perched ground-water level. Since 1939 Island Park Reservoir has filled so the winter nonirrigation season release of water for groundwater recharge almost without exception has not influenced the filling of the reservoir. See Figure 25 for a view of variability of the diversions by month and the amount of winter diversions.

On the Egin Bench on the north side of the Henrys Fork, the regional water table varies from 40 feet deep at Plano to 100 feet deep at Parker. Figure 26 shows the current irrigation method and change from 1966 when virtually the entire area was subirrigated. On the south side of the Henrys Fork, changes are being made in irrigation methods, but at a slower rate. Subirrigation on the south side of the river appears to be incidental to flood irrigation. The geologic section (Figure 27) of the Lower Henrys Fork Valley shows high summer water levels for the Sugar City-Hibbard area. The levels may no longer be as high because of a major shift to sprinkler use in the area.

Figure 21:
Precipitation Contours

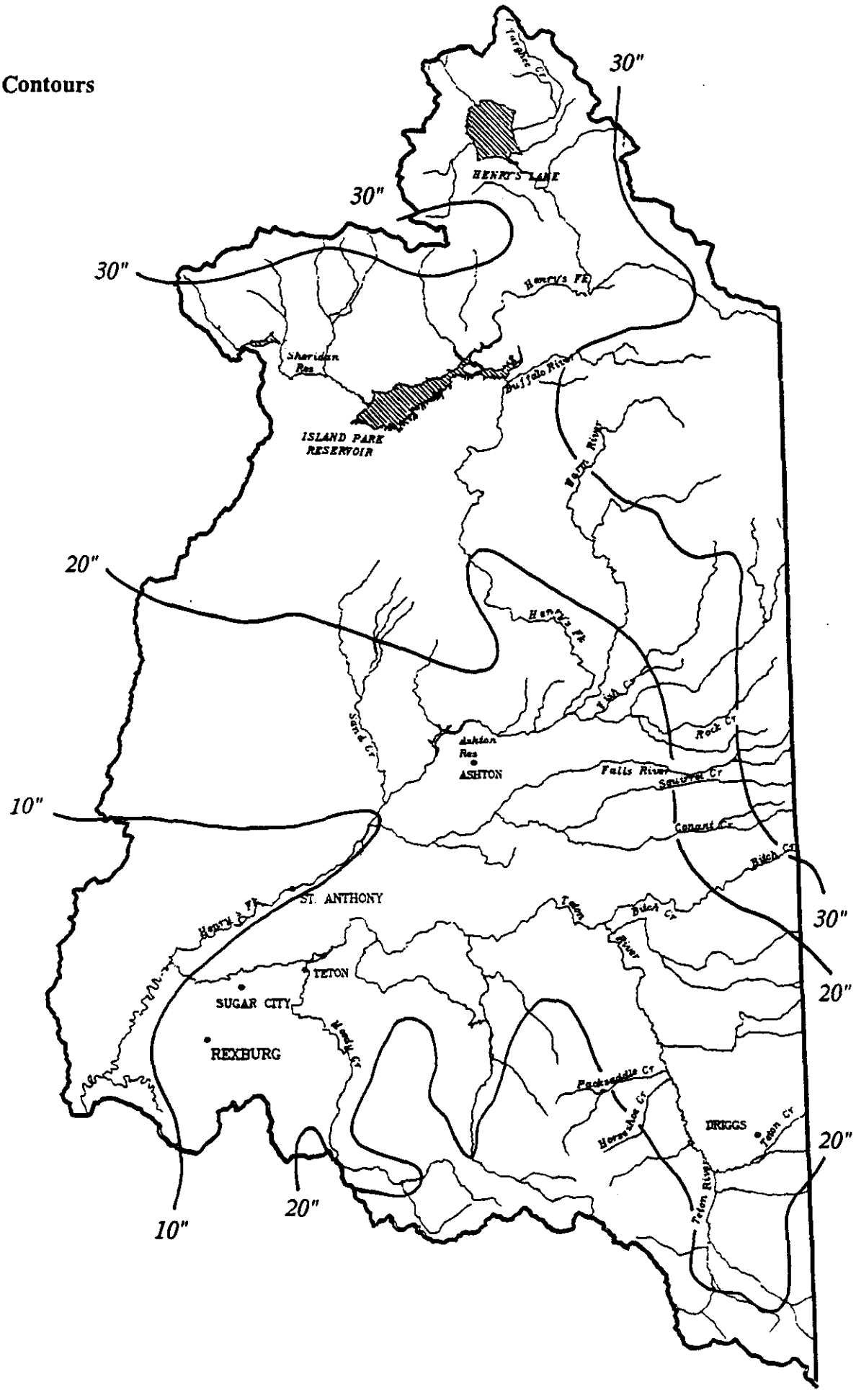
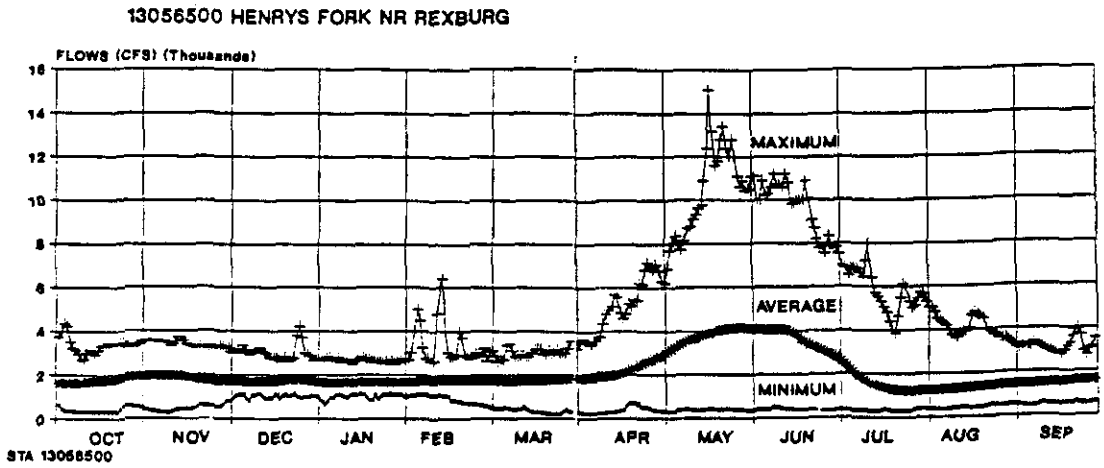


Figure 22:
Annual Discharge - Henrys Fork



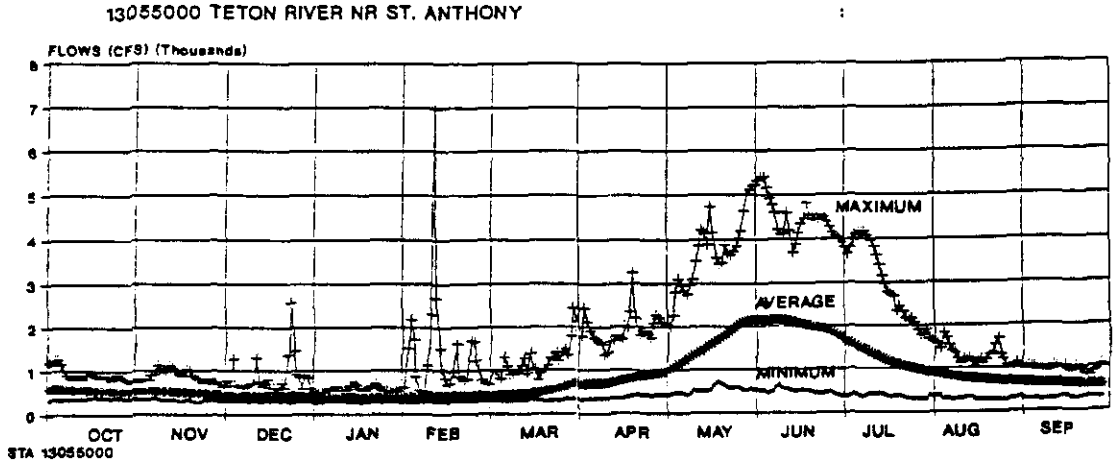
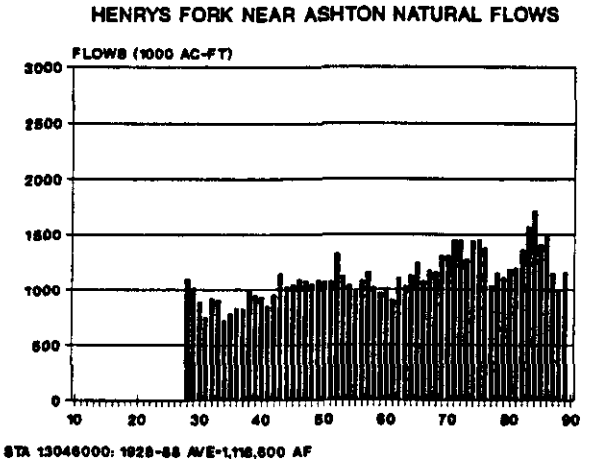
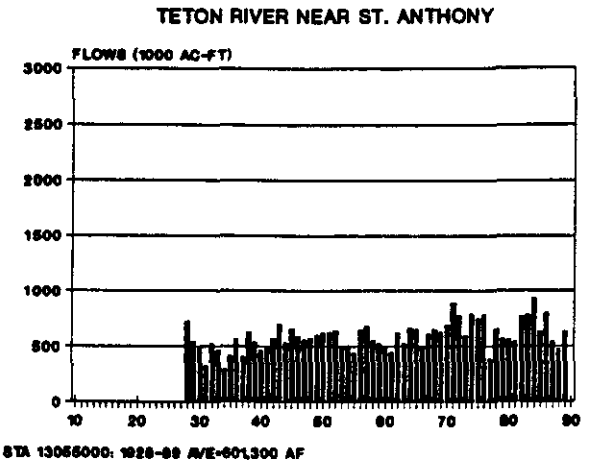
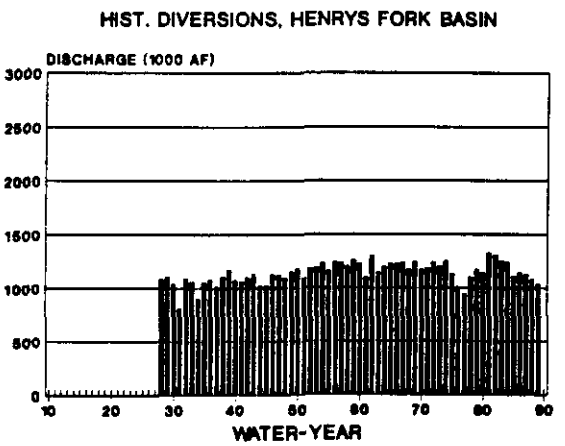


Figure 23:
Discharge and Diversions - Henrys Fork







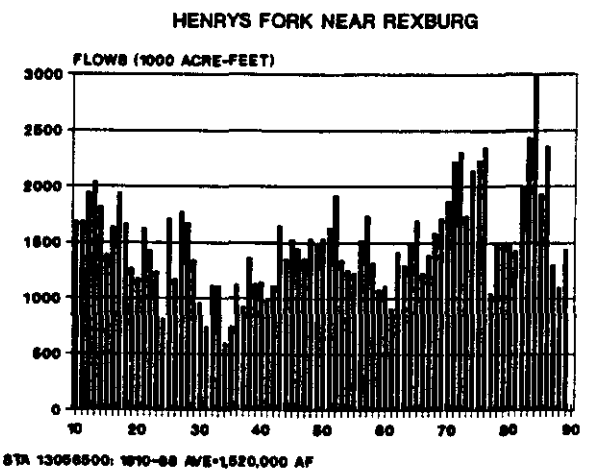


Table 51. Canal Records - 1986

Name	Recorded Acres	Calculated Acres*	Diversion Ac-ft	Ac-ft/Ac	% Return Flow	Return Flow Ac-ft/Ac	Consumptive Use Ac-ft/Ac	Groundwater Recharge Ac-ft/Ac	Total Recharge Ac-ft
Dewey	1,200		6,700	5.6	5	0.3	2.1	3.2	3800
Last Chance	1,860	2,630	27,300	10.4	10	1.0	2.1	7.2	19,000
Farmers Friend	3,025	2,250	44,300	19.7	14	2.8	2.1	14.8	33,400
Twin Groves	2,500	2,420	34,700	14.3	10	1.4	2.1	10.8	26,100
St. Anthony Union	9,700		161,400	16.6	10	1.7	2.1	12.9	124,900
Salem Union	5,500	4,367	64,300	14.7	8	1.2	2.1	11.4	50,000
Egin	7,000	6,030	109,300	18.1	10	1.8	2.1	14.2	85,700
St. Anthony U. Feeder	2,300		28,700	12.5	10	1.2	2.1	9.1	21,000
Independent	6,000	6,525	106,500	16.3	3	0.5	2.1	13.7	89,600
Consolidated Farmers	6,000	2,432	78,800	>12.5	6	0.8	2.1	9.6	23,300
Subtotal	45,085	39,854	662,000						476,800
Falls River									
Yellowstone	2,100		3,136	1.5	0	0.0	2.1	0.0	0
Marysville	16,000		30,300	1.9	0	0.0	2.1	0.0	0
Farmers Own	5,800		18,900	3.3	5	0.2	2.1	1.0	5800
Conant Creek	1,680		3,463	2.1	0	0.0	2.1	0.0	0
Boom Creek	2,180		512	0.2	0	0.0	2.1	0.0	0
Squirrel Creek	1,165		2,158	1.9	0	0.0	2.1	0.0	0
Orme			123		0		2.1		
Enterprise	5,890	1,340	20,000	14.9	10	1.5	2.1	11.3	15,200
Fall River	9,000	6,780	86,800	12.8	14	1.8	2.1	8.9	60,400
Chester	1,400	1,240	15,100	12.2	5	0.6	2.1	9.5	11,700
McBee	125		500	4.0	5	0.2	2.1	1.7	200
Silkey	1,080		4,748	4.4	5	0.2	2.1	2.1	2200
Curr	1,300		17,200	13.2	10	1.3	2.1	9.8	12,800
Subtotal	47,720	40,790	202,940						108,300
Lower Teton River									
Canyon Creek	2,200		5,845	2.7	0	0.0	2.1	0.6	1200
Wilford	2,630	2,005	42,200	21.0	17	3.6	2.1	15.4	30,800
Teton Irrigation	2,500	2,954	23,100	7.8	39	3.0	2.1	2.7	7900
Siddoway	240		1,388	5.8	5	0.3	2.1	3.4	800
Pioneer	300		2,860	9.5	5	0.5	2.1	7.0	2100
Stewart	480		3,543	7.4	5	0.4	2.1	4.9	2400
Pincock-Byington	260	243	2,817	11.6	0	0.0	2.1	9.5	2300
Teton Island Feeder	10,400		121,700	11.7	11	1.3	2.1	8.3	86,500
North Salem	450		1,972	4.4	5	0.2	2.1	2.1	900
Roxana	880	665	5,006	7.5	5	0.4	2.1	5.1	3400
Island Ward	3,300	4,493	7,817	>12.5	6	0.8	2.1	9.6	43,100
Saurey-Sommers	275	289	4,046	14.0	10	1.4	2.1	10.5	3000
McCormick-Rowe	160		345	2.2	0	0.0	2.1	0.1	0
Pincock-Garner	480	370	1,999	5.4	0	0.0	2.1	3.3	1200
Bigler Slough	240	180	1,115	6.2	0	0.0	2.1	4.1	700
Woodmansee-Johnson	1,320	1,295	2,462	1.9	10	0.2	2.1	0.0	0
City of Rexburg	950	250	5,546	22.2	9	2.0	2.1	18.1	4500
Rexburg Irrigation	5,280	5,655	54,500	9.6	5	0.0	2.1	7.5	42,600
Subtotal	32,345	32,639	288,261						233,400
Total	125,150	113,283	1,153,201						818,500

* See Wytzes. Further mapping review needs to be made of the Consolidated Farmers system.
> Average of Consolidated Farmers and Island Ward (dual operation)

Table 52. Canal Records - 1977

Name	Recorded Acres	Calculated Acres*	Diversion Ac-ft	Ac-ft/Ac	% Return Flow	Return Flow Ac-ft/Ac	Consumptive Use Ac-ft/Ac	Groundwater Recharge Ac-ft/Ac	Total Recharge Ac-ft
Dewey	1,200		2,360	2.0	5	0.1	2.1	0.0	0
Last Chance	1,860	2,630	12,850	4.9	10	0.5	2.1	2.3	6000
Farmers Friend	3,025	2,250	8,650	3.8	14	0.5	2.1	1.2	2700
Twin Groves	2,500	2,420	17,830	7.4	10	0.7	2.1	4.5	11,000
St. Anthony Union	9,700		115,370	11.9	10	1.2	2.1	8.6	83,500
Salem Union	5,500	4,367	41,250	9.4	8	0.8	2.1	6.6	28,800
Egin	7,000	6,030	80,360	13.3	10	1.3	2.1	9.9	59,700
St. Anthony U. Feeder	2,300		29,210	12.7	10	1.3	2.1	9.3	21,500
Independent	6,000	6,525	28,000	4.3	3	0.1	2.1	2.1	13,500
Consolidated Farmers	6,000	2,432	47,270	>7.3	6	0.4	2.1	4.8	11,700
Subtotal	45,085	39,854	383,150						238,400
Falls River									
Yellowstone	2,100		1,468	0.7	0	0.0	2.1	0.0	0
Marysville	16,000		24,240	1.5	0	0.0	2.1	0.0	0
Farmers Own	5,800		11,590	2.0	5	0.1	2.1	0.0	0
Conant Creek	1,680		2,696	1.6	0	0.0	2.1	0.0	0
Boom Creek	2,180		890	0.4	0	0.0	2.1	0.0	0
Squirrel Creek	1,165		1,092	0.9	0	0.0	2.1	0.0	0
Orme			123		0		2.1		
Enterprise	5,890	1,340	20,100	15.0	10	1.5	2.1	11.4	15,300
Fall River	9,000	6,780	66,800	9.9	14	1.4	2.1	6.4	43,200
Chester	1,400	1,240	4,890	3.9	5	0.2	2.1	1.6	2000
McBee	125		61	0.5	5	0.0	2.1	0.0	0
Silkey	1,080		3,650	3.4	5	0.2	2.1	1.1	1200
Curr	1,300		9,840	7.6	10	0.8	2.1	4.7	6100
Subtotal	47,720	40,790	147,317						67,800
Lower Teton River									
Canyon Creek	2,200		1,590	0.7	0	0.0	2.1	0.0	0
Wilford	2,630	2,005	14,960	7.5	17	1.3	2.1	4.1	8200
Teton Irrigation	2,500	2,954	18,140	6.1	39	2.4	2.1	1.6	4900
Siddoway	240			0.0	5	0.0	2.1	0.0	0
Pioneer	300		282	0.9	5	0.0	2.1	0.0	0
Stewart	480		930	1.9	5	0.1	2.1	0.0	0
Pincock-Byington	260	243	1,154	4.7	0	0.0	2.1	2.6	600
Teton Island Feeder	10,400		55,690	5.4	11	0.6	2.1	2.7	27,700
North Salem	450		48	0.1	5	0.0	2.1	0.0	0
Roxana	880	665	2,610	3.9	5	0.2	2.1	1.6	1100
Island Ward	3,300	4,493	3,130	>7.3	6	0.4	2.1	4.8	21,600
Saurey-Sommers	275	289	3,090	10.7	10	1.1	2.1	7.5	2200
McCormick-Rowe	160		103	0.6	0	0.0	2.1	0.0	0
Pincock-Garner	480	370	958	2.6	0	0.0	2.1	0.5	200
Bigler Slough	240	180	80	0.4	0	0.0	2.1	0.0	0
Woodmansee-Johnson	1,320	1,295	1,610	1.2	10	0.1	2.1	0.0	0
City of Rexburg	950	250	2,450	9.8	9	0.9	2.1	6.8	1700
Rexburg Irrigation	5,280	5,655	39,310	6.9	5	0.0	2.1	4.8	27,400
Subtotal	32,345	32,639	146,135						95,600
Total	125,150	113,283	676,602						401,800

* See Wytzes. Further mapping review needs to be made of the Consolidated Farmers system.
> Average of Consolidated Farmers and Island Ward (dual operation)

Figure 24:
Storage and Diversion Schematic - Henrys Fork Basin

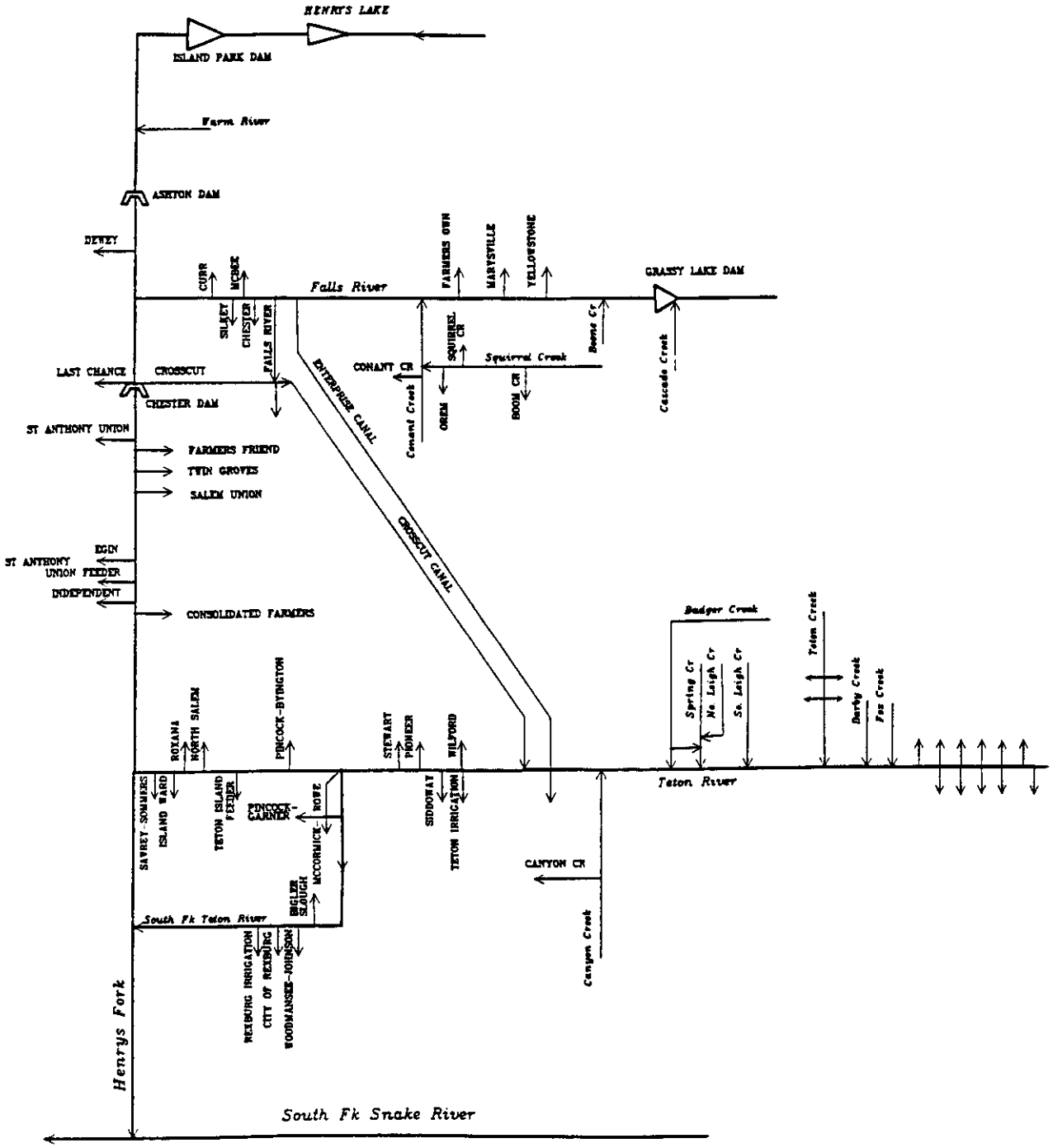
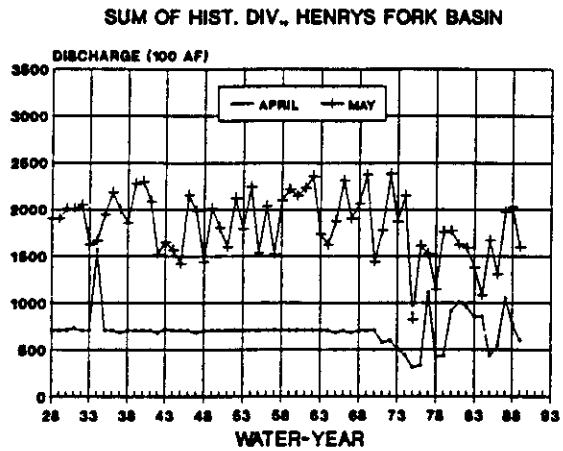
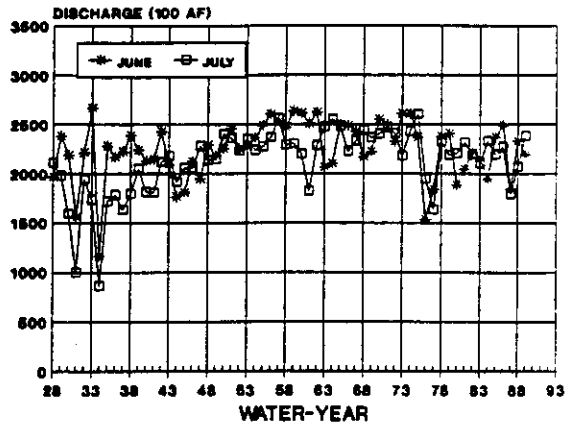
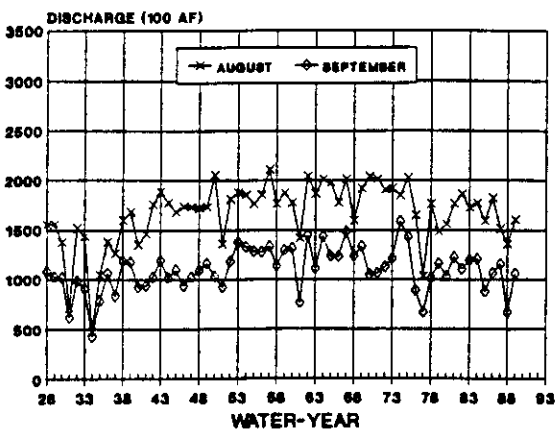


Figure 25:
Diversions - Henrys Fork Basin







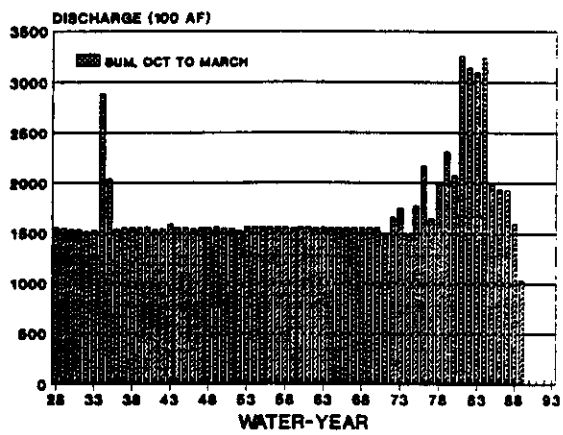


Figure 26. Egin Bench Irrigation Methods

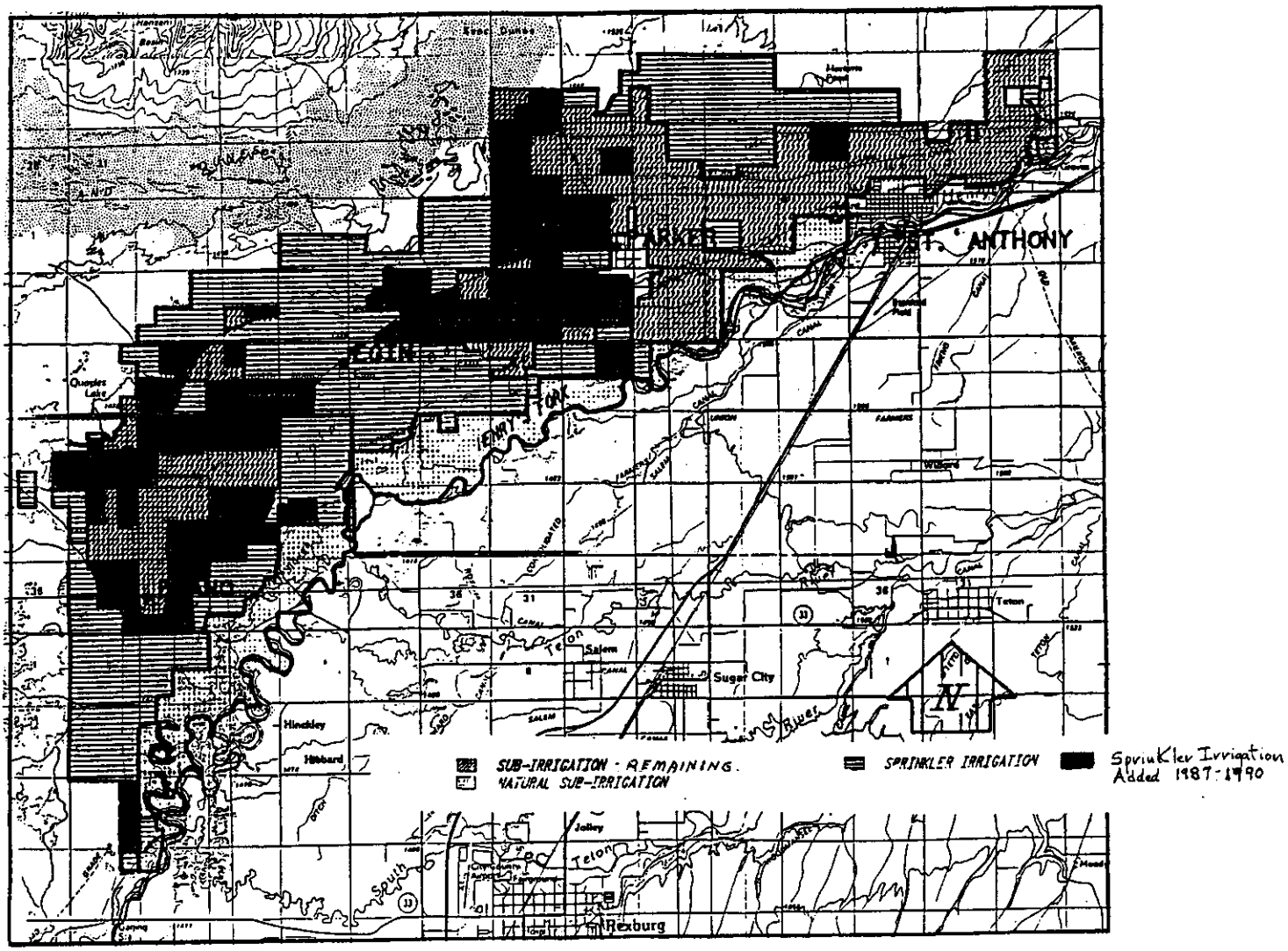


Table 53. Water Use Summary

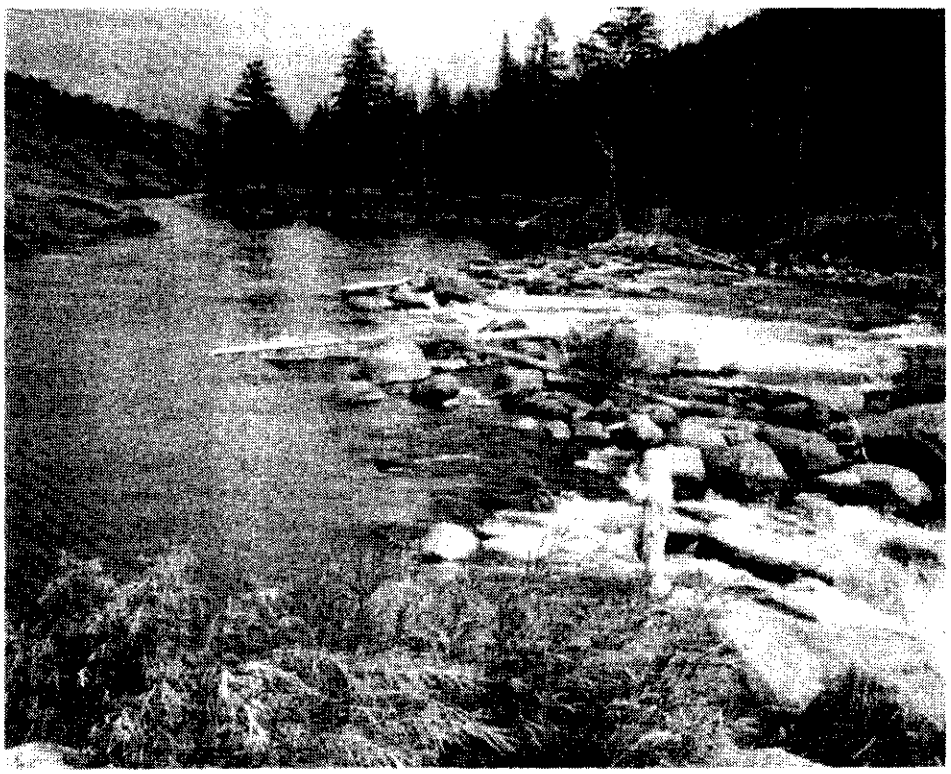
1986	Acres	Diversions/AC	Return Flow	Consumptive* Use	Groundwater Recharge
Falls River	40,800	5.0	0.7	2.1	2.7
Teton River	32,600	8.8	1.2	2.1	6.2
Henrys Fork	39,900	16.6	1.4	2.1	13.1
1977					
Falls River	40,800	4.0	0.4	1.9	2.0
Teton River	32,639	4.8	0.6	1.9	2.5
Henrys Fork	39,900	9.5	0.8	1.9	6.8

* Some areas used less, so the average will be less than indicated amount

In 1987 the Department of Water Resources did a study of irrigation on the Egin Bench; the mapping was recently updated. The 1987 study identified 27,600 acres under cultivation in the upper bench area. The acreage by irrigation method by year was:

	Sprinkler Irrigation	Natural Subirrigation	Subirrigation
1966	200	24,700	2,700
1987	9,600	15,300	2,700
1990	16,000	8,900	2,700

The recent rapid change in irrigation method is due to better potato yields and grade with sprinkler irrigation. At the current rate of change, it appears that nearly all subirrigated land other than natural subirrigated land will be changed to sprinkler irrigation within a few years.



Yellowstone Diversion on the Falls River.

If subirrigation were eliminated, the per acre use would drop to approximately 5.0 acre-feet. For a short water year, such as 1977, there would be 4.5 acre-feet per acre water savings. Somewhere on the order of 112,000 acre-feet (24,900 acres x 4.5) would have been available for other users.

In some cases, water diversions to field perimeter ditches continue year-round, and contribute to the large per-acre use of water. If not diverted to the field perimeter ditches natural flow would be available to the next junior water right holder. During the nonirrigation season and early spring runoff period, water not diverted would be stored (on-paper) in one of the following reservoirs listed in order of priority: Henrys Lake, American Falls, Island Park, or by exchange Palisades--if American Falls fills.

Ground Water

The valley portions of this study area generally yield relatively high amounts of groundwater. These are the areas that generally are presently irrigated. In the Teton Valley the depth to groundwater in many areas is 50 feet or less. Downriver from St. Anthony the regional water table depth decreases from about 100 feet to 50 feet between Egin and Sugar City, and approaches zero near the mouth of the Henrys Fork. Depth to groundwater beneath the adjacent bench-land areas is of course proportionally deeper. The perched water table in the valley down river from St. Anthony and in the Ashton area may approach the surface (see Figure 28).

Irrigation in the Ashton-Marysville area and downriver about six miles appears to have created perched water at less than 50 feet in many places. Basalts underlying the St. Anthony-Rexburg area and the area south of the Teton River are relatively porous and have good water yield potential.

South of the Falls River, in the Grainville-Squirrel-Lamont area, the bedrock appears to consist of rhyolite, a silicic volcanic material. These rocks contain large amounts of quartz ($SiO_2 > 65\%$), and are much less porous than basalts. This same rock type nearly outcrops on the benches north and south of the Teton River in the Canyon Creek area. These areas, generally, have poor groundwater yields.

Further localized and detailed study is needed of potential groundwater sources on the south side of the Henrys Fork. Significant groundwater studies have been done of the irrigated valley area below St. Anthony, and of the Teton Valley bottomlands. Likewise, north of the Henrys Fork the depth to groundwater is generally known. In parts of the rangeland area of the basin pumping levels may be high by today's standard. The rangeland aquifer is generally a high-yielding basalt rock. In the sand dune area the subsurface geology is basalt.

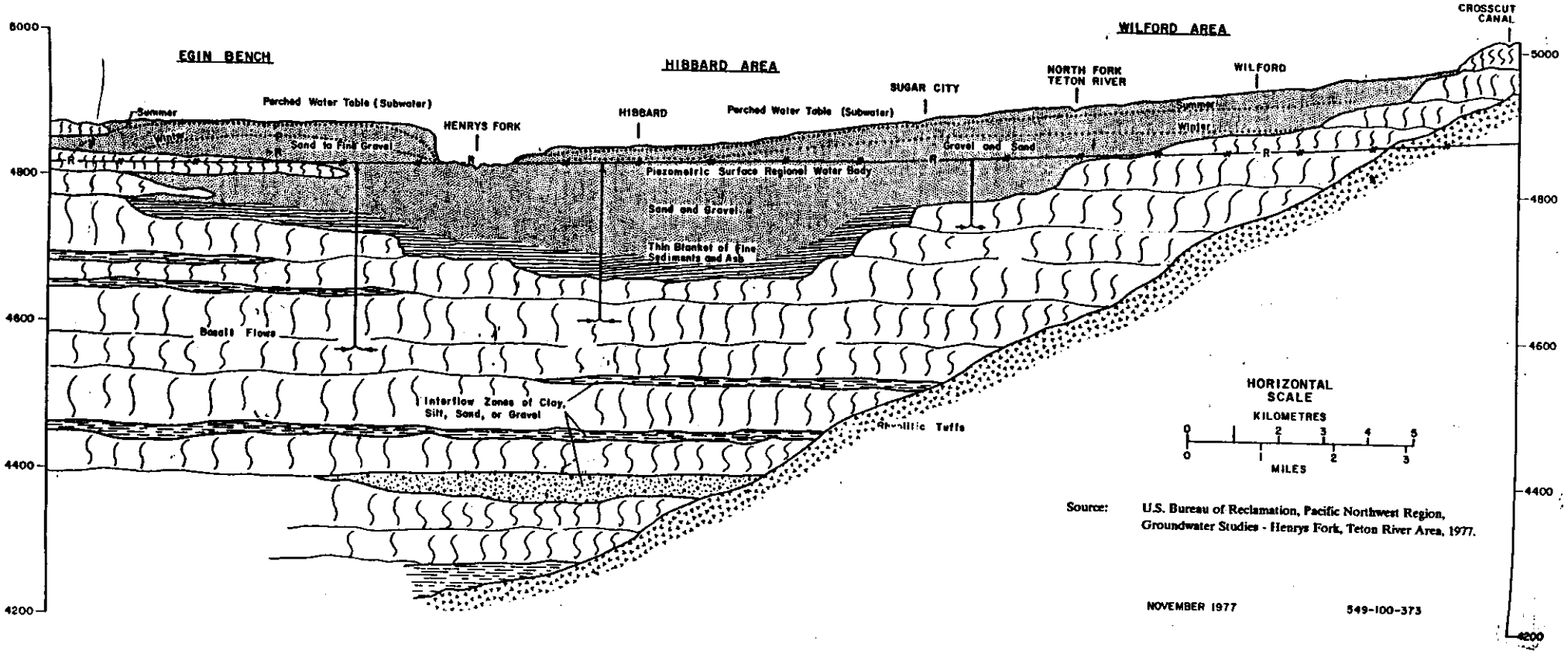
See Figures 29 and 30 for the depth to groundwater. (Note: Figure 30 generally shows deeper depths to the regional water table in the lower Henrys Fork bottom lands than the general area map for the first encounter with water. Regional water may be 100 feet deeper than the first water encountered.)

Minimum Stream Flows

A state designated minimum stream flow has been established for reaches of the Henrys Fork, the Warm River, Teton River, and Bitch Creek (see Table 54).

An application for a 140 cfs minimum instream flow on Falls River, from Highway 32 to the mouth, was withdrawn in 1985 after a local information meeting. In general, these stream flows are the minimum flow required to sustain the fishery. The summer flow established for the Henrys Fork

Figure 27:
Geological Section - Henrys Fork Valley



Source: U.S. Bureau of Reclamation, Pacific Northwest Region, Groundwater Studies - Henrys Fork, Teton River Area, 1977.

NOVEMBER 1977

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Figure 28:
Perched Water Tables - Lower Henrys Fork

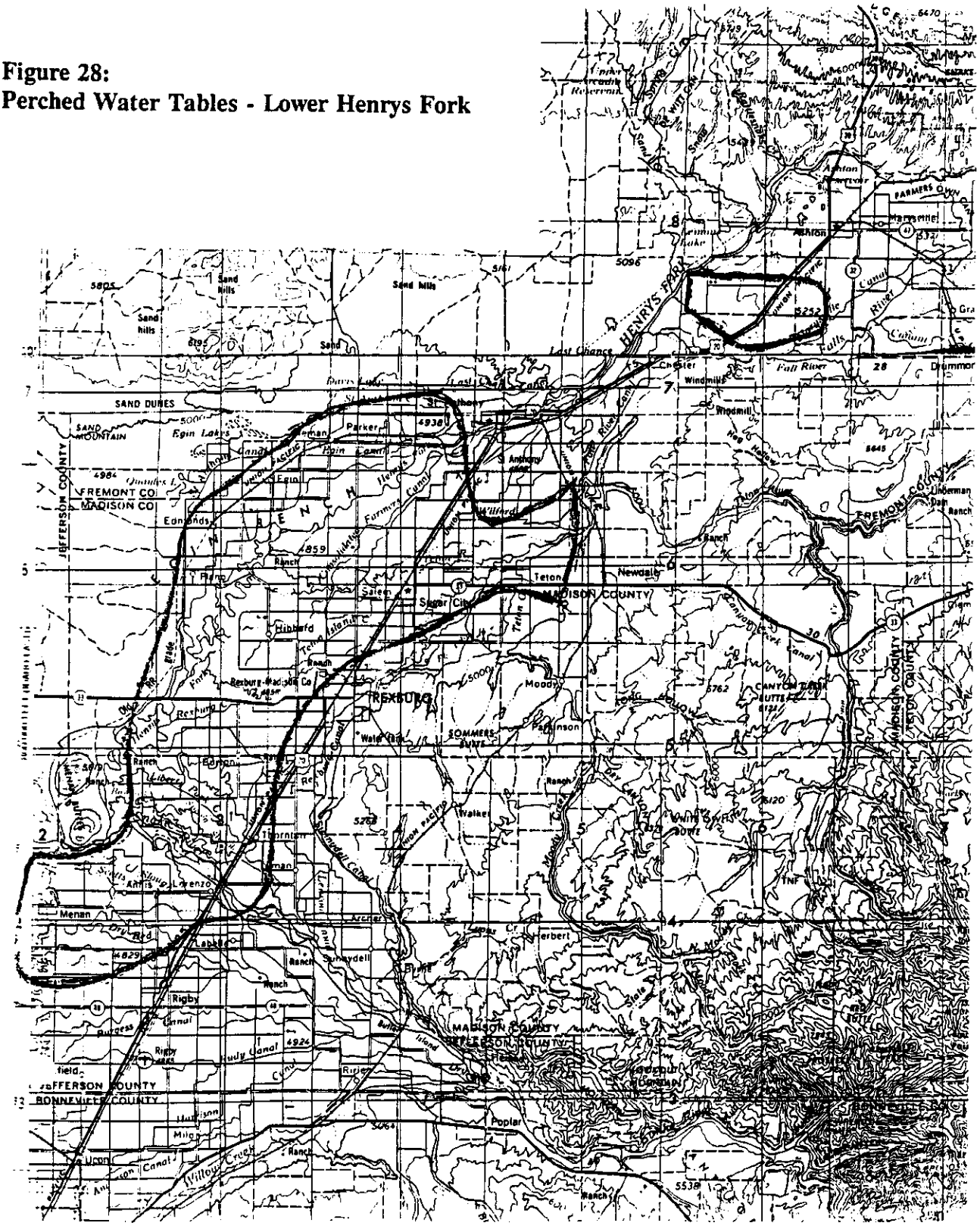
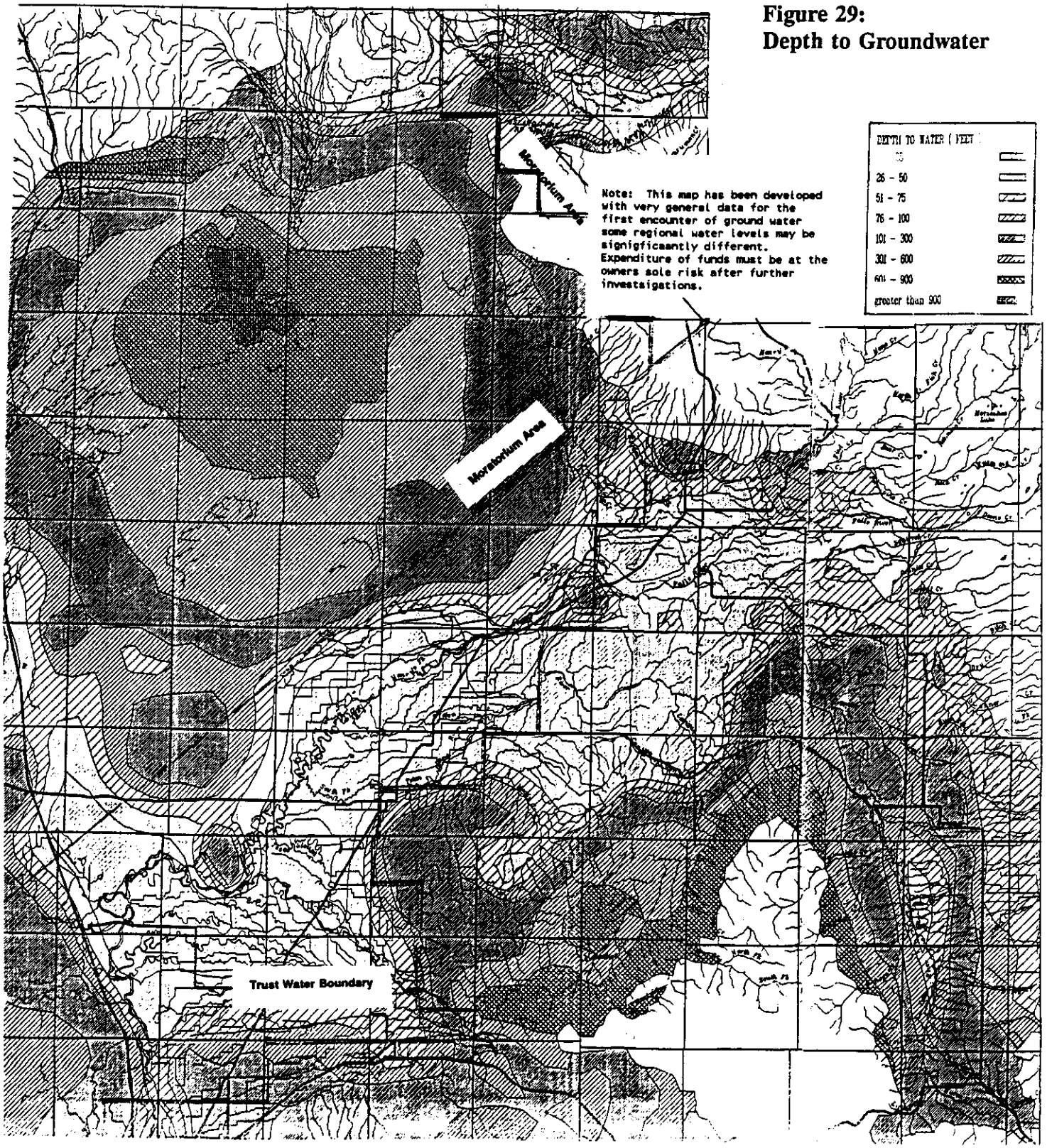
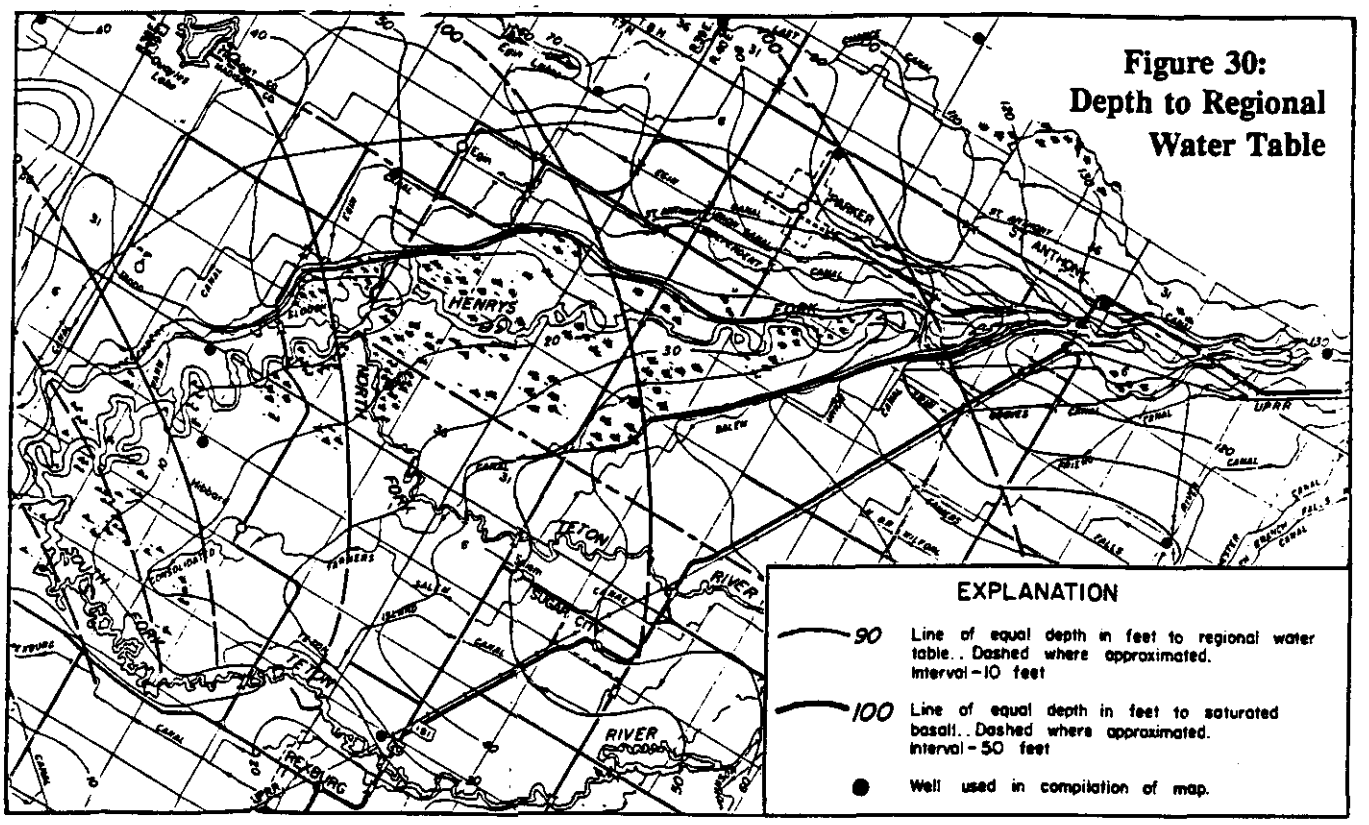


Figure 29: Depth to Groundwater





Source: Ham, Herbert, U.S. Bureau of Reclamation, Teton Basin Project, 1968.

is tied to the recent historical flow of this stream and is provided largely for aesthetic and recreational purposes, including flow over Upper and Lower Mesa Falls and through Harriman State Park.

Table 54. Minimum Stream Flows - Henrys Fork Basin

Stream	Priority Date	Amount	Dates	River Area
Henrys Fork	9-23-81	300 cfs 1000 cfs	10-1 to 3-31 4-1 to 9-30	One mile above Upper Mesa Falls to one mile below Lower Mesa Falls (2 miles)
Henrys Fork	9-23-81	300 cfs	1-1 to 12-31	The mouth of the Buffalo River (one mile below Island Park Dam) to one mile above Upper Mesa Falls (about 24 miles)
Warm River	11-20-85	141 cfs	1-1 to 12-31	Warm River Springs to mouth (about 8 miles)
Teton River	11-21-85	106 cfs	1-1 to 12-31	Highway 33 to confluence with Bitch Creek (about 9 miles)
Bitch Creek	11-21-85	28 cfs	1-1 to 12-31	Highway 32 to mouth (about 7.5 miles)

Potential Water Supplies

1. Surface Water Storage Sites

In the Henrys Fork Basin significant water storage occurs only on the upper main stem of the Henrys Fork. Any new storage developed in the Henrys Fork basin would have to be used in conjunction with other Water District 01 reservoirs. As the junior water right, new storage could not be filled until downstream reservoirs above Milner Dam were full. In dry years water for storage would have to be purchased or leased from other right holders. In most dry years there is rental pool water available. There may be an occasional year, such as 1977, when the open market would have to satisfy some of the rental water need.

Twenty some potential surface storage sites have been identified within the basin. None of these sites are being actively pursued at this time because of financial or environmental constraints. New storage for irrigation should be located in the upper reaches of the basin. Lower elevation level storage such as at Teton or Warm River would require significant pump lifts for use on high ground. Table 55 lists some potential reservoir sites in the basin. Off-stream sites (sites that would need water from an adjacent drainage) are generally listed first. All potential "Off-Stream" sites could be smaller and use only the water from their drainage basin. A few small storage sites (2,000 to 10,000 acre-feet) are known in the basin, but are not identified here. (See p. 213 and other Chapter 7 projects of the "Upper Snake River Basin Wyoming-Idaho-Utah-Nevada-Oregon, Vol. 1, Summary Report" published by the U.S. Department of Interior, Bureau of Reclamation.)

Moody Creek - Sec. 3, T. 5 N., R. 41 E. - This site, on a south-side tributary to the lower Teton River, would have a 300-foot high dam with a short 1,300-foot length. It could store 50,000 acre-feet in a narrow canyon at the 5,400 feet elevation level. About 6,000 acre-feet of storable water would be available from Moody Creek and about 9,000 acre-feet would be available from Canyon Creek through a gravity canal about 15 miles long. The majority of the water would need to be brought from the Teton River through a canal approximately 10 miles long coupled with a pumping plant to lift the water about 350 feet. The water, of course, could come from the Upper Teton River Basin with no net lift through a 25 mile canal. The adjacent drylands generally start at the 5,400 feet level so the water used would have to be pumped 200 to 400 feet above the reservoir.

Spring Creek - Sec. 11, T. 5 N., R. 42 E. - This site is on a tributary to Canyon Creek, a south-side tributary to the Teton River. A dam 165 feet high and 1,000 feet long would provide for storage for 30,000 acre-feet at the 6,150 feet elevation level. About 9,000 acre-feet of water would be available through a three mile canal from Canyon Creek. The remaining needed water would require a 150-foot lift pumping plant and a 20-mile canal from the Teton River. By extending the canal another 10 miles to Bitch Creek the pumping lift could be reduced to 100 feet. This reservoir could be used to irrigate some of the higher lands southeast of Rexburg. There is 775 feet of elevation drop between this site and Teton damsite over a distance of nine miles. Some hydropower potential, therefore exists, but would prevent the water use for bench-land irrigation.

Another location for water storage in this area would be the Canyon Creek site just below the junction of Canyon, Calamity, and Warm Creeks. The waters of Calamity and Warm Creeks could not be stored at the Spring Creek site but at the Canyon Creek site. The reservoir storage level would be at about the 6,000 feet level with a dam height under 150 feet.

Lane Lake - Sec. 13, T. 7 N., R. 42 E. - This potential off-stream storage site is located in a dry basin east of St. Anthony and just to the north of the Teton River. A 150-foot high and 2,500-foot long dam would store 70,000 acre-feet of water at the 5,570 feet level. An 15 mile canal from Conant Creek would provide about 30,000 acre-feet. An additional 15 miles of canal would be needed to divert water from the Falls River in the vicinity of the Marysville diversion dam. An alternate water source would be Bitch Creek with a 25 mile canal. This would allow water to be picked up near the forest boundary in order to stay above the lower Bitch Creek Canyon. The 6,050 feet elevation at Bitch Creek could allow about 450 feet of hydroelectric head to be developed along the canal.

Table 55. Potential Reservoir Sites

Potential for Further Study by Priority	Name	Reservoir Elevation in Feet	Water Level Rise	Dam Length	Reservoir Capacity Acre-Feet	Water Source	Canal Length
	OFF-STREAM						
	Bitch Cr.	5,970	475	1,400	140,000	Falls R. or Teton R.	35 miles 20-25 miles
1	Bitch Cr.	6,010	515	1,800	210,000	60,000-Bitch Cr. & Falls R. or Teton R.	35 miles & 20-25 miles
	Moody Cr.	5,400	300	1,300	50,000	6,000 - Moody Cr. 9,000 - Canyon Cr. 35,000 - Teton R.	 15 miles 10 miles + 150 ft. lift
2	Spring Cr.	6,150	165	1,000	30,000	9,000 - Canyon Cr. 21,000 - Teton R. or 21,000 - Bitch Cr.	3 miles 20 miles + 150 ft. lift 30 miles + 100 ft. lift
1	Lane Lake	5,570	150	2,500	70,000	30,000 - Conant Cr. 40,000 - Falls R.	15 miles 30 miles
1	Lower Badger Cr.	5,900	410	1,400	70,000	Teton R.	10 miles
2	Upper Badger Cr.	5,970	130	2,600	50,000	Teton R.	10 miles
1	Conant Cr.	5,600	150	1,300	40,000	30,000 - Conant Cr. 10,000 - Falls R. or 10,000 - Bitch Cr.	 15 miles 15 miles + 400 ft hydro
	Squirrel Cr.	6,400	280	3,300	130,000	Falls R.	10 miles + 2,400 ft. lift
	Squirrel Meadows	6,440	50 & 20	1,200 & 2,500	10,000	Boone Cr.	5 miles
	Boon Cr.	6,320	290	2,800	80,000	Falls R.	10 miles + 160 ft. lift
2	Robinson Cr.	5,800	300	2,000	70,000	20,000 - Robinson Cr. 50,000 - Falls R.	 12 miles + 1 mile tunnel with J.Y. Ranch Reservoir
1	J.Y. Ranch	5,800 or 5,840	170 210	3,300	50,000 80,000	Falls R. Falls R.	12 miles 13 miles
	Howell Ranch	5,720	130	3,700	30,000	Falls R.	10 miles
	Park Lake	6,200	220	2,200	40,000	Falls R.	12 miles + 40 ft. lift
	Moose Cr.	6,640	140	1,000	60,000	Henrys Fk.	6 miles + 250 ft. lift
2	Ground-water Exchange	5,150				Falls R.	various lengths
	DIRECT STORAGE						
2	Ashton Enlargement	5,192	+38	1,000 + 4,000 dike	50,000/40,000	Henrys Fk.	
2	Teton	5,320	320	2,800	315,000/200,000	Teton R.	
	Warm River	5,478	265	1,600	140,000/75,000	Henrys Fk. & Warm R.	
	Tetonia or Driggs	6,010 6,010	140 42	1,200 6,500	590,000 50,000/35,000	Teton R.	
1	Newdale Diversion		10	900	to 2,000 cfs	Teton R.	
2	Marysville Headworks	5,740	140	3,000	56,000	Falls R.	

Lane Lake is one of four sites in the basin that the University of Idaho's Water and Energy Resources Research Institute (1981) believed had the most potential for development. Water from the project could be used for irrigation on adjacent dry-farmed land. This land could be served with a pump lift generally under 200 feet. This site also could develop about 400 feet of head through a three mile canal and penstock to the bottom of the Teton River Canyon, just upstream of the Teton damsite. However, hydroelectric use would preclude the use of that water to irrigate adjacent drylands.

Bitch Creek - Sec. 10, T. 7 N., R. 44 E. - Two miles up from the mouth of Bitch Creek, a 475-foot high dam with a 1,400 foot crest could store 142,000 acre-feet at the 5,970 feet elevation level. If the dam was raised 40 feet, to 6,010 feet, it could increase the storage capacity to nearly 210,000 acre-feet. Approximately 75,000 acre-feet is available for storage during a normal year in Bitch Creek. The remaining water would need to be diverted from the Teton River via a 20-25 mile canal originating in the Driggs area, extending over to and down Badger Creek. An alternative water source would be Falls River, near the Idaho border, and Conant Creek through a 35 mile canal. The Bitch Creek site is an alterative to the Teton Dam project. Water would be available for irrigation of adjacent Teton Bench lands and the Lamont-Drummond-Squirrel area, where groundwater appears to have limited availability.

Power generation would be possible at the site. For any power generation analysis, the diversion of spring freshet flows from the Falls River must be reviewed. For the higher reservoir the available hydropower head could range up to 515 feet. Figuring only Bitch Creek water, the estimated average annual generation is 5,000 KW. With the diversion of Teton River water to this site, generation could double. The use of water for power generation would, however, prevent the water's use for irrigation on higher land.

Lower Badger Creek - Sec. 21, T. 7 N., R. 44 E. - At the 5,900 feet elevation level, a 410-foot high, 1,400-foot long dam would store 70,000 acre-feet in this deep canyon site near the mouth of Badger Creek. A canal about 10 miles long would bring Teton River water to this site. A powerhouse at the site would allow for the capture of some hydroelectric benefits but, again, to the exclusion of irrigation of higher lands.

Upper Badger Creek - Sec. 26, T. 7 N., R. 44 E. - A 130-foot high, 2,600-foot long dam at the 5,970 feet elevation level could store about 50,000 acre-feet. Similar to the Lower Badger Creek site, this reservoir's water source would be the Teton River, via a 10 mile canal. A 1-3/4 mile tunnel to the Teton River would allow for the development of 440 feet of hydroelectric head. As in several other storage sites, hydroelectric development would prevent irrigation of higher elevation land with the portion of the storage used for power generation. Estimated average generation is 2,000 KW.

Conant Creek - Sec. 25, T. 8 N., R. 43 E. - A 150-foot high, 1,300-foot long dam could store 40,000 acre-feet at 5,600 feet elevation. The water available annually from Conant Creek is estimated to be 30,000 acre-feet. Provisions for dry years may reduce this to 20,000 acre-feet. Additional water could be diverted from Falls River into a 15 mile canal. An alternate water source would be Bitch Creek from a diversion at the 6,050 feet elevation level, again through a 15 mile canal. Approximately 400 feet of head could be developed in this canal system. An alternative to diversion from the Falls River, is a diversion from Boone Creek at 6,200 feet elevation, three miles upstream from the mouth. A four mile canal could provide a 250-foot head. Preliminary estimates suggest 30,000 acre-feet could be available from a Boone Creek/Squirrel Creek diversion. A dry year estimate would be 20,000 acre-feet.

Squirrel Creek - Sec. 1, T. 8 N., R. 45 E. - A 280-foot high, 3,300-foot long dam could store 130,000 acre-feet at 6,400 feet elevation. The water source would be Falls River through a 240-foot lift pumping plant and a 10 mile canal originating just below the Yellowstone National Park boundary, and 30,000 acre-feet, in most years, through a four mile canal from Boone Creek.

Squirrel Meadows - Sec. 9, T. 47 N., R. 118 W. (Wyoming survey origin) - A 50-foot high, 1,200-foot long dam could store 10,000 acre-feet in Wyoming at 6,400 feet elevation. Five dikes, about 20 feet high and 500 feet long, would also be needed at this site. The water source would be Boone Creek via a five mile canal.

Boone Creek - Sec. 35, T. 9 N., R. 45 E. - A 290-foot high, 2,800-foot long dam could store 80,000 acre-feet at 6,320 feet elevation. The water source would be Falls River through a 160-foot lift pumping plant and a 10 mile canal originating just below the Yellowstone National Park boundary. Approximately 30,000 acre-feet would be available in most years from the Boone Creek drainage. A generating plant could be located one and one-half miles downstream from the dam at the confluence of Boone Creek with the Falls River. This would develop 520 feet of head between elevations 6,320 and 5,800 with a full reservoir. Approximately 3,000 KW would be the average generation using only Boone Creek water. To use reservoir water for power generation would generally prevent its use for irrigation on higher land. Without the dam, about 400 feet of head could be developed with a three-mile conduit.

JY Ranch - Sec. 24, T. 9 N., R. 44 E. - A 170-foot high, 3,300-foot long dam on Rock Creek, a tributary to Robinson Creek, could store 50,000 acre-feet at 5,800 feet elevation. If the dam was raised 40 feet the storage capacity would be increased roughly an additional 30,000 acre-feet for a total of 80,000 acre-feet. The water source would be Falls River through a 12 mile canal starting just below Sheep Falls. Alternately, if water was taken three miles downstream at the Yellowstone Canal inlet on the Falls River, an 80-foot pump lift would be needed. Geologic features at the damsite may not be favorable and would need further analysis, as is the case for all sites reviewed in this report. Geologic studies one mile downstream, just below the mouth of Porcupine Creek, reported unfavorable findings (1961 Snake River Basin Summary Report of USBR/COE site 68, p. 7-214).

Howell Ranch - Sec. 24, T. 9 N., R. 44 E. - A 130-foot high, 3,700-foot long dam on Rock Creek could store 30,000 acre-feet at 5,720 feet elevation. The water source would be Falls River at the Yellowstone Dam diversion, two miles above the National Forest boundary. The inlet canal would be 10 miles long.

Robinson Creek - Sec. 3, T. 9 N., R. 44 E. - A 300-foot high, 2,000-foot long dam could store 70,000 acre-feet at 5,800 feet elevation. Approximately 20,000 acre-feet are available from Robinson Creek, and 5,000 acre-feet might be available via a three-mile canal from Fish Creek. Additional water could be made available through a canal system from the Falls River. The easiest canal route from the Falls River would be an over-flow tunnel one mile long from a reservoir at the JY Ranch site, so facilities at Robinson Creek should be constructed in conjunction with this project.

Park Lake - Sec. 10, T. 9 N., R. 45 E. - A 220-foot high, 2,200-foot long dam at 6,200 feet elevation could store about 40,000 acre-feet. The site is on Upper Rock Creek near the southwest corner of Yellowstone National Park. The water source would be Falls River just below the Yellowstone National Park boundary. A 12 mile canal would be needed plus a pumping plant to fill the top 40 feet of the reservoir.

Moose Creek - Sec. 13, T. 13 N., R. 44 E. - A 140-foot high, 1,000-foot long dam at 6,640 feet elevation could store 60,000 acre-feet. The water source would be Henrys Fork through a six-mile canal with a pump lift of 250 feet. A narrow constriction at the end of a large valley provides a good reservoir site for a low, short dam. However, the Henrys Fork is well regulated by Island Park Reservoir. Island Park Reservoir is below the point at which water would be taken from the Henrys Fork so the Moose Creek Reservoir site would have few water-storage benefits.

Ashton Dam Enlargement - Sec. 28, T. 9 N., R. 42 E. - This enlargement would be a 38-foot rise in the water surface for a total height of 94 feet at the dam. Although the proposed dam would be 1,000 feet long, a couple of dikes totaling an additional 4,000 feet would be needed. The reservoir storage could increase 40,000 acre-feet, and the reservoir surface area would change from 400 acres to 1,800 acres. With the increase in surface area, there would be an additional water loss to evaporation of approximately 4,000 acre-feet. The new water surface would be at 5,192 feet elevation with the dam crest at 5,200 feet. The benefits of this project are storage for flood control on the lower Henrys Fork, and power generation (90 percent of the benefits). The current 5,800 KW hydroelectric plant generating 33,000 MWH could be replaced with a 12,000 KW generating plant. This would generate a total of 70,000 KWH annually or an average of 8,000 KW. (See report, Upper Snake River Basin, Volume I, Summary Report, USBR/COE, 1961, p. 7-28.)

Teton - Sec. 30, T. 7 N., R. 42 E. - A 300-foot high dam on the lower Teton River could create the largest reservoir within the basin. The site is located about two miles upstream of the mouth of the canyon and about 15 miles northeast of Rexburg. Active storage could be 200,000 acre-feet with 315,000 acre-feet total-storage. The reservoir would extend 17 miles up to the mouth of Bitch Creek and a little over two miles up Canyon Creek. The reservoir site is a narrow but gently descending canyon incised through a rolling plateau used largely for dryland and sprinkler irrigated agriculture. A hydroelectric plant located at the dam would have 295 feet maximum head. The average generation could be about 14,000 KW (123,000 MWH). Because of water releases from the reservoir for seasonal uses, the probable average generation is reduced to 8,000 KW (73,000 MWH) from an installed capacity of 22,000 KW. The movement of a large amount of Falls River water into the Teton basin for storage at an off-stream site such at Bitch Creek could considerably improve the power benefits at the Teton site.

One primary benefit of the Teton Reservoir site is that Upper Teton River water users (about 7,000 acres in Teton County) could continue to divert the upper river flows later into the summer. The Lower Teton River users have an earlier priority for natural flow water rights which could be provided by Teton Reservoir storage water. Natural flows then, by exchange, could be used above Teton Reservoir after July 1. An alternative use of Teton Dam could be to provide the head for a valley-wide gravity irrigation system for the lower Henrys Fork including the Egin Bench. This could conserve water, but in turn, would prevent ground-water recharge.

Teton: Recent Reappraisal Summary - The U.S. Bureau of Reclamation has recently completed a reappraisal of the Teton Reservoir project. Re-analysis has been set up to allocate water yields as follows:

41,000 ac-ft for mitigation flows - resident fish
24,000 ac-ft to enhance trumpeter swans
<u>20,000</u> ac-ft for supplemental irrigation
85,000 ac-ft of total yield.

Water bank water or the use of supplemental ground-water wells were not added to increase total water yield as was done in the original project.

The allocation of construction cost in million dollars was:

Irrigation	52
Power	34
Flood Control	49
Swan Flows	28
Recreation	5
Total	168

Interest during construction would be an added cost. The irrigation portion of the project included 25 million dollars to provide distribution to the Enterprise, East Teton and Canyon Creek Canals. Since Teton Reservoir water would belong to the water bank in exchange for natural flows, the project could probably be constructed using only the smaller Canyon Creek Canal. Of the 168 million dollar construction cost, 137 million dollars is the current estimate for the dam, spillway, powerplant, river outlet works, mechanical items for structures, lands and rights, and clearing of lands.

Fish and wildlife mitigation for the original project included 17,000 acres to be acquired, or set aside, which has been done. In addition, a minimum pool of 100,000 acre-feet was to be provided for fishery use. Hatchery facilities were to be constructed to rear trout and kokanee for release into the reservoir and river below the dam. Thirteen existing diversions below the dam were to be screened and the original proposal was to provide 300 cfs of stream flow with 150 cfs during dry years. In the reappraisal the U.S. Fish and Wildlife Service requested a mitigation stream flow of 450 cfs below the dam.

Fifty-two million dollars allocated to irrigation with zero interest and a 50-year repayment schedule, would require an annual repayment of $1,040,000. For an average annual yield of 20,000 acre-feet, the annual cost per acre-foot would be $52.00. If the cost allocation for irrigation was cut in half by deleting distribution facilities, and the amount of water allocated to irrigation was doubled, the annual cost per acre-foot would be $13.00 plus $2.70 for operation and maintenance costs. On the lower Henrys Fork where exchange water from main-stem Snake River storage has been available at a cost of $2.95 per acre-foot, the $15.70 ($13.00 + $2.70) per acre-foot is not competitive. Project analysis and cost of construction make new storage water much more costly. The allocated cost originally authorized by Congress for the failed Teton Dam was $2.21 per acre-foot including operation and maintenance (about $1.50 for construction costs only).

Warm River - Sec. 14, T. 9 N., R. 43 E. - A dam on the Henrys Fork six miles northeast of Ashton, just below the mouth of the Warm River could raise the water about 220 feet and create a reservoir with an active capacity of 75,000 acre-feet (140,000 acre-feet total capacity). Water would be backed up the Henrys Forks seven miles to the top of Lower Mesa Falls. This site could be used for power generation. The average annual generation would be 22,000 KW (190,000 MWH) with a 30,000 KW powerplant. A dam that raised the water 150 feet instead of 220 feet would back water up to the base of Lower Mesa Falls but would have considerably less water storage potential and an average annual generation of about 15,000 KW (130,000 MWH).

Driggs/Tetonia - A 43 feet high, 6,500 feet long dam on the upper Teton River near Driggs, (Sec. 13, T. 5 N., R. 44 E.), could store 50,000 acre-feet of which 35,000 acre-feet would be usable. The water storage elevation would be 6010 feet. A 140-foot high, 1200 feet long dam at the lower

Tetonia site, (Sec. 3, T. 6. N., R. 44 E.), could store 590,000 acre-feet at 6010 feet elevation, although the reservoir would flood a considerable area. A powerhouse could be built at the dam with a head of 140 feet. Average generation would be 4,000 KW if storage water is used on lands below the outlet elevation of the reservoir. The Tetonia site might be used with a lower height dam of 66 feet for hydroelectric production. It would generate about 18,000 MWH annually or an average of 2,000 KW with a 4,000 KW generator. The upper water level would be at 5930 feet elevation. Geologic studies for a large reservoir at this site disclose potential reservoir leakage. Correction of this problem would impose significant cost (USBR, 1961).

Marysville Headworks - Sec. 35, T. 9 N., R. 44 E. - A 120-foot high dam on the Falls River, above the site of the Marysville Canal diversion, could store 38,000 acre-feet and use about three miles of the Falls River. The Yellowstone Canal diversion works would be one-half mile upstream. A 140-foot high dam would raise the elevation to 5740 feet, store 56,000 acre-feet, and back water up to the Yellowstone Dam. The elevation of this reservoir would allow its use as a gravity irrigation system for much of the lower dryland in the Drummond-Lamont area.

Buffalo River Hydro - Sec. 20, T. 13 N., R. 44 E. - This 17,000 acre-feet site is on the upper Buffalo River six miles above its mouth. A 1400-foot long dam could raise the water level 100 feet. A tunnel about 0.6 mile long in Sec. 35, T. 13 N., R. 44 E. would move Split Creek into the upper Buffalo Creek drainage. This reservoir generally would be used for power generation. Average annual generation may be near 2,000 KW although the installed capacity could be twice this amount. The springs that form the beginning of a large part of the Buffalo River would be inundated to a depth of 50-75 feet. There is some concern that water pressure would slow the spring flow and shift part of the outflow to a different location. This project is reviewed in Water Power Resources of Idaho Under the Ponds Lodge heading, p. 67.

2. Ground-water Use and Ground-water Exchange

The selective direct use of ground water in the lower Henrys Fork area from St. Anthony to the mouth of the basin would allow the diversion of the Henrys Fork onto land now served by the Falls River. A gravity diversion at Ashton Dam (elevation 5,150 feet), could move water into the Enterprise and Falls River Canals. In order to serve higher lands in the Ashton area, the Henrys Fork could be diverted near the settlement of Warm River at elevation 5250 through a pumping plant with a lift of 250 feet. The Falls River water, in turn, could be diverted in the vicinity of the Yellowstone Canal and could be used in the Drummond/Lamont areas.

3. Ground-water Storage

Further study needs to be given to the potential of groundwater recharge for local use. The area that appears to have the best groundwater recharge potential is the Marysville-Grainville-Squirrel-France-Lamont area west of the National Forest boundary. In this area, material directly below the soil profile is mapped as gravel and outwash from the east mountains. The bedrock material is unknown, although in many areas it appears to be rhyolite, a less porous rock than basalt. Thus, it appears recharged groundwater could largely stay in the area for later use. Further groundwater studies are needed.

This study also should cover the Chester-Drummond area south to the Teton River as well as the south side Teton River Plateau areas from Moody Creek to Canyon Creek and east to the Teton River. Much of this area appears only to have the less porous felsic rock below the soils but, again, a detailed study would be helpful to further define local differences and opportunities for ground-water recharge.

4. Weather Modification

Cloud seeding has been successful in increasing winter precipitation. The success rate appears to be significant in mountainous terrain much like the upper reaches of the Henrys Fork Basin. However, weather modification programs are generally not successful increasing precipitation during drought periods since storm clouds are not present for seeding. Cloud seeding in normal years can provide more water for carry-over into a drought cycle. An increase in precipitation of 10 to 15 percent during a drought period appears low, however, the increase in runoff could be higher if the soil profile was saturated or became saturated as a result of induced precipitation. Consequently, even in an impending drought situation, the seeming small amount of additional precipitation does make a difference.

The implementation of a weather modification program should be long-term. One consideration for cloud seeding is the usefulness of winter and early spring snow. In the winter or early spring additional runoff generated by cloud seeding would generally occur over frozen ground and could be stored in basin reservoirs. Late spring rains, much of the time, percolate into the groundwater system and are greatly delayed in returning to streamflow. This consideration accentuates the importance of starting cloud seeding early in the water year, probably in November.

5. Rental Pool

The rental pool, also known as the water supply bank, generally consists of assigned irrigation storage water space in Jackson Lake Reservoir, Palisades Reservoir and American Falls Reservoir. This storage water may be used by Henrys Fork basin irrigators through an exchange for natural flow which would normally pass downstream to earlier priority water-right holders. The exchange of water is limited to available stream flow not used in the area. Rental pool water is the most economical water for new uses, if it can be made physically available. The current price is $2.95 per acre-foot used, of which $0.75 goes to Water District #1, Snake River and Tributaries above Milner, for administering the rental pool.

6. Water Conservation

In the Henrys Fork basin, water conservation applies principally to irrigation, since irrigation is the primary off-stream use of water. The greatest on-farm water losses are from deep percolation or seepage below the root zone, especially in the sandy subsoil of river bottom areas. End-of-field runoff is a much smaller loss and, of course, can be immediately reused by a lower diverter.

With sprinkler systems crop yields may be significantly increased since over watering is reduced. Labor expenditures for irrigation may also be reduced or reallocated. A conjunctive use strategy to maximize water use in the basin would use surface water in "good" water years. Ground water could be used to supplement supplies during low water years. The continued reliance on surface water throughout much of the basin will ensure adequate recharge to the aquifer for local needs.

Water conservation has been a focal point in many different water-use programs. Recently, in the Drought Assistance Act of 1988, it was stated the Secretary of Interior is to "perform studies to identify opportunities to . . . conserve water supplies available to Federal reclamation projects." In the Reclamation Reform Act of 1982 (regarding a change of acreage limitation), a lesser discussed section of the act states:

> "(a) The Secretary (of Interior) shall . . . encourage the full consideration and incorporation of prudent and responsible water conservation measures in the operations of non-Federal recipients of irrigation water from Federal reclamation projects, were such measures are shown to be economically feasible . . . ."

"(b) Each district that has entered into a repayment contract or water service contract . . . shall develop a water conservation plan which contain definite goals, appropriate water conservation measures, and a time schedule for meeting the water conservation objectives."

"(c) The Secretary is authorized and directed to enter into memorandums of agreement with those Federal agencies having capability to assist in implementing water conservation measures to assure coordination of ongoing programs. Such memorandums should provide involvement of non-Federal entities such as States, Indian tribes, and water user organizations to assure full public participation in water conservation efforts" (underlining added).

In answer to subsection B of the above act and as an example of what can be done in water conservation measures, an excerpt follows from a letter of the Falls Irrigation District of American Falls, Idaho (Michaud Flats) to the U.S. Bureau of Reclamation.

As you will see below, the District (since 1980) has not used water in excess of 2.07 acre feet per irrigable acre:

AVERAGE WATER USE PER IRRIGABLE ACRE
in Acre-Feet

1980 - 1.73
1981 - 2.07
1982 - 1.76
1983 - 1.35
1984 - 1.59
1985 - 1.82

Average 1.72

One definite advantage we have over other organizations is being an almost total (we have one or two small acreages who still use flooding to irrigate pastures) sprinkler project. Our water, when put upon the land, stays there. We do not have to contend with part of the delivered water running off the end of the field, so this does entail less water needed to be applied to acquire the water crops need for proper growth.

There are two acre feet of water per acre allowed each wateruser for normal usage which is paid for in the O&M assessment. Any water used in addition to this amount is classed as excess water. The first acre foot of excess water is charged at the same rate as the first two in the allotment. The second acre foot of excess is charged at one and a half times the price of the first three acre-feet. These excess water charges encourage our waterusers to conserve as much as possible by improving their equipment and using it more efficiently.

We also have a very strict water measurement procedure when delivering water to our waterusers. All the District's delivery points are locked and operated only by District personnel. This enables the District to have a more controlled water delivery system and equality of charges to all waterusers.

We are using a computerized water recording system where the ditchriders put the delivery into a calculator and later feed it into the computer. Written records are also kept to confirm the computer printouts. The computer can compile and organize the records quickly so that, when calling, waterusers are provided a faster and more accurate status of their water accounts. This helps them use their water more wisely and efficiently and encourages conservation in their operations."

Recommended Action

1. Encourage water conservation and the use of water bank water in lieu of new impoundments as sources of additional water. Use both yearly leases and develop innovative long-term leases. Exchanges with natural flow rights will be the main method of implementation in the Henrys Fork basin.
2. Ground-water wells and more efficient irrigation systems are additional water sources that should be considered. The benefits of large water conservation actions must be carefully weighed against the ground-water recharge benefits associated with current practices.
3. Study the availability of the ground-water resource in the plateau areas east of St. Anthony and in the Canyon Creek area.
4. Study off-stream reservoir sites for Falls River and Teton River water. (Uses would be irrigation of Drummond-Lamont dryland farmed area and similar plateaus, plus power development, limited flood control, and recreation.)
5. Encourage the use of surface water during high and average flow years in order to promote regional ground water recharge; during low flow years a partial switch to ground water use is encouraged.
6. Amend new ground-water license/transfer procedures to allow irrigators that transfer from a surface water source to a ground-water source to keep the surface water priority date for a portion of the water transferred if certain conditions are met.
7. Specific aquifer recharge project areas may be helpful if set aside for use during high and average runoff seasons.
8. For any surface water development, if the environmental consequences are acceptable, encourage reservoir location in the upstream or upper plateau areas in order to allow for water use in these areas.
9. Continue to reserve the Teton Dam site for future use as a major water storage project. Release the reservation of the Warm River Dam Site.
10. Set up a weather modification study in the upper basin with a companion study to determine resulting increased surface runoff.
11. Water quality, water yield and water development opportunities should be a planning consideration for all regulatory and management agencies in the basin.
12. Seek legislative change which would provide incentives for water conservation. Saved water must somehow benefit the entity effecting the savings.

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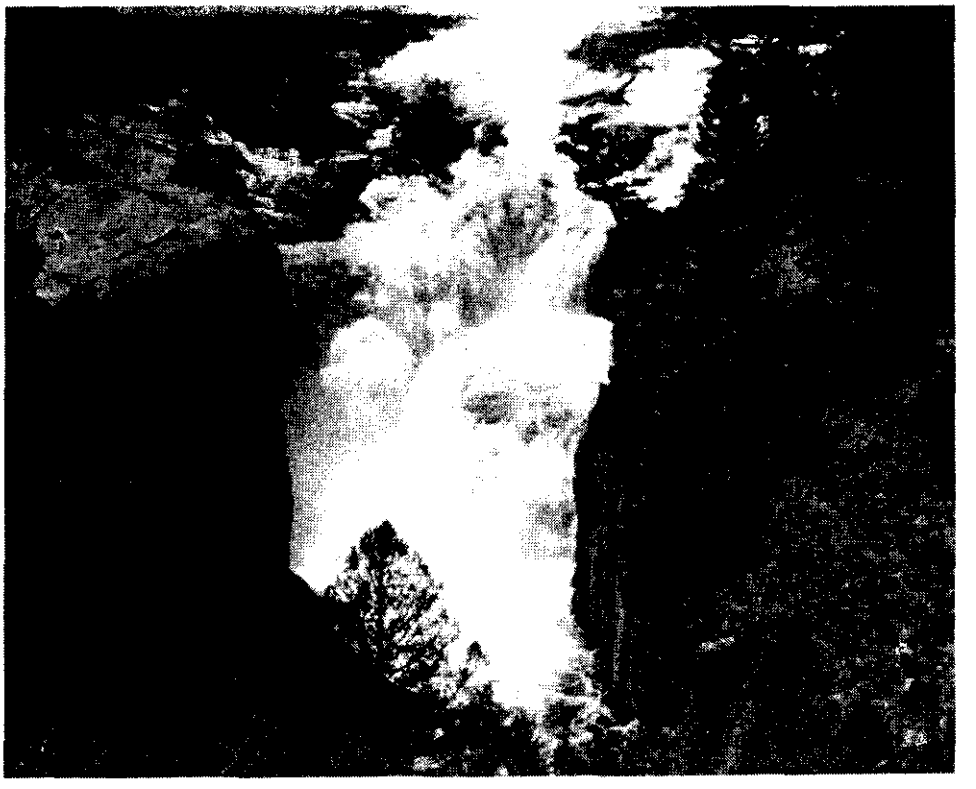
RESOURCE EVALUATION

Identified as part of the basin goals and objectives is the need to identify and care for historic and archaeologic sites, protect outstanding natural features, scenic values, and the quantity and quality of prime recreation waters, and maintain and enhance fish and wildlife populations and their habitat. Rivers that possess outstanding fish and wildlife, recreational, aesthetic, or geologic values can be designated as Idaho protected rivers. An assessment of the effects of protection on other identified resource uses is undertaken prior to designation. An initial attempt to assess these values in the Henrys Fork basin has been documented by the Pacific Northwest Rivers Study. Following is a matrix of stream segment assets based on the Pacific Northwest Rivers study, with resource data updated to reflect current information. The matrix was used to help identify and evaluate stream segments with "outstanding" natural and recreational resource values.

Aesthetic and Geologic Values

Aesthetic and geologic values are addressed in the first two columns of the matrix. Aesthetic features are noted vistas and canyon environments. Geologic features are: waterfalls, canyons, caves, glacial features, active meander complexes, hot, warm, or cold springs, or an exceptional display of bedrock structural features. Three criteria were used to evaluate these features: (1) scarcity, (2) quality, and (3) scientific value. Scarcity refers to the distribution of the feature both within the state



Lower Mesa Falls on the Henrys Fork

and worldwide. Quality refers to the relative physical condition of a natural feature in comparison to other known occurrences of the same feature. The scientific value of a feature or a given site refers to its usefulness and importance as an educational resource. Scarcity, quality, and scientific value determinations weighed the final scenic/natural features evaluation for a stream segment. Only "Outstanding" = 1, or "Substantial" = 2, ratings were recorded on this matrix. The features of note for each stream segment are listed in the second column.

Fishery Values

The following components were included in the resident fish resource assessments: habitat quality, species present and their current status, migration corridors, research sites, abundance of catchable sport fish, angler effort, quality of angling experience and potential fishery and habitat value. Resident fish include game fish and non-game fish.

High (=1), Intermediate (=2) and Low (=3) quality habitats were defined as those which provide optimum, satisfactory and poor environmental conditions, respectively, for the species present. Environmental factors considered in evaluating habitat quality included temperature, water quality parameters, instream flow, substrate composition, availability of instream cover, food abundance, and quality of riparian habitat.

Fish species of High (=1) concern are wild or native gamefish species of regional importance. In the Henry's Fork this would encompass cutthroat trout, rainbow trout, and mountain whitefish. Species of Intermediate (=2) concern are all gamefish species except as noted above; all native nongame species in natural, unimpounded environments; and exotic nongame fish that serve as a forage base for a species of high concern. Species of Low (=3) concern are all exotic nongame species not noted above, and native nongame fish populations in altered habitats.

Levels of fish abundance (High = 1, Intermediate = 2, and Low = 3) were correlated with catch per unit effort, actual population size based on field sampling data, or resource expert consensus estimates. Levels of angler use (High = 1, Intermediate = 2 and Low = 3) are expressed as fisherman-days per unit area, or are resource expert consensus estimates. For estimate purposes the following guidelines were used. High - supports a renowned fishery as evidenced by the number of anglers who come specifically to fish this particular stream segment, anglers from a national or statewide area. Intermediate - supports a fishery utilized by anglers from a 3-4 county area. Low - supports a fishery used by local anglers.

Wildlife Values

The criteria used to assess wildlife resources were habitat quality, species composition and abundance, recreational use or potential, and geographic importance. Noted use of habitat for nesting, winter range, calving, or migration is listed under the Critical Use column on the matrix. Final wildlife values recorded on the matrix were further modified by IDWR staff to reflect water-associated species or land-associated species as follows:

1 = Outstanding wildlife value
primarily water-associated animals, e.g., muskrat, beaver, bald eagle, swans
2 = Outstanding wildlife value
primarily land-associated animals, e.g., bear, deer, moose
3 = Substantial wildlife value

Wildlife values are logged as "Outstanding" or "Substantial" for most of the stream segments evaluated in the Henry's Fork basin. This contrasts, however, with other river basins within the state which show substantially lower wildlife values for their respective streams. The Henry's Fork basin is unique on a state and regional scale in wildlife abundance.

Recreational Values

In evaluating the recreational value of a stream segment it is impossible to rank all rivers on exactly the same criteria. The physiographic diversity of stream segments contributes to distinct settings and to the suitability for some activities over others. Consequently, the river segments were inventoried and ranked on a regional basis. Although some Idaho rivers boast users from throughout the nation and the world, the river segments with primarily regional and/or local use are no less important as recreation resources. Use figures were not seen as an appropriate measure of a river's recreation value. User counts do not exist for most of the rivers that do not require permits. The number of users does indicate the popularity of a river segment, but tells nothing of the quality of experience. The best source of recreational data was thought to be from the recreation planners and managers of the region.

Three major criteria, land-based recreation opportunities, water-based recreation opportunities and scenic factors, were used to evaluate recreational resources on each stream segment. Land-based recreation included activities that occurred within 1000 feet of the river or stream. Other factors such as the accessibility, type of experience desired, water level, and difficulty also played a role in the assessment of the recreational value. Each criteria was evaluated using an inventory and ranking matrix which documented the physical attributes and activity opportunity characteristics of each stream segment. Assessment values for the individual study reaches were determined by group consensus at meetings held throughout the state.

The Land and Water Opportunity Use columns in the matrix describe the recreation opportunities that occur along the river segment. Potential developed recreation sites located by the Targhee National Forest in the 1985 Management Plan are listed in the final recreation column. Recreation potential was considered but not included in the Parks and Recreation inventory and evaluation. The Targhee National Forest has mapped potential recreation sites as a part of its Forest Management Plan (1985). The following definitions describe the recreational value rating:

1 = "Outstanding" recreational resource

An outstanding recreational resource may be due to a unique combination of attributes or to one specific characteristic that creates exceptional recreational opportunities for one or more activities. Outstanding resources would be described by recreation experts and the public as "blue ribbon" resources--the epitome or classic of its type of setting and/or experience. Recreationists may be willing to travel substantial distances or endure difficult access to use these resources.

2 = "Substantial" recreational resource value

This class describes recreational resources that are highly valued but do not offer the special characteristics found in outstanding recreational resources. These may be somewhat scarce opportunities in a region due to the limited suitability for certain opportunities or based on the special physical attributes of the river segment. These opportunities and/or settings are of a higher quality than the resources typically found in the region. These are very important recreational settings in the region.

3 = "Moderate" recreational resource value

Moderate recreational resources are typically available in the region. They have considerable recreational value, but the physical setting or experience opportunity may be considered standard for what is available in the region.

Development Use Values

Several columns in the matrix identify other uses or concerns for specific river segments or streams. Hydropower sites are summarized from the Power Development section of the Henry's Fork basin plan. If the project is an active FERC filing, it is noted in the column to the right with an "A". Potential sites are noted with a "P". Potential irrigation water supply sites are summarized from the Water Supply section of the Henry's Fork basin plan. A priority classification for further study is noted in the column to the right. Stream segments adjacent to scheduled Targhee National Forest timber sales, and/or noted for flooding problems in the Henry's Fork basin plan, and/or designated as "Special Resource Waters", (see also Water Quality chapter), are marked with an "X" in the appropriate column of the matrix.

State Protection Eligibility Criteria

The final matrix column identifies that the segment meets particular eligibility criteria for defining outstanding aesthetic, geologic, fish & wildlife, and recreational values. Eligibility for state protected river designation is based solely on the relative significance of the reach as a public resource, e.g., to be eligible for protection a reach must contain at least one "Outstanding" fish and wildlife, recreational, aesthetic or geologic value. After eligibility is determined, an assessment of the effects of designation on other identified resource uses is undertaken.

In order to highlight outstanding stream segments in the Henrys Fork basin, screening criteria were applied to the matrix values. The following criteria were developed:

#1 Fish & Wildlife

Fishery Habitat & Abundance = 1; and
Species of Concern = 1 or stream segment is spawning habitat; and
Wildlife value = 2 or
Critical use by wildlife

#2 Fish & Wildlife and Recreation

Fishery Abundance & Angler Use = 1; and
Habitat & Species of Concern minimum = 2; and
Wildlife Value = 2; and
Recreation value minimum = 2

#3 Aesthetics, Geology, and Recreation

Recreation value = 1; or
Scenic/natural linear features value = 1

River Segment Values

Stream segments in the Henrys Fork basin that met criteria for outstanding fish and wildlife, recreational, aesthetic, and geologic resource values are described below.

Henrys Fork from Big Springs to Island Park Reservoir -
Outstanding fish habitat, high fish numbers, and spawning use; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities; scenic terrain and outstanding geologic features: - Big Springs, hot springs, and volcanics.

Henrys Fork from Island Park Dam to Harriman State Park -
Outstanding fish habitat high fish numbers, and spawning use; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork through Harriman State Park -
Outstanding fish habitat, high fish numbers, and spawning use; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities; scenic open vista and historic railroad ranch.

Henrys Fork from Harriman State Park to Riverside Campground -
Outstanding recreation value based on current land and water opportunities; outstanding scenic and geologic features: - view of Teton Range, canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use.

Henrys Fork from Riverside Campground to Hatchery Ford -
Outstanding recreation value based on current land and water opportunities; scenic canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Hatchery Ford to Upper Mesa Falls -
Outstanding recreation value based on current land and water opportunities; outstanding scenic and geologic features: - Sheep Falls, volcanics, canyon environment. Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use.

Henrys Fork from Upper Mesa Falls to Lower Mesa Falls -
Outstanding recreation value based on current land opportunities; planned recreational development at Mesa Falls; outstanding scenic/geologic features: - Upper and Lower Mesa Falls, canyon environment.

Henrys Fork from Lower Mesa Falls to Warm River -
Outstanding recreation value based on current land and water opportunities; outstanding scenic canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Warm River to Ashton Reservoir -
Outstanding recreation value based on current land and water opportunities. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Ashton Dam to Chester Dam -
Outstanding fish habitat and high fish numbers; critical use by species of concern; outstanding wildlife habitat, and water-associated species present; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork from Chester Dam to St. Anthony -
Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork from St. Anthony to Teton River confluence -
Outstanding recreation value based on current land and water opportunities. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern.

Buffalo River -
Outstanding fish habitat, high fish numbers, and spawning use; high fish species value; critical use by species of concern; outstanding wildlife habitat, and water-associated species present; substantial recreation value based on current land and water opportunities.

Warm River from Split Creek to Warm River Spring -
Outstanding scenic canyon environment.

Warm River from Warm River Spring to mouth -
Outstanding fish habitat, high fish numbers, and spawning use; outstanding wildlife habitat and critical use by species of concern; outstanding scenic and geologic features: - canyon environment, hot springs; campground, trails, and scenic route provide recreation opportunities.

Falls River from Wyoming Border to Yellowstone Diversion -
Outstanding fish habitat, high fish numbers; high fish species value; outstanding wildlife habitat, water-associated species present; substantial angler use and outstanding recreation value based on current land and water opportunities.

Falls River from Yellowstone Diversion to Conant Creek -
Outstanding recreational value based on current land and water opportunities. Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Falls River from Conant Creek to mouth -
Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present; high angler use and substantial recreation value based on current land and water opportunities.

Teton River from Spring Creek to Bitch Creek -
Outstanding fishery habitat and abundance, and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern.

Duck Creek -
Outstanding fish habitat,high fish numbers, and spawning use; critical use by species of concern; high fish species value; outstanding wildlife habitat.

Timber Creek -
Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Targhee Creek -
Outstanding scenic/natural features in proposed Research Natural Area. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Howard Creek -
Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Robinson Creek -
Outstanding scenic canyon with hot springs. Outstanding fishery habitat and spawning area; high fish abundance; outstanding wildlife habitat; harlequin duck habitat.

Bitch Creek -
Outstanding fish habitat,high fish numbers, and spawning use; high fish species value; big game winter range.

	Aesthetic, Natural or Geologic		Fish & Wildlife							Recreation				Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Area NPPC Rec P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Lake Outlet			1	2	2	3	1	Eagle-W, N TSwan-W SCrane-N Wetlands	F&W		F	FB, C	Crooked Cr; 2mi N of Conf	1	H								
Henrys Fork-Big Springs to Island Park Reservoir	1	Volcanics Big Springs Hot Springs	1 So	2	1	1	1	Eagle-W, N TSwan-W Wetlands Osprey	F&W	1	CG,Tr,P,Dr ORV,Res,F	S,T,PB,FB,C Outfitters	North Fk Summer Hm Area	2	A&H	Coffee Pot	P	Moose Cr				X	1 2 3
Henrys Fork-Island Park Dam to Harriman State Park		Canyon	1 So	1	1	1	1	Eagle-W, N TSwan-W Osprey	F&W	1	CG,Tr,P,Dr ORV,Res,F	S,T,FB,C,F Outfitters	Hwy 20 1mi S of Last Chance	2	A&H	Island Park Last Chance	A P					X	1 2 3
Henrys Fork-Harriman State Park	1	Vista	1 So	1	1	1	1	Eagle-W, N TSwan-W, N SCrane-N Elk-C Wetlands Osprey	F&W	1	CG,Tr,P,Dr	S,T,PB,FB,C F-Outfitters		1	A&H							X	1 2 3
Henrys Fork-Harriman SP to Riverside Campground	1	Teton View Canyon	1 So	1	1	1	1	Eagle-W, N TSwan-W, N Osprey	F&W	1	CG,Tr,P,Dr ORV	FB,C,F Outfitters	Osborne Br; near Riverside Campground		A	Lookout Butte	P					X	1 2 3
Henrys Fork-Riverside CG to Hatchery Ford		Canyon	1 So	1	1	2	1	Eagle-W, N TSwan-W Osprey	F&W	1	CG,Tr,P	FB,C,F Outfitters	Lookout Butte; Hatchery Fd		A	Lookout Butte	P					X	1 3

Natural Features:

pNNL - Proposed National Natural Landmark
pRNA - Proposed Research Natural Area

___ Underlined data indicates rating or information update supplied by regional Idaho Fish and Game personnel, 1991.

Fish and Wildlife:

D - Deer
Mo - Moose
SCrane - Sandhill Crane
TSwan - Tundra or Trumpeter Swan

C - Calving
M - Migration
N - Nesting
Sp - Spawning
W - Wintering
WR - Winter Range

Recreation:

C - Canoe
CG - Campground
Cp - Camping
Dr - Pleasure Driving
F - Fishing
H - Hunting
ORV - Off-Road Vehicles
P - Picnicking
Res - Resort
S - Swimming
T - Tubing
Tr - Trail
PB - Power Boating
FB - Float Boating:
Kayak
Dory
Raft

NPPC - Northwest Power Planning Council Designations

F&W - Fish and Wildlife
F - Resident Fish
W - Wildlife

	Aesthetic, Natural or Geologic		Fish & Wildlife							Recreation				Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Fork-Hatchery Ford to Upper Mesa Falls	1	Waterfalls Canyon	1	1	1	2	1	Eagle-W, N TSwan-W Elk-M, WR Osprey	F&W	1	Tr	FB,F Outfitters	Sheep Falls		A	Lookout Butte Sheep Falls Hatchery Ford	P P P					X	1 3
Henrys Fork-Upper Mesa Falls to Lower Mesa Falls	1	Waterfalls Volcanics pNNL	1	1	2	3	1	Osprey	F&W	1	CG,Tr		Mesa Falls		A	Mesa Falls Hatchery Ford	P P					X	3
Henrys Fork-Lower Mesa Falls to Warm River	1	Canyon	1 Sp	1	1	2	1	Eagle-W, N TSwan-W Osprey	F&W	1	Tr,P,Dr	FB,C,F Outfitters			A	Hatchery Ford	P	Warm River				X	1 3
Henrys Fork-Warm River to Ashton Reservoir			1 Sp	1	1	2	1	Eagle-W, N TSwan-W Elk-M, WR Osprey	F&W	1	Cp,Tr,P	S,T,FB,C,F Outfitters		3	A	Warm River Hatchery Ford	P P	Warm River				X	1 2 3
Henrys Fork-Ashton Dam to Chester Dam			1	1	1	1	1	Eagle-W, N Osprey	F&W	1	Cp,F,H	S,T,PB,FB,F Outfitters		3		Ashton Cross Cut St. Anthony Lwr Ashton	A P A P	Ashton	2		X	X	1 2 3
Henrys Fork-Chester Dam to St. Anthony			1	1	1	1	1	Eagle-W, N Osprey		1											X	X	1 2 3
Henrys Fork-St. Anthony to Confluence with N Fk Teton		Sand Dunes	1	1	1	3	1	Eagle-W, N D-M, WR	F&W	1	Cp,F,H	S,T,PB,FB,F Outfitters		3	A&H						X	X	1 3

Natural Features:

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pRNA - Proposed Research Natural Area

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Fish and Wildlife:

D - Deer
Mo - Moose
SCrane - Sandhill Crane
TSwan - Tundra or Trumpeter Swan

C - Calving
M - Migration
N - Nesting
Sp - Spawning
W - Wintering
WR- Winter Range

Recreation:

C - Canoe
CG - Campground
Cp - Camping
Dr - Pleasure Driving
F - Fishing
H - Hunting
ORV - Off-Road Vehicles
P - Picnicking
Rsv- Resort
S - Swimming
T - Tubing
Tr - Trail
PB - Power Boating
FB - Float Boating:
Kayak
Dory
Raft

NPPC - Northwest Power Planning Council Designations

F&W - Fish and Wildlife
F - Resident Fish
W - Wildlife

	Aesthetic, Natural or Geologic		Fish & Wildlife								Recreation				Cultural or Historic										
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	Archaeologic Site Historic Site	Hydropower Site	A - Area FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Fork-N Fk Teton Confluence to Mouth	1	Eolian Features Menan Buttes pNNL	3	1	3	3	1	Eagle-W, N Elk/D/Mo-WR													X	X	
Buffalo River-from springs (SW ¼ Sec 21) to mouth			1 Sp	1	1	1	1	Eagle-W, N TSwan-W, N	F&W	2	Cp,Rec,F	S,T,FB,C,F		3	A&H	Ponds Ldg Buffalo River	A P			X		X	1 2
Warm River-Partridge Creek to Warm River Spring	1	Hot Springs Canyon	1 Sp	1	2	2	2	Elk/Mo-C, WR	F&W	2	CG,Tr,P,Dr ORV,F	S,T,FB	Partridge Cr; Flat Canyon	2	A&H	Partridge Buffalo R	P P			X		X	3
Warm River-Warm River Spring to HF Confluence	1	Hot Springs Canyon	1 Sp	1	1	2	2	Eagle-W, N TSwan-W Elk/D/Mo-WR	F&W		CG,Tr,P,Dr ORV,F	S,T,FB	Warm Springs Twisted Draw Overlook	2	A&H	Warm R Butte	P	Warm R				X	1 3
Falls River-Wyoming border to Yellowstone Diversion			1 Sp	1	1	3	1	Elk-M, C Harlequin Ducks Osprey	F&W	1	Tr,F,H	FB	Boone Cr Cll Dog Cr Cll Sheep Falls			Sheep Falls	P	Bitch Cr Park Lake Squirrel Cr Boone Cr JY Ranch	1 1			X	1 3
Falls River-Yellowstone Diversion to Conant Creek			1	1	1	2	1	Eagle-W Elk/D/Mo-WR Osprey	F&W	1	Tr,F,H	FB				Falls River Yellowstone Maryville Dp	A A P	Howell Rch Lane Lake Conant Cr Maryville	1 1 1			X	1 3
Falls River-Conant Creek to Enterprise Canal Diversion			1	1	1	1	1	Eagle-W Elk/D/Mo-WR Osprey	F&W	2	Cp,Tr,ORV F,H	S,T,FB,C		3	A&H	Enterprise Cnl	P					X	1 2

Natural Features:

pNNL - Proposed National Natural Landmark
pNNA - Proposed Research Natural Area

___ Underlined data indicates rating or information update supplied by regional Idaho Fish and Game personnel, 1991.

Fish and Wildlife:

D - Deer
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Sp - Spawning
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WR- Winter Range

Recreation:

C - Canoe
CG - Campground
Cp - Camping
Dr - Pleasure Driving
F - Fishing
H - Hunting
ORV - Off-Road Vehicles
P - Picnicking
Rec- Resort
S - Swimming
T - Tubing
Tr - Trail
FB - Power Boating
FB - Float Boating:
Kayak
Dory
Raft

NPPC - Northwest Power Planning Council Designations

F&W - Fish and Wildlife
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	Aesthetic, Natural or Geologic		Fish & Wildlife							Recreation				Cultural or Historic										
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A - Archeologic Site H - Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated Special Resource Water	Eligible River by Criteria Group #
Teton River-Trail Creek to Spring Creek			2	1	2	1	3	Eagle-W TSwan-W SCrane-N Elk/D/Mo-WR Wetlands	F&W			Outfitters			A	Tetonia/ Drigge	P	Bitch Cr UpprBdgr LowrBdgr Te/Drigge	1 2 1 2			X	
Teton River-Spring Creek to Bitch Creek			1	1	1	3	1	Eagle-W TSwan-W Elk/D/Mo-WR	F&W	2	Cp,F,H	FB Outfitters			A	Felt Uppr Teton	A A	Tetonia	2			X	1
Teton River-Bitch Creek to Canyon Creek			3	1	2	2	1	Eagle-W D/Mo-WR		2	Cp,F,H	FB Outfitters										X	
Teton River-Canyon Creek to North-South Branches			3	1	2	1	1	Eagle-W D/Mo-WR	F&W	3	Cp,F	FB Outfitters			A	Brigge Enterprise Crd Teton	A P P	Teton Newdale Div	2 1			X	
North Branch Teton River to Henrys Fork Confluence			3	1	2	2	1	Eagle-W													X		
South Branch Teton River to Henrys Fork Confluence			3	1	2	2	1	Eagle-W													X		
Sand Creek	1	Hot Springs	2	2	1	3	1	SCrane-N Elk/D/Mo-C Elk/D/Mo-WR							A								
Sheridan Creek			3	2	3	3	2	Eagle-W, N TSwan-W, N SCrane-N						2	A&H								

Natural Features:

pNNL - Proposed National Natural Landmark
pRNA - Proposed Research Natural Area

___ Undefined data indicates rating or information update supplied by regional Idaho Fish and Game personnel, 1991.

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P - Picnicking
Rec - Recreat
S - Sightseeing
T - Tubing
Tr - Trail
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FB - Float Boating:
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Icehouse Creek			1	2	3	3	2	Eagle-W TSwan-W, N Elk-C, M	W				nr Bunkhouse Creek Cll	2	A&H								
Sheep Creek							2	Mo-WR	W														
Blue Creek			3				2	Mo-WR	W					2						X			
Hotel Creek			1	2			2	Eagle-W TSwan-W Mo-WR	W											X			
Yale Creek							2	Elk-C Mo-WR	W					2									
Duck Creek			1 Sp	1	1	3	2	Eagle-W, N TSwan-W	F&W				near South Fk Cll										1
Timber Creek			1 Sp	1	1	3	2	Eagle-W, N Elk-M, C	F&W														1
Targhee Creek	1	pRNA	1 Sp	1	1	3	2	Eagle-W, N Elk/D/Mo-WR	F&W				T16,R43,Sec25										1 3
Howard Creek			1 Sp	1	1	3	2	Eagle-W, N Elk/D/Mo-WR	F&W											X			1
Moose Creek			1 Sp	2	1	2	2	Eagle-W, N Elk/D/Mo-WR	W	3			1mi SE Rd 292		A			Moose Cr					
Partridge Creek	1	Hot Springs	2	2	2	3	1								A					X			

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Fish Creek	1	Hot Springs	1	2	1	3	2						2mi NE Moose Cr Butte	3	A	Fish Cr	P	Robinson Cr	2	X			
Snow Creek	1	Hot Springs	1	1	2	3	2								A	Fish Cr	P			X			
Rock Creek			1	2	1	3	1						Shaefer Cr Cll; 1mi SW of Yellowstne NP	3	A	Park Lake Fish Cr	P P	Park Lake JY Ranch Howell Rch	1				
Porcupine Creek			2	2	2	3	2			3	Cp,F		Rising Cr Cll	2	A&H	Fish Cr	P						
Robinson Creek-Wyoming border to mouth	1	Hot Springs Canyon	1 Sp	2	1	3	2	Harlequin Ducks	F&W	2	Cp,Tr,ORV,F		Horseshoe Lk			Fish Cr	P	Robinson Cr	2	X			1 3
Boone Creek-Wyoming border to mouth			1	2	2	3	1		W				Falls R Cll			Boone Cr	P	Boone Cr Conant Cr Squirrel Cr Sqrl/Mdow	1				
Squirrel Creek-Wyoming border to mouth			1	2	2	3	1		F&W					3				Squirrel Cr					
Conant Creek-Wyoming border to mouth			2	2	2	3	1	Elk/D/Mo-WR	W					3				Lane Lake Conant Cr Bitch Cr	1 1 1				
Bitch Creek-Wyoming border to mouth		Canyon	1 Sp	1	1	3	3	Elk/D/Mo-WR Harlequin Ducks	F	2	F	FB,F			A	Judkins	P	Bitch Cr Lane Lake Conant Cr Spring Cr	1 1 1 2				1

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Badger Creek-Wyoming border to mouth			2	1	2	3	3	Elk/D/Mo-WR SCrane-N	F&W	4	Cp,Tr,P,F	S,T				Uppr Bdgr	P	UpprBdgr LowrBdgr	2 1				
Spring Creek			2	1		3	3	Elk/D/Mo-WR TSwan-W SCrane-N	F&W														
South Leigh Creek-Wyoming border to mouth			3	1		3	3	Elk/D/Mo-WR TSwan-W SCrane-N	F														
Teton Creek-Wyoming border to mouth			2	1	2	2	3	Elk/D/Mo-WR TSwan-W SCrane-N	F														
Darby Creek-Wyoming border to mouth			2	1			3	Elk/D/Mo-WR TSwan-W SCrane-N															
Trail Creek-Wyoming border to mouth			2	1			3	Elk/D/Mo-WR TSwan-W SCrane-N	F	3	CG,Tr,P Dr,F				A	Victor	P						
Mahogany Creek				1		3	3	Elk/D/Mo-WR SCrane-N	F				1.5 mi SW of Bates										
Horseshoe Creek			2 Sp	1		3	3	Elk/D/Mo-WR SCrane-N	F				Ski Area at HW	2	A								
Packsaddle Creek			2 Sp	1		3	3	Elk/D/Mo-WR SCrane-N	F				N Fork HW; S Fork HW	2	A								

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Canyon Creek-Headwaters to Calamity Creek			2	1	2	3	2	Elk/D/Mo-WR SCrane-N	F				3mi S of Calamity Cll; Hilton Cr Cll	3	A&H			Spring Cr Canyon Cr Moody Cr	2				
Canyon Creek-Calamity Creek to Mouth	2	pNNL, Pincock Hot Springs	3	1	3	3	2	Elk/D/Mo-WR SCrane-N Eagle-W	F							Canyon Cr	P	Canyon Cr Teton	2 2				
Spring Creek			2	1			3	Elk/D/Mo-WR	F									Spring Cr	2				
Calamity Creek			2	1			3	Elk/D/Mo-WR	F											X			
Moody Creek			1 Sp	1	2	3	3	Elk/D/Mo-WR SCrane-N	F				Sheep Cr HW					Moody Cr		X			

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DESIGNATIONS AND RECOMMENDATIONS

The role of the Idaho Water Resource Board is to establish water policy for the state, including the development of comprehensive water plans for geographic areas within the state. A key element of Idaho water policy and planning is state sovereignty. It is the policy of Idaho that the state has sovereignty over decisions affecting the development and use of its water resources. The state opposes any attempt by any other entity to usurp the state's role in these areas. Consistent with the goals and objectives of the Idaho Water Resource Board, and through the water planning process mandated by the Idaho Legislature, the following designations and recommendations are made to protect and manage the water resources of the Henrys Fork of the Snake River.

State River Designations

The river reaches designated as state protected rivers have outstanding fish and wildlife, recreation, aesthetic or geologic values. These reaches are identified on maps in the appendix showing potential hydropower and reservoir sites. Having considered these values and balanced them with other river uses, the Water Resource Board has determined that the value of preserving the reach for these particular uses outweighs use of the waterway for other uses (Idaho Code 42-1734A). Existing uses will continue, and in many cases some other new uses will be allowed. This judgement is influenced to a large degree by current values. Where the designation of a state protected river precludes a project or development, the Board will consider requests from individuals to amend a component of the comprehensive state water plan on a case-by-case basis. The Board will amend the plan whenever the balance of competing uses changes. The determination shall be based on their evaluation of the impact of such change on the protection and preservation of the state's waterways, its economic impact on the state as a whole, whether it effects existing water rights, whether it is necessary to provide adequate and safe water for human consumption, and whether it is necessary to protect life. Where the Water Resource Board has not prohibited activities, this plan does not exempt persons from meeting normal regulatory requirements such as stream channel alteration permits, Department of Lands easements, water right permits, etc.

The comprehensive water planning legislation protects approved applications for the appropriation of water and other property rights from restrictions developed as part of the planning process. A water user may maintain or replace a water diversion structure, and may remove obstructions from the stream channel that interfere with the delivery or use of water.

There are many other river lengths that have some outstanding values, however, other uses or potential uses are significant. These streams or stream segments are not afforded protected river status at this time. A significant degree of protection exists for these other river areas because of well established federal and state agency regulatory programs. By choosing not to designate other state protected rivers at this time, the state does not endorse or support any specific development plans on any undesignated river reach.

1. Targhee Creek, including West and East Forks: from source to National Forest boundary (12.5 miles) - Natural

- Within Lionhead Roadless area.
- Grizzly bear and peregrine falcon habitat.

- Important spawning habitat for cutthroat and brook trout.

Targhee Creek, including West and East Forks, from sources to the Targhee National Forest boundary (Forest Route 057 bridge) is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

2. Henrys Fork: Big Springs to Island Park Reservoir (11 miles) and the lower 2 miles of Henrys Lake Outlet - Recreational

- Outstanding fishery values; national and international recognition, very high use rate per mile and a trophy fishery.
- Outstanding recreational values.
- Outstanding aesthetic values - the river is the focal point of large summer recreational use.
- Contains the first National Water Trail - from the abandoned railroad trestle crossing below Big Springs to U.S. Highway 20 bridge at Macks Inn.
- Major area of floating use from Big Springs to Upper Coffee Pot Rapids - the majority of the floaters are from out-of-state.
- Has one identified small potential hydroelectric project at Coffee Pot Rapids. A 45- foot drop within one-half a mile which could produce an average of 1,000 KW.
- No identified irrigation potential.

The Henrys Fork from Big Springs to Island Park Reservoir (McCrae Bridge) is designated a state recreational river. Also designated a state recreational river is the last two miles of Henrys Lake Outlet (also known as the Henrys Fork) starting at the beginning of the Forest Service land between Sections 29 and 30 near the Forest Boundary and ending at the mouth in Section 32, all in T. 14 N., R. 44 E. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

The good water quality in this river section is very important to its continued recreational use. The large amount of ground-water inflow below the springs combined with the gravel materials underlying many recreational homesite areas creates a situation requiring close monitoring of water quality in this river section.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at Big Springs of past and present forest management practice in the ground-water basin above the spring which includes the Thirsty Creek drainage.

3. Henrys Fork: Island Park Dam to Riverside Campground (16 miles) - Recreational

- Outstanding fishery values from Island Park Reservoir to U.S. Highway 20 crossing - has national and international recognition with very high use rates per mile and a trophy fishery.
- Outstanding recreational values and use from Island Park to Riverside Campground.
- Outstanding aesthetic values - the middle reach from the Box Canyon settlement to the Pine Haven subdivision is in an outstanding pastoral setting while the reaches at the upstream and downstream ends generally would be considered as having outstanding limited canyon environments.
- A major area of floating use from Island Park Reservoir to Riverside Campground.
- Has a limited hydroelectric potential partially in a short area in the upstream area near Island Park Reservoir.
- No identified irrigation potential.
- Year-round minimum stream flow of 300 cfs from mouth of Buffalo River to end of reach.

The Henrys Fork from the downstream right-of-way line of the U.S. Bureau of Reclamation Island Park Dam to the section line between Sections 24 and 25, T. 11 N., R. 42 E., located approximately one-fourth mile below Riverside Campground, is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct fishery enhancement facilities and public access facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

4. Golden Lake, Silver Lake and Thurman Creek from Golden Lake to mouth (4 miles) - Recreational

- Smaller sized water bodies: Golden Lake is 50 acres and Silver Lake is 150 acres.
- Lakes are somewhat shallow. Golden Lake is approximately ten feet deep, Silver lake is approximately three feet deep and is eutrophic with high summer water temperatures.
- Lakes are located generally within the special use Harriman State Park property, a pastoral setting beauty spot of the basin.
- Lakes are managed so no development can take place around them, lake level is not drawn down.
- Trumpeter swans nest on the shorelines. A significant portion of the local breeding population nest in this area.
- The lakes are an outstanding aesthetic natural resource.

Golden Lake, Silver Lake and Thurman Creek from Golden Lake to its confluence with the Henrys Fork, all mostly within Harriman State Park, are designated state recreational rivers (waterways). Waterways can include lakes. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction of hydropower projects;
- construction of water diversions works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, impoundments, fish and wildlife enhancement facilities and public stream access facilities and for public agencies to construct public access facilities, and fish and wildlife enhancement facilities.

Close coordination with the Idaho Department of Parks and Recreation will be necessary to ensure that their management of the lakes and creek complements this designation.

5. Henrys Fork: Riverside Campground to Hatchery Ford (4 miles) - Natural

- Outstanding fishery numbers and habitat, however, angler use is considerably reduced from upstream angler use.
- The recreational value is largely for kayaking use and is very good to outstanding. Actual recreational use is reduced from upstream recreation use, however, recreation use appears to be increasing.
- The aesthetic values relate to a mountain evergreen-covered canyon area without access except at the end points of this river area. Most viewers rate the canyon aesthetic values as outstanding.
- There is hydroelectric potential in this river reach.
- Year-round minimum stream flow of 300 cfs through the reach.

The Henrys Fork from the section line between Section 24 and 25, T. 11 N., R. 42 E., located approximately one-fourth mile below Riverside Campground to a point 100 feet upstream of the

Forest Service boat ramp at Hatchery Ford is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

6. Henrys Fork: 100 feet upstream of the Hatchery Ford boat ramp to a point 300 feet downstream of the ramp (approximately 400 feet) - Recreational

- This one-twelfth mile reach is extremely scenic because of its canyon environment.
- A concrete boat ramp is used as a take-out point for floaters from up river. Kayakers access the river here for whitewater runs to Sheep Falls or Upper Mesa Falls.
- The boat ramp access detracts from the naturalness of the setting.
- Improved recreational access will be needed in the future for this area.
- The Fremont County Commissioners filed for a Federal Energy Regulatory Commission permit to study the hydroelectric potential of the site as a diversion point for a pumped storage project that would use Ashton Reservoir as the release point. On November 22, 1991 the Federal Energy Regulatory Commission denied the request based on the federal prohibition against hydropower construction on this reach of the Henrys Fork.
- Year-round minimum stream flow of 300 cfs through the reach.

The Henrys Fork from a point 100 feet upstream of the Forest Service boat ramp to a point approximately 300 feet downstream of the ramp, is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments.
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed;

7. Henrys Fork: Hatchery Ford boat ramp to National Forest Boundary near Warm River (13 miles) - Natural

- This reach from Hatchery Ford to Upper Mesa Falls has outstanding aesthetic values as a river canyon environment. Sheep Falls has a 35-foot drop. Upper Mesa Falls is a spectacular single drop of 160 feet (compared to the Niagara Falls drop of 182 feet; the respective water flow is 1,000 cfs versus 200,000 cfs). One mile downstream, Lower Mesa Falls has a constricted cascade of 65 feet. These falls have statewide significance.
- The geologic aspects of the reach below Upper Mesa Falls are outstanding.
- The Upper Mesa Falls visitors area receives heavy use. The river area below Lower Mesa Falls is used by a small number of floaters who have a high regard for the faster water in this reach. In the area from Lower Mesa Falls past the Forest Boundary to the Highway 20 bridge, there is commercial river guiding activity and significant noncommercial recreation use. Angler use is much lower than upriver areas, perhaps because of limited access.

- Outstanding fish numbers and habitat exist in this river reach. Above Upper Mesa Falls angler use is restricted because of limited access.
- Year-round minimum stream flow of 300 cfs to one mile above Upper Mesa Falls, one mile above Upper Mesa Falls to one mile below Lower Mesa Falls: 300 cfs 10/1-3/31, 1000 cfs 4/1-9/30.

The Henrys Fork from a point 300 feet downstream of the Hatchery Ford boat ramp to the southern boundary of the Targhee National Forest near the mouth of Warm River is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

8. Henrys Fork: Forest Boundary near Warm River to Ashton Reservoir (8 miles) - Recreational

- The geologic aspects of the canyon change slightly near the forest boundary because of a decreased gradient in the river.
- The visual impact of the river also changes slightly near the forest boundary since the south-facing slopes of the canyon become nonforested. The aesthetic values for the reach are very high. The canyon ends two miles upstream from the highway crossing.
- The reach is heavily fished.
- The recreation classification is high because of the boating and fishing activity.
- Some hydroelectric potential exists.

The Henrys Fork from the southern boundary of the Targhee National Forest near Warm River to the U.S. Highway 20 bridge near the upstream limit of Ashton Reservoir is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new water diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to installations which have the main riverbed structure located below the water level and blended with the riverbed or to pumping installations which do not create an obstruction in the river, and are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

9. Henrys Fork: Ashton Dam to Falls River (6 miles) - Recreational

- The fishery in this reach is classified as good to outstanding, and is heavily used.
- The identified Lower Ashton hydroelectric site is located in this reach.

The Henrys Fork from the south property line of the Utah Power and Light Co. Ashton Dam property to the confluence with the Falls River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alteration is prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new water diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

10. Buffalo River - (8) miles and Elk Creek (1 mile) - Recreational

- The fishery use is very good to outstanding. The proposed addition of a fish ladder over the Ponds Lodge hydroelectric impoundment should further improve the fishery.
- Elk Creek below Elk Creek Reservoir and the seven-mile stretch of the Buffalo River above the U.S. Highway 20 bridge generally are classified as having outstanding aesthetic qualities. The Buffalo River Springs at the upper end of this designated area are particularly scenic.
- Recreational use of this river area is substantial.
- Sandhill cranes frequent the area.
- The identified Buffalo River project at the upper end of this river area has hydroelectric potential.

The Buffalo River from the springs (in the SW 1/4 of Sec. 21, T. 13 N., R.44 E.) to its confluence with the Henrys Fork and Elk Creek from below the right-of-way line of Elk Creek Dam to its confluence with the Buffalo River are designated state recreational rivers. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

The construction of hydropower projects is prohibited except for the rebuilding of the Ponds Lodge hydropower facility.

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities including bridges and fishery enhancement facilities; and for new diversion works including those associated with the rebuilding and upgrading of the Ponds Lodge hydroelectric project providing the conditions of the stream channel permit process are met.

Construction or expansion of dams or impoundments are prohibited unless associated with the rebuilding and upgrading, including a raise in the water level, of the Ponds Lodge project.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation of this river reach, attention is directed to the fact there are occasional fences across the river reach. Provisions need to be made so boaters can navigate down the river area without restriction. State law prohibits restricting navigation. Assistance to landowners in providing alternate livestock control measures would be helpful.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at the Buffalo River Springs of past and present forest management in the ground-water basin above the springs.

11. Warm River: Partridge Creek to the Forest Route 153 bridge (approximately 1/4 mile) - Natural

- This stream is quite small during the nonrunoff season.
- This reach is the upper end of a river reach that qualifies as a state natural river.
- The bridge detracts from the naturalness of the setting.
- Use of the fishery is low.

The Warm River from its confluence with Partridge Creek downstream to a point 100 feet upstream of the Forest Route 153 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(6) the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

12. Warm River: Forest Route 153 bridge area (approximately 200 feet) - Recreational

- The recreational use of this reach is low.
- Use of the fishery is low.

- The bridge detracts from the naturalness of the setting.

The Warm River from a point 100 feet upstream of the Forest Route 153 bridge (in the NW 1/4 of Sec. 20, T. 44 E., R. 11 N., B.M.) to a point 100 feet downstream of the bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain, improve, or replace the bridge.

13. Warm River: Forest Route 153 bridge to Forest Route 154 bridge (7 miles) - Natural

- The recreational use of the reach is low, although access is provided at both ends.
- The stream is quite small except during the runoff season.
- The hydroelectric potential is low because of the limited water flow.
- The aesthetic value is quite high.

The Warm River from a point 100 feet downstream of the Forest Route 153 bridge to a point 100 feet upstream of the Forest Route 154 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

14. Warm River: Forest Route 154 bridge area (approximately 200 feet) - Recreational

- The bridge is located at the Warm River Fish Hatchery site. The hatchery is not operational, but the buildings and bridge detract from the naturalness of the setting.
- This is the access point to view Warm River Springs, an outstanding aesthetic value.
- The hatchery buildings have value as an historic site.

The Warm River from a point 100 feet upstream of the Forest Route 154 bridge (in the SW 1/4 of Sec. 10, T. 44 E., R. 44 E., B.M.) to a point 100 feet downstream of the bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain, improve, or replace the bridge.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at Warm River Springs of past and present forest management practices in the ground-water basin above the Warm River Springs.

15. Warm River: Forest Route 154 bridge to Warm River Campground (7 miles) - Natural

- Year-round minimum stream flow of 141 cfs from Warm River Springs to mouth.
- The aesthetic values are tied to the canyon, and are high to outstanding. The cascades are particularly scenic.
- The hydroelectric potential is low, although some offstream development might be possible.
- Fishery values are high, although use is low. The reach is used as a spawning area.

The Warm River from a point 100 feet downstream of the Forest Route 154 bridge to a point 100 feet upstream of the bridge near the upstream edge of Warm River Campground (in the SW 1/4 of Sec. 7, T. 9. N., R. 44 E., B. M.) is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

16. Robinson Creek: from Yellowstone Park boundary to Forest Route 241 bridge (10 miles) - Natural

- Scenic canyon environment.
- Important spawning habitat for rainbow and brown trout.
- Grizzly bear habitat.

Robinson Creek from the Yellowstone National Park boundary to a point 100 feet upstream of the Forest Route 241 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

17. Robinson Creek: Forest Route 241 bridge to mouth (4 miles) - Recreational

- Important spawning habitat for rainbow and brown trout.
- Bridge crossing at both ends of reach.

Robinson Creek from a point 100 feet upstream of Forest Route 241 bridge to its confluence with Warm River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to repair or replace existing bridges.

18. Rock Creek: from Yellowstone Park boundary to mouth (9 miles) - Recreational

- Important trout spawning habitat.
- Grizzly bear habitat.
- Several potential dam sites may be technically feasible.

Rock Creek from the Yellowstone National Park boundary to its confluence with Robinson Creek is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to repair or replace existing bridges.

19. Falls River: Idaho border to a point 100 feet upstream of the Yellowstone Diversion Dam (7 miles) - Natural

- The recreational value of this river reach is outstanding, although the actual use is quite low largely because of limited access.
- The aesthetic value of this river reach is outstanding because of its pristine condition.
- Sheep Falls is a scenic drop of about 30 feet, and is an outstanding visual resource.
- The hydroelectric potential of this river reach is significant.

The Falls River from the Idaho border to a point 100 feet upstream of the upstream right-of-way boundary of the Yellowstone Diversion Dam, is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;

- mineral or sand and gravel extraction within the streambed.

20. Falls River: from 100 feet upstream of the Yellowstone Diversion Dam to Kirkham Bridge (11 miles) - Recreational

- The reach has considerable potential for recreation use.

The Falls River from a point 100 feet upstream of the upstream right-of-way boundary of Yellowstone Diversion Dam to the Kirkham Bridge, located in Sections 2 and 3 along the northern boundary of T. 8 N., R. 43 E., is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

The construction of water diversion works is prohibited except for those associated with off-stream storage projects. The Water Resource Board can not support any project at this time since feasibility studies are not available for consideration. The existing water-right process provides opportunity for the public and the Water Resource Board to be involved in the approval of any potential project.

Stream channel alterations are prohibited except those necessary to maintain, improve, or relocate existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new off-stream storage projects; and for public agencies to construct public access facilities and fishery enhancement facilities.

The Falls River (FERC #9885) hydropower project will use the existing Marysville Canal diversion. This project has received a FERC license, and as such is considered a vested right by the Warer Resource Board. The prohibitions associated with this state protected river designation, therefore, do not apply to this project.

21. Boone Creek: Idaho border to mouth (4 miles) - Natural

- Outstanding fish habitat.
- Outstanding wildlife values.
- Potential site for a high dam and reservoir.

Boone Creek from the Idaho border to its conflence with Falls River is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

22. Conant Creek: Idaho border to National Forest boundary (6 miles) - Natural

- Moose winter range.
- Trout spawning habitat when water is available.

Conant Creek from the Idaho border to the Targhee National Forest boundary is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

23. Conant Creek: National Forest boundary to Conant Creek diversion structure (3 miles) - Recreational

- Moose winter range.
- Trout spawning habitat when water is available.

Conant Creek from the Idaho border to the Targhee National Forest boundary is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticable from the river; are providied with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

24. Teton River: Trail Creek to Highway 33 (14 miles) - Recreational

- The fishery values of the reach and its tributaries are outstanding.
- The reach and its tributaries contains outstanding wildlife habitat with water-dependent species present; used by Idaho species of concern.
- The scenic values of the area are extremely high.

The Teton River from its confluence with Trail Creek to the Highway 33 bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, impoundments, fish and wildlife enhancement facilities and public stream access facilities, and for public agencies to construct public access facilities and fish and wildlife enhancement facilities.

25. Teton River: Highway 33 to Felt Dam (11 miles) - Recreational

- The reach is an identified whitewater run.
- There is a year-round minimum stream flow from the bridge to the confluence with Bitch Creek of 106 cfs.
- Most of the reach is in a canyon setting.
- There is an existing hydropower project with an impoundment approximately three-quarters of a mile long at the end of the reach, and the potential exists for additional projects.
- There are a number of pump diversions in the lower end of the reach.

The Teton River from the Highway 33 bridge to Felt Dam is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments.
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed;

The construction of hydropower projects is prohibited except for the Upper Teton Project (FERC #10613), located in Sec. 3, T. 6 N., R. 44 E. The Water Resource Board has reviewed this proposed project and feels that the minimum streamflow that exists will provide sufficient protection to the river in the project area.

The construction of water diversion works is prohibited except for those associated with off-stream storage projects. The Water Resource Board can not support any project at this time since feasibility studies are not available for consideration. The existing water-right process provides opportunity for the public and the Water Resource Board to be involved in the approval of any potential project.

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new off-stream storage projects; and for public agencies to construct public access facilities and fishery enhancement facilities.

26. Teton Creek: from the springs near Highway 33 to mouth (3 miles) - Recreational

- Habitat for Idaho species of concern.
- Trout spawning habitat.

Teton Creek from the springs near Highway 33 to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticable from the river; are providied with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

27. Fox Creek: from the springs to mouth (2.5 miles) - Recreational

- Habitat for Idaho species of concern.
- Trout spawning habitat.

Fox Creek from the springs for approximately 2.5 miles to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

28. Badger Creek: from the springs to mouth (3 miles) - Recreational

- Habitat for Idaho species of concern.

- Trout spawning habitat.

Badger Creek from the springs in the canyon for approximately 3 miles to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;
- mineral or sand and gravel extraction within the streambed.

29. Bitch Creek: Idaho Border to the railroad trestle (5 miles) - Natural

- The fishery values for this stream reach are outstanding, although the use levels are low.
- Other recreation use also is low, probably because access is limited.
- The canyon has high aesthetic value with conifers on both slopes.
- There is some hydroelectric potential along this stretch.

Bitch Creek from the Idaho border to the railroad trestle in the NW 1/4 of Sec.9, T. 7 N., R. 45 E. is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed
- mineral or sand and gravel extraction within the streambed;

30. Bitch Creek: Railroad trestle to Highway 32 (2 miles) - Recreational

- The fishery is outstanding.
- High aesthetic values, with a narrow valley in this reach.
- The railroad trestle and highway bridge detract from the natural setting.

Bitch Creek from the railroad trestle in the NW 1/4 of Sec. 9, T. 7 N., R.45 E. to the Highway 32 bridge, located in the NW 1/4 of Sec. 17, T. 7 N., R. 45 E., is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments.
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed;

31. Bitch Creek: Highway 32 to mouth (7.5 miles) - Natural

- This reach has an outstanding fishery, although use is low because of limited access.

- There is a year-round minimum stream flow of 28 cfs.
- There is some hydropower potential on the reach.
- The reach is an identified whitewater run.

Bitch Creek from the Highway 32 bridge to its confluence with the Teton River is designated a state natural river. If Teton Dam is rebuilt to its original height this designation shall terminate at the backwaters of the reservoir. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed
- mineral or sand and gravel extraction within the streambed;

Recommendations

1. Encourage water resource-related economic development funding for private, city, county, state and federal projects.
2. Provide minimum stream flows where necessary to protect existing uses and values.
3. All regulatory agencies should seek to protect riparian areas.
4. Encourage the screening of irrigation diversion structures to protect fishery values,where necessary or appropriate.
5. The development of new irrigation is kept as a goal and shall be encouraged through state actions where environmental values can be retained.
6. Develop programs or incentives to make water conservation more attractive to water users.
7. Cooperative basin planning is encouraged, particularly where management entities have overlapping interests.
8. Having adopted a plan for the Henrys Fork Basin, the State will oppose actions by other entities which do not recognize and are not compatible with the State's plan.
9. Having identified river reaches where the state wants the construction of hydropower projects prohibited, the state recommends modification of the Northwest Power Planning Council's protected areas designations to coincide with the river reaches identified in the basin plan.
10. Flood control studies are needed on several river reaches.
11. Encourage water conservation and the use of water bank water, in lieu of new impoundments, as a source of additional water.
12. Study the availability of the ground-water resource in the plateau areas east of St. Anthony and in the Canyon Creek area.
13. Water yield, water quality, and water development opportunities should be a planning consideration by the U.S. Forest Service and U.S. Bureau of Land Management.
14. The state should seek to insure sufficient flow in the tributaries to Henrys Lake and the tributaries to the Teton River to provide spawning habitat for the resident fishery.
15. Support the efforts of the Division of Environmental Quality, Fremont County, the Yellowstone Soil Conservation District, Idhao Department of Fish and Game, and the Henrys Lake Foundation to improve the water quality in Henrys Lake and its tributaries.

16. The state should reexamine the role of artificial recharge within the basin. Earlier studies in the Egin Bench area can provide direction to the study effort.
17. The following waterways have recreational values that deserve special recognition and stringent application of existing regulatory authorities whenever new stream-altering activities are proposed:

    Henrys Fork: confluence with Falls River to mouth
    Falls River: Kirkham Bridge to mouth
    Teton river: Bitch Creek to North Branch (Fork) - South Branch (Fork) at point of division
    Teton River: North Branch (Fork)
    Teton River: South Branch (Fork)

APPENDIX

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931-1965

Idaho Falls Airport — **IDAHO**

1931-1965

MAXIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -10	-10 TO -6	-5 TO -1	0 TO 4	5 TO 9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 TO 104	105 TO 109	110 TO 114	ABOVE 114
MAR 1							2	3	10	23	23	20	9	7	2												
MAR 8							•	2	9	11	25	25	16	5	3	2	1	1									
MAR 15								2	2	11	16	22	16	13	9	7	3	•									
MAR 22								1	2	6	11	20	21	13	12	9	6										
MAR 29										3	9	11	19	22	19	9	6	2									
APR 5											3	13	13	22	20	14	7	7	1								
APR 12											2	4	12	9	15	21	19	11	7	1							
APR 19											2	3	15	9	14	17	18	11	7	3	1						
APR 26											1	4	8	14	15	18	19	11	9	1	•						
MAY 3											•	2	3	12	16	16	15	16	14	5	2						
MAY 10											•	•	5	5	10	17	18	17	11	13	3	•					
MAY 17													1	8	14	11	16	23	11	10	5						
MAY 24													•	2	9	10	17	18	21	16	6	•					
MAY 31												•	2	4	9	11	16	22	16	13	5	1					
JUN 7													1	1	7	11	15	17	17	19	10	4					
JUN 14												•	•	1	3	6	9	16	27	20	12	5	1				
JUN 21														•	2	5	9	11	22	22	16	12	1				
JUN 28															1	2	5	11	16	24	25	15	1				
JUL 5																1	2	4	7	26	35	23	3				
JUL 12																	1	2	6	20	35	26	10	•			
JUL 19																	•	1	5	18	32	33	11	•			
JUL 26																	1	2	8	20	37	28	4				
AUG 2																•	•	2	8	25	39	19	6	•			
AUG 9																	2	3	7	25	34	25	4				
AUG 16															•	•	2	7	9	22	35	25	1				
AUG 23															1	2	6	9	16	31	28	7	•				
AUG 30														•	•	2	8	15	23	27	17	7	1				
SEP 6														1	1	5	10	16	16	29	19	3	•				
SEP 13											1		1	3	5	14	9	16	19	21	9	2					
SEP 20													2	5	9	12	14	18	18	17	5						
SEP 27												•	2	6	9	12	14	22	25	8	2	•					
OCT 4												2	7	7	10	13	11	24	21	5							
OCT 11											•	•	6	10	13	16	24	20	10	1							
OCT 18									•	1	2	6	9	12	13	20	22	12	2								
OCT 25										•	4	11	15	14	14	16	13	•	1								
NOV 1								•	4	5	11	14	19	15	14	9	7	1									
NOV 8								2	2	11	11	17	16	19	10	9	4										
NOV 15						•	•	1	7	14	18	15	14	11	9	2	•	•									
NOV 22							•	2	11	15	22	16	15	9	7	2											
NOV 29							•	4	11	23	20	20	15	6		1											
DEC 6						2	3	3	10	19	22	24	11	5	2	2											
DEC 13				•		•	3	5	11	14	24	23	12	5	1	1											
DEC 20						•	2	6	9	17	27	17	14	5	3	•											
DEC 27						1	2	5	16	21	22	23	8	2	•												
JAN 3			1	7		4	7	10	14	21	15	15	9	2	•												
JAN 10		1		1		2	2	9	13	21	22	20	7	2													
JAN 17	•		1	7		2	4	9	16	21	20	14	8	1	•												
JAN 24				1		2	6	10	14	16	22	20	7	2	•												
JAN 31				•		2	3	5	13	13	17	28	9	6	2	2	•										
FEB 7		•	•	1		1	2	5	10	16	19	24	11	7	2	2											
FEB 14				•		•	2	5	10	15	17	27	15	5	3	•											
FEB 21						•	3	2	5	9	18	27	19	10	7	•											
FEB 28							2	5	5	9	14	26	21	14	5												

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

BEGINNING DATE	MEAN MAXIMUM	STANDARD DEVIATION	HIGHEST OF RECORD
MAR 1	37.2	8.3	59
MAR 8	40.4	9.0	72
MAR 15	45.0	9.9	70
MAR 22	47.6	9.9	69
MAR 29	51.0	9.0	72
APR 5	54.8	9.1	79
APR 12	60.6	9.9	81
APR 19	60.6	10.7	85
APR 26	61.1	10.0	85
MAY 3	65.0	10.1	87
MAY 10	67.7	10.4	93
MAY 17	69.4	9.7	89
MAY 24	71.6	9.0	91
MAY 31	70.6	10.0	93
JUN 7	73.6	9.8	93
JUN 14	76.3	9.0	97
JUN 21	78.5	9.1	95
JUN 28	81.3	8.0	96
JUL 5	85.3	6.3	97
JUL 12	87.3	5.5	104
JUL 19	87.9	5.5	101
JUL 26	86.5	5.7	98
AUG 2	85.8	5.7	100
AUG 9	85.8	5.9	99
AUG 16	84.8	6.4	97
AUG 23	80.8	7.2	95
AUG 30	79.1	7.7	99
SEP 6	77.7	8.2	95
SEP 13	73.0	10.3	91
SEP 20	70.3	9.9	87
SEP 27	69.2	9.1	90
OCT 4	66.4	10.2	82
OCT 11	64.1	8.8	83
OCT 18	59.5	10.0	78
OCT 25	55.7	9.8	79
NOV 1	48.7	10.4	72
NOV 8	46.6	10.3	67
NOV 15	41.0	10.7	70
NOV 22	40.2	9.6	64
NOV 29	37.7	8.0	63
DEC 6	32.7	9.9	60
DEC 13	32.2	9.3	59
DEC 20	32.5	8.9	55
DEC 27	30.1	8.1	54
JAN 3	27.0	10.6	51
JAN 10	26.6	9.3	48
JAN 17	27.1	10.3	51
JAN 24	29.3	9.3	53
JAN 31	32.1	10.4	60
FEB 7	32.4	10.4	58
FEB 14	33.3	9.2	55
FEB 21	36.2	9.7	59
FEB 28	36.3	9.4	51

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MINIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -40	-40 TO -36	-35 TO -31	-30 TO -26	-25 TO -21	-20 TO -16	-15 TO -11	-10 TO -6	-5 TO -1	0 TO 4	5 TO 9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	ABOVE 84
MAR 1							•	1	•	3	5	11	14	19	17	19	9	2									
MAR 8									1	2	6	7	8	13	24	24	13	1	•								
MAR 15										1	2	7	5	9	22	33	17	3	•								
MAR 22										•	1	5	4	9	21	28	26	3	3								
MAR 29											•	•	3	5	18	30	27	13	3								
APR 5														3	14	34	34	12	3	1							
APR 12														2	8	25	32	24	8	2							
APR 19														1	7	20	28	26	15	3	•						
APR 26															2	16	28	29	22	2	•						
MAY 3															1	9	24	30	24	10	1	•					
MAY 10															1	8	18	29	27	14	3						
MAY 17																2	15	27	31	21	2	1	•				
MAY 24																1	9	20	29	28	13	•					
MAY 31																1	7	16	30	34	10	1					
JUN 7																	3	13	33	31	18	1					
JUN 14																	•	9	28	36	23	3	•	•			
JUN 21																	•	7	20	35	27	10	2				
JUN 28																	1	4	18	34	31	11	2				
JUL 5																		1	10	26	42	16	5	•	•		
JUL 12																		•	5	23	42	23	7				
JUL 19																		1	5	19	46	21	9	•			
JUL 26																		1	3	14	49	20	12	2			
AUG 2																	•	•	10	26	32	24	6	1			
AUG 9																		•	10	31	34	16	7	•			
AUG 16																	•	3	12	38	34	10	3	•			
AUG 23																	1	6	24	30	30	8	1				
AUG 30																	5	13	31	25	20	7	1				
SEP 6																1	6	19	33	28	10	4	•				
SEP 13															1	9	11	22	37	20	5	1					
SEP 20															1	7	15	35	27	13	2	•					
SEP 27															3	11	24	34	18	7	4						
OCT 4															4	9	33	34	16	5	1						
OCT 11													1	6	12	30	36	14	1			1					
OCT 18													2	14	29	34	15	5	1								
OCT 25												•	6	18	30	31	9	5	1								
NOV 1											2	3	4	15	22	26	21	7	•	•							
NOV 8											2	3	8	14	27	22	16	7	•	•							
NOV 15							•	1	2	2	6	9	16	21	25	11	7	•									
NOV 22								1	1	3	7	16	11	22	23	13	3	•									
NOV 29									3	5	7	18	18	20	20	10	1										
DEC 6						2	1	1	3	10	11	14	16	16	17	8	1										
DEC 13					•	1	2	2	7	9	10	18	18	12	12	6	2										
DEC 20							1	2	6	10	9	16	16	13	16	10	2	•									
DEC 27				•		1	1	3	6	15	16	16	15	15	7	5											
JAN 3				1	1	3	5	6	8	12	11	10	16	15	9	3	1										
JAN 10			•	•	1	1	3	6	5	13	16	13	17	11	10	4											
JAN 17			•	1	1	2	2	8	7	14	14	14	16	6	6	5	1										
JAN 24					1	3	5	4	9	11	17	14	11	11	10	4	1										
JAN 31				•	1	1	3	4	5	11	14	14	12	14	14	5	1	•									
FEB 7		•	•	•	1		2	4	5	12	11	13	14	11	16	10	2										
FEB 14				•	•	2	3	5	7	8	11	9	10	15	18	11											
FEB 21						1	2	3	5	7	8	8	14	23	20	6	2										
FEB 28					2	2		7		5	5	16	9	21	21	7	5										

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

BEGINNING DATE	MEAN MINIMUM	STANDARD DEVIATION	LOWEST OF RECORD
MAR 1	17.8	10.0	-16
MAR 8	20.3	9.5	-10
MAR 15	23.0	8.2	-3
MAR 22	25.2	7.8	-1
MAR 29	28.1	6.7	1
APR 5	29.4	5.5	15
APR 12	32.1	5.8	17
APR 19	33.5	6.2	19
APR 26	34.9	5.7	22
MAY 3	37.1	6.1	24
MAY 10	38.3	6.3	23
MAY 17	40.2	5.9	25
MAY 24	42.8	5.8	26
MAY 31	43.2	5.6	27
JUN 7	44.5	5.2	31
JUN 14	46.1	5.1	34
JUN 21	47.8	5.6	34
JUN 28	48.1	5.4	33
JUL 5	51.0	5.2	38
JUL 12	52.0	6.9	39
JUL 19	52.5	5.0	37
JUL 26	53.2	5.1	38
AUG 2	51.4	5.4	34
AUG 9	50.8	5.4	35
AUG 16	49.4	5.0	34
AUG 23	47.4	5.4	32
AUG 30	45.4	6.4	30
SEP 6	43.4	5.8	26
SEP 13	40.5	6.2	21
SEP 20	38.4	5.8	22
SEP 27	36.5	6.3	22
OCT 4	35.1	5.6	20
OCT 11	34.2	5.8	18
OCT 18	30.1	5.8	15
OCT 25	28.6	6.0	13
NOV 1	24.8	7.7	2
NOV 8	23.4	8.0	0
NOV 15	21.4	9.8	-15
NOV 22	20.4	9.2	-9
NOV 29	18.0	8.8	-5
DEC 6	15.6	11.5	-20
DEC 13	13.7	11.8	-21
DEC 20	15.9	11.4	-11
DEC 27	12.2	10.8	-26
JAN 3	9.6	13.9	-30
JAN 10	10.6	12.4	-33
JAN 17	8.2	13.6	-35
JAN 24	9.4	13.0	-25
JAN 31	12.8	12.8	-29
FEB 7	13.9	13.4	-37
FEB 14	13.7	13.9	-28
FEB 21	16.8	12.0	-18
FEB 28	16.3	13.8	-22

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931-1965

Ashton 15

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1931-1965

MAXIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -10	-10 TO -6	-5 TO -1	0 TO +4	+5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TU 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 TO 104	105 TO 109	110 TO 114	ABOVE 114
MAR 1							2	5	11	26	34	17	5	1													
MAR 8							1	1	8	15	34	25	12	1	2	1											
MAR 15							*	2	2	11	28	30	17	5	3	*	*										
MAR 22								1	3	9	21	31	20	9	4	1	*										
MAR 29								1	1	5	15	30	25	15	7	1	1										
APR 5									*	*	8	20	24	21	9	7	3	3	*								
APR 12											2	7	15	19	17	21	11	6	2								
APR 19										1	2	4	11	15	17	27	14	6	5								
APR 26											2	7	9	14	14	18	18	11	4	2	1						
MAY 3										*	1	2	5	8	13	18	20	18	13	3	1						
MAY 10												1	3	6	11	17	23	19	15	7	1						
MAY 17												1	2	7	8	14	23	25	11	7	2						
MAY 24														4	8	13	20	22	16	15	3	*					
MAY 31												*	1	5	7	12	20	24	16	13	3						
JUN 7													1	1	5	15	14	22	18	17	6	1					
JUN 14														1	5	5	10	27	25	19	8	1					
JUN 21															1	5	11	19	27	17	15	4	1				
JUN 28																5	5	16	24	29	17	4					
JUL 5																*	4	7	18	34	31	6					
JUL 12																*	*	3	17	30	34	14	1	*			
JUL 19																	1	2	9	34	38	9	5	1			
JUL 26																*	1	4	14	33	33	12	2	*			
AUG 2																	2	5	13	39	33	8	2				
AUG 9																*	1	6	20	30	29	11	2				
AUG 16																2	3	7	17	34	31	7					
AUG 23															1	4	7	12	24	32	15	5					
AUG 30															1	3	11	17	27	27	9	4	*				
SEP 6													*	1	3	16	20	25	25	9							
SEP 13											*			1	6	13	16	25	22	11	6						
SEP 20												*		2	4	7	14	22	24	15	11	1	*				
SEP 27														2	3	10	14	17	27	20	8	1					
OCT 4													2	3	9	12	13	17	26	16	3						
OCT 11													1	7	8	9	22	25	17	9	1						
OCT 18											1	2	8	8	13	16	22	24	6	*							
OCT 25										*	2	6	11	16	16	14	13	4	1								
NOV 1									1	3	8	11	18	21	16	11	4	2									
NOV 8								*	1	6	8	14	22	16	19	7	5	1									
NOV 15						*	*	*	2	11	18	28	16	7	9	5	3										
NOV 22								1	6	10	24	21	16	8	9	6	1										
NOV 29							*	1	5	11	23	32	15	9	2	3											
DEC 6					2	5	2	13	17	26	21	11	3	1	1												
DEC 13			*	*	1	1	4	12	16	26	22	13	2	2	1												
DEC 20					*	2	5	11	16	27	24	10	3	1													
DEC 27					1	1	7	13	28	28	20	3	*														
JAN 3			1	1	1	6	9	15	24	20	16	7															
JAN 10			1	*	1	3	7	16	22	27	15	7	*														
JAN 17		*		1	3	4	7	16	22	25	16	5	*														
JAN 24				*	1	5	10	12	18	24	21	9	*														
JAN 31					2	2	6	8	16	26	24	11	3	1	1	*											
FEB 7		1	1		*	1	4	12	16	23	28	10	2	1	2	1											
FEB 14					*	2	4	12	15	21	22	17	5	2	1												
FEB 21					*	*	2	5	14	20	29	24	5	*													
FEB 28						2	5	2	11	21	23	30	7														

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

BEGINNING DATE	MEAN MAXIMUM	STANDARD DEVIATION	HIGHEST OF RECORD
MAR 1	35.1	6.3	54
MAR 8	38.1	6.9	63
MAR 15	40.4	7.1	65
MAR 22	42.2	7.2	65
MAR 29	44.7	7.1	67
APR 5	49.2	8.4	78
APR 12	56.3	8.9	77
APR 19	58.5	9.1	78
APR 26	59.7	10.2	88
MAY 3	64.4	10.2	86
MAY 10	66.5	9.2	87
MAY 17	67.7	8.8	88
MAY 24	70.4	8.9	90
MAY 31	69.8	8.7	88
JUN 7	72.1	8.6	92
JUN 14	74.6	7.7	92
JUN 21	76.9	8.0	98
JUN 28	78.7	7.0	92
JUL 5	82.0	5.7	94
JUL 12	84.0	5.6	100
JUL 19	84.8	5.2	100
JUL 26	83.8	5.6	100
AUG 2	83.0	5.2	96
AUG 9	82.9	5.7	98
AUG 16	81.7	6.1	94
AUG 23	78.5	7.1	94
AUG 30	77.0	7.4	95
SEP 6	75.6	7.0	89
SEP 13	71.6	8.4	89
SEP 20	68.9	8.7	92
SEP 27	68.5	8.3	86
OCT 4	65.9	9.3	83
OCT 11	61.8	8.5	81
OCT 18	57.8	9.3	76
OCT 25	53.9	10.0	75
NOV 1	46.2	9.6	67
NOV 8	44.0	9.7	69
NOV 15	38.9	9.6	64
NOV 22	37.9	9.3	62
NOV 29	36.2	7.5	58
DEC 6	31.2	9.0	58
DEC 13	31.8	8.8	57
DEC 20	31.4	8.0	54
DEC 27	29.1	6.7	45
JAN 3	27.2	9.1	44
JAN 10	28.2	8.3	47
JAN 17	27.3	8.9	47
JAN 24	29.0	8.6	45
JAN 31	31.8	9.0	61
FEB 7	31.9	9.5	61
FEB 14	32.9	8.5	58
FEB 21	34.9	7.1	50
FEB 28	34.8	7.8	48

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MINIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -40	-40 TO -36	-35 TO -31	-30 TO -26	-25 TO -21	-20 TO -16	-15 TO -11	-10 TO -6	-5 TO -1	0 TO +4	+5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	ABOVE 84
MAR 1						2	1	3	7	9	12	23	18	12	12	1											
MAR 8							2	5	7	9	10	19	18	19	19	8	1										
MAR 15							1	2	6	5	9	11	22	22	16	7											
MAR 22								1	4	8	5	13	13	21	24	11	1										
MAR 29								1	*	1	6	10	15	20	24	20	3										
APR 5									*	*	2	5	14	24	30	19	4	2	1								
APR 12												2	6	14	31	32	11	4	1								
APR 19												1	3	8	29	35	14	9	1								
APR 26												*	1	7	16	44	23	8	*								
MAY 3														3	16	29	31	18	2								
MAY 10														3	7	27	40	18	5	*							
MAY 17													*	3	5	28	39	20	5								
MAY 24															4	21	27	36	11	1							
MAY 31														*	2	17	29	38	11	2							
JUN 7															2	10	23	40	20	3	1						
JUN 14															*	6	25	33	26	7	3						
JUN 21															1	7	17	37	25	11	2						
JUN 28															*	7	22	38	21	8	3	*					
JUL 5															*	2	10	36	34	14	3	1					
JUL 12																2	9	23	42	20	5						
JUL 19																1	7	26	40	20	4	3					
JUL 26																*	7	27	35	27	4	*					
AUG 2																3	8	41	31	12	5						
AUG 9																1	12	32	37	15	2	*					
AUG 16															1	4	18	40	26	11	*						
AUG 23															1	6	28	41	18	6	*						
AUG 30															3	14	29	36	16	4							
SEP 6														1	5	17	30	31	14	2							
SEP 13													*	3	11	27	32	18	7	1							
SEP 20													*	4	14	33	29	17	3								
SEP 27													2	6	20	33	28	11	*								
OCT 4												*	*	9	18	42	22	7									
OCT 11													2	6	20	43	19	8	1	*							
OCT 18											*	3	5	16	32	35	7	1	*								
OCT 25												4	12	18	36	25	4	2	*								
NOV 1								*	3	2	3	7	13	25	22	21	3										
NOV 8									4	2	6	10	16	21	24	17											
NOV 15							*	1	4	5	9	10	12	26	16	16											
NOV 22							*	3	3	7	14	13	13	19	13	13	2										
NOV 29							1	2	6	9	13	20	12	18	13	6											
DEC 6					1	3	4	7	11	10	17	16	15	10	6	*											
DEC 13			*	1	1	3	4	6	10	13	16	15	16	11	5	*											
DEC 20					1	4	3	6	11	8	20	18	12	11	6	1	*										
DEC 27					1	3	7	12	11	14	15	14	14	7	3												
JAN 3		*	1	2	2	5	9	7	10	16	14	16	11	5	2												
JAN 10			1	1	3	4	4	10	13	14	16	14	12	5	3	*											
JAN 17		*	1	2	5	4	6	13	12	16	15	9	8	5	4	*											
JAN 24				3	4	5	5	11	9	12	17	12	13	5	4												
JAN 31			1	1	2	3	4	9	13	11	13	18	12	9	5												
FEB 7	1		1	1	1	3	5	8	15	10	12	10	11	14	7												
FEB 14		*	*	1	1	3	8	7	10	10	15	16	12	10	5												
FEB 21				*	*	2	4	9	9	11	15	18	19	8	4												
FEB 28				2		2	5	14	11	5	18	18	16	5	5												

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

BEGINNING DATE	MEAN MINIMUM	STANDARD DEVIATION	LOWEST OF RECORD
MAR 1	12.0	10.4	-20
MAR 8	14.3	11.5	-14
MAR 15	16.4	10.0	-14
MAR 22	18.8	10.0	-8
MAR 29	22.6	6.4	-7
APR 5	25.0	7.3	-3
APR 12	28.8	6.1	11
APR 19	30.9	6.0	13
APR 26	32.3	5.2	12
MAY 3	34.4	5.4	23
MAY 10	35.8	5.2	20
MAY 17	35.8	5.2	18
MAY 24	38.6	5.3	26
MAY 31	39.3	5.2	24
JUN 7	40.7	5.1	27
JUN 14	42.4	5.6	29
JUN 21	43.7	5.4	34
JUN 28	42.5	5.6	29
JUL 5	44.8	5.0	29
JUL 12	46.1	5.1	30
JUL 19	46.7	5.3	31
JUL 26	46.7	4.9	34
AUG 2	44.8	5.0	32
AUG 9	44.8	5.0	31
AUG 16	43.0	5.0	30
AUG 23	41.3	4.9	26
AUG 30	39.7	5.5	25
SEP 6	38.8	5.6	22
SEP 13	35.7	6.1	19
SEP 20	34.4	5.4	18
SEP 27	32.7	5.6	18
OCT 4	32.1	5.3	11
OCT 11	31.7	5.4	16
OCT 18	27.7	6.0	8
OCT 25	26.2	6.1	11
NOV 1	22.7	8.8	-6
NOV 8	20.5	9.1	-5
NOV 15	18.6	10.3	-15
NOV 22	17.0	11.2	-13
NOV 29	14.8	10.1	-12
DEC 6	13.3	11.8	-20
DEC 13	11.0	12.0	-30
DEC 20	12.7	11.9	-17
DEC 27	9.5	11.5	-19
JAN 3	7.3	12.9	-34
JAN 10	8.4	12.7	-28
JAN 17	5.9	13.6	-35
JAN 24	7.3	13.7	-25
JAN 31	10.2	13.0	-28
FEB 7	10.7	14.2	-37
FEB 14	10.3	13.1	-35
FEB 21	12.0	11.4	-25
FEB 28	10.3	12.3	-23

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931-1965

Island Park Dam — IDAH

1937-1965

MAXIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -10	-10 TO -6	-5 TO -1	0 TO +4	5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 TO 104	105 TO 109	110 TO 114	ABOVE 114
MAR 1						1	3	10	17	31	19	14	4	2													
MAR 8							1	7	14	32	21	18	5	2													
MAR 15					1	1	1	4	12	17	22	20	12	11	1												
MAR 22						1	1	3	3	18	18	25	14	8	8												
MAR 29								1	2	6	16	30	23	16	6	1											
APR 5									1	3	15	30	28	13	5	4											
APR 12										1	8	14	26	23	17	11	1										
APR 19										1	8	13	22	23	17	11	4	2									
APR 26										2	6	18	16	17	15	17	7	3									
MAY 3										1	2	9	13	16	16	19	19	6	1								
MAY 10											1	6	10	12	16	22	16	10	7	1							
MAY 17											1	6	8	9	18	16	18	15	8	2							
MAY 24												1	5	8	12	18	25	19	11	1							
MAY 31												3	6	7	10	21	18	18	14	3							
JUN 7												1	2	6	16	15	20	19	17	4	1						
JUN 14												1	3	5	5	11	23	31	13	9	1						
JUN 21													1	4	7	12	19	21	22	12	2						
JUN 28														3	5	5	13	22	33	20	1						
JUL 5															3	1	4	16	32	36	8						
JUL 12															1		5	14	30	33	18	1					
JUL 19																1	2	9	25	42	18	3					
JUL 26															1	2	4	8	26	37	22	1					
AUG 2																3	3	11	27	36	18	3	1				
AUG 9															1		4	15	28	35	15	2					
AUG 16															1	3	5	12	25	40	15	1					
AUG 23													1	1	3	6	9	20	34	21	3	1					
AUG 30													1	1	3	9	16	21	22	19	7	2					
SEP 6													1	3	5	9	14	26	22	16	4						
SEP 13										1	1	2	3	8	9	11	20	15	20	11	1						
SEP 20											1	4	3	8	10	14	19	20	16	5							
SEP 27											1	4	6	11	12	17	19	22	9	2							
OCT 4											5	8	7	10	10	16	19	21	6								
OCT 11											3	9	12	12	16	21	13	12	2								
OCT 18									3	2	6	8	12	14	15	26	11	2									
OCT 25									1	10	12	12	13	17	13	17	4	2									
NOV 1								2	5	14	21	19	13	10	10	6	1										
NOV 8							1	5	9	19	19	13	16	13	7	1											
NOV 15				1			3	5	20	26	21	8	9	6	1		1										
NOV 22						1	4	7	18	22	27	12	7	3	2	1											
NOV 29							4	8	19	32	21	13	2	1	1												
DEC 6				1	2	2	10	16	25	19	17	5	3	1													
DEC 13			1			4	9	14	21	30	16	3	2														
DEC 20					1	4	10	12	28	30	13	3	1														
DEC 27				1	1	5	9	28	25	24	9																
JAN 3				3	5	7	13	24	20	17	11	2															
JAN 10	1		1	1	2	6	11	21	27	19	7	5	1														
JAN 17			1	2	2	5	14	19	24	21	10	3															
JAN 24			1		3	7	10	14	26	26	9	4	1														
JAN 31				2	2	4	5	13	17	32	16	7	2		1												
FEB 7						3	6	16	23	27	17	5	2	1													
FEB 14				1	2	3	3	13	19	26	19	10	4	1													
FEB 21				1	1	2	5	12	15	25	20	14	4	3													
FEB 28						6		17	11	28	19	19															

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

BEGINNING DATE	MEAN MAXIMUM	STANDARD DEVIATION	HIGHEST OF RECORD
MAR 1	32.9	7.4	54
MAR 8	34.4	6.8	52
MAR 15	37.6	8.8	57
MAR 22	40.8	8.7	59
MAR 29	43.7	7.0	60
APR 5	45.1	6.8	64
APR 12	50.0	7.5	65
APR 19	51.0	8.1	73
APR 26	52.1	9.3	73
MAY 3	56.7	9.2	77
MAY 10	60.0	9.7	80
MAY 17	61.6	9.9	82
MAY 24	64.0	8.5	80
MAY 31	64.4	9.5	82
JUN 7	66.6	8.9	87
JUN 14	68.7	8.7	89
JUN 21	70.5	8.4	88
JUN 28	73.4	7.5	87
JUL 5	77.7	6.1	88
JUL 12	79.3	5.7	90
JUL 19	80.7	5.2	94
JUL 26	79.8	5.7	90
AUG 2	79.7	5.9	96
AUG 9	79.2	5.8	93
AUG 16	78.9	6.1	90
AUG 23	74.3	7.6	90
AUG 30	73.7	8.3	91
SEP 6	71.8	8.4	87
SEP 13	67.5	10.9	89
SEP 20	65.2	10.4	84
SEP 27	63.2	10.0	81
OCT 4	60.5	11.0	78
OCT 11	57.7	9.8	78
OCT 18	54.0	10.3	72
OCT 25	49.4	10.8	70
NOV 1	43.0	9.8	66
NOV 8	39.8	9.8	61
NOV 15	34.5	9.5	69
NOV 22	34.3	8.8	63
NOV 29	32.7	6.7	56
DEC 6	28.6	8.5	52
DEC 13	28.6	7.9	47
DEC 20	28.2	7.1	46
DEC 27	25.9	6.8	39
JAN 3	24.1	9.0	40
JAN 10	25.3	8.9	46
JAN 17	25.2	8.5	45
JAN 24	26.4	8.6	48
JAN 31	28.9	8.9	55
FEB 7	29.5	7.7	51
FEB 14	30.8	8.6	52
FEB 21	31.9	8.6	53
FEB 28	31.3	7.8	44

1937-1965

MINIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -40	-40 TO -36	-35 TO -31	-30 TO -26	-25 TO -21	-20 TO -16	-15 TO -11	-10 TO -6	-5 TO -1	0 TO +4	+5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	ABOVE 84
MAR 1		1	1	3	3	5	9	11	10	9	9	11	14	8	5	1											
MAR 8			2	1	3	5	3	11	6	8	10	14	13	9	11	3											
MAR 15			1	3	3	4	3	8	7	6	10	13	11	14	6	3											
MAR 22				1	1	3	4	4	9	9	10	14	15	20	7	3											
MAR 29						1	1	3	4	7	11	15	16	17	17	7											
APR 5							1	1	1	5	7	19	20	18	18	10	1										
APR 12									1	1	5	14	19	27	23	11											
APR 19										1	2	6	13	29	28	20	3										
APR 26										1	1	5	7	22	38	21	3	2									
MAY 3												1	5	19	38	27	9	2	1								
MAY 10													2	14	30	31	20	3	1								
MAY 17													1	7	25	40	20	5	2								
MAY 24														6	14	28	29	20	4								
MAY 31														2	11	30	33	21	3	1							
JUN 7														1	7	25	39	24	3	1							
JUN 14														1	6	19	33	29	11	3							
JUN 21														1	5	21	29	32	10	3	1						
JUN 28															4	20	29	33	10	4							
JUL 5															2	9	22	30	27	7	1						
JUL 12															2	4	20	37	24	12	1	1	1				
JUL 19															1	4	19	32	31	9	4						
JUL 26																4	11	46	29	8	2						
AUG 2															1	7	25	36	22	8	2						
AUG 9															1	9	22	36	22	9	2						
AUG 16															1	21	23	29	16	9	1						
AUG 23														1	6	19	31	28	10	3	1						
AUG 30														1	10	19	28	22	11	2							
SEP 6														4	13	28	30	19	3	3							
SEP 13												1	2	8	20	37	19	12	2								
SEP 20													3	13	22	40	12	7	2								
SEP 27											1	1	3	23	33	24	11	5									
OCT 4											1	2	2	18	43	21	10	3	1								
OCT 11											1	4	7	13	36	28	10	3									
OCT 18												2	13	30	39	14	4	1									
OCT 25										2	2	9	14	31	29	11	3										
NOV 1							1	2	5	2	9	13	15	23	20	12	1										
NOV 8						1	3	1	5	6	6	12	22	23	20	3	1	1									
NOV 15			1		1	2	3	4	4	7	11	17	17	16	10	7	1										
NOV 22				1	2		4	5	8	10	6	10	15	21	12	6											
NOV 29						2	4	8	10	12	12	15	14	12	10	2											
DEC 6		1		1	2	3	8	8	8	8	15	12	12	15	6	2											
DEC 13	1	1	2	1	2	3	5	6	8	12	15	14	9	13	7	3											
DEC 20			2	3	3	4	5	4	7	12	7	15	6	10	7	2	1										
DEC 27			2	3	4	8	5	11	9	11	10	13	17	7	4	1											
JAN 3	1	1	3	3	8	7	8	7	9	9	8	13	13	6	5	1											
JAN 10	2	1	2	3	4	6	8	10	5	11	8	12	11	10	6	3											
JAN 17	2	2	2	4	4	7	10	8	10	9	7	9	15	8	5	1											
JAN 24		3	2	2	4	6	10	8	8	10	9	8	12	14	3	1											
JAN 31	2	1	1	3	4	4	4	6	11	12	10	11	13	9	8	2											
FEB 7	1	1	1	2	4	6	5	8	8	4	12	11	12	14	8	3											
FEB 14	1	1	2	3	3	9	7	6	8	6	10	13	10	10	9	1											
FEB 21	1		2	3	3	6	6	11	9	9	15	10	10	9	5	4											
FEB 28		3		6	11	3	8	11	11	17	6	8		14		3											

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

BEGINNING DATE	MEAN MINIMUM	STANDARD DEVIATION	LOWEST OF RECORD
MAR 1	2.5	15.6	-36
MAR 8	6.5	15.6	-35
MAR 15	8.5	13.6	-31
MAR 22	10.2	13.4	-29
MAR 29	15.6	10.8	-17
APR 5	18.4	8.8	-11
APR 12	20.9	7.1	-1
APR 19	24.1	6.5	3
APR 26	25.9	6.5	3
MAY 3	28.0	5.6	14
MAY 10	30.1	5.3	18
MAY 17	31.8	5.2	19
MAY 24	34.7	6.0	20
MAY 31	35.5	5.1	23
JUN 7	36.6	4.9	24
JUN 14	38.3	5.9	21
JUN 21	38.5	5.6	23
JUN 28	38.7	5.8	25
JUL 5	42.2	5.1	26
JUL 12	43.0	5.8	25
JUL 19	43.4	5.7	27
JUL 26	43.5	4.8	31
AUG 2	42.0	5.5	29
AUG 9	42.1	5.7	28
AUG 16	40.2	6.1	27
AUG 23	38.5	6.2	24
AUG 30	38.5	6.5	23
SEP 6	35.2	6.2	20
SEP 13	32.3	6.1	13
SEP 20	30.9	5.9	17
SEP 27	28.3	6.1	9
OCT 4	28.0	6.0	7
OCT 11	27.6	6.2	9
OCT 18	25.0	5.2	10
OCT 25	22.7	6.6	3
NOV 1	18.6	10.1	-11
NOV 8	16.7	10.6	-19
NOV 15	13.4	12.4	-34
NOV 22	12.3	13.2	-26
NOV 29	9.8	12.0	-20
DEC 6	6.8	14.2	-38
DEC 13	6.8	13.2	-51
DEC 20	0.2	16.9	-32
DEC 27	2.7	15.1	-34
JAN 3	0.3	16.8	-45
JAN 10	2.2	17.5	-46
JAN 17	-0.1	17.6	-60
JAN 24	1.3	17.2	-40
JAN 31	4.0	16.9	-46
FEB 7	5.5	16.7	-45
FEB 14	2.7	17.3	-47
FEB 21	3.1	16.0	-44
FEB 28	-2.7	16.5	-37

PRECIPITATION: Weekly Totals -- Average, Median and Greatest, 1931-1965

Ashton 1S

WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.33	0.22	1.28
MAR 8	0.33	0.32	1.17
MAR 15	0.29	0.16	1.94
MAR 22	0.28	0.20	1.18
MAR 29	0.32	0.22	1.37
APR 5	0.27	0.14	1.04
APR 12	0.12	0.03	0.62
APR 19	0.28	0.14	1.86
APR 26	0.40	0.36	1.70
MAY 3	0.29	0.06	1.41
MAY 10	0.34	0.21	2.04
MAY 17	0.40	0.19	2.31
MAY 24	0.36	0.19	2.41
MAY 31	0.44	0.34	2.68
JUN 7	0.42	0.35	1.95
JUN 14	0.34	0.16	1.78
JUN 21	0.38	0.18	2.25
JUN 28	0.34	0.04	2.39
JUL 5	0.17	0.02	1.03
JUL 12	0.21	0.	2.58
JUL 19	0.14	0.	0.85
JUL 26	0.17	0.05	1.22
AUG 2	0.22	0.04	2.35
AUG 9	0.24	0.06	1.49
AUG 16	0.21	0.	1.79
AUG 23	0.23	0.07	1.65
AUG 30	0.17	0.	0.98
SEP 6	0.22	0.07	1.51
SEP 13	0.32	0.14	1.84
SEP 20	0.30	0.15	1.56
SEP 27	0.22	0.	1.45
OCT 4	0.25	0.03	2.38
OCT 11	0.31	0.10	2.05
OCT 18	0.38	0.08	1.89
OCT 25	0.28	0.07	2.28
NOV 1	0.40	0.28	1.34
NOV 8	0.41	0.24	1.80
NOV 15	0.46	0.32	2.00
NOV 22	0.32	0.16	1.50
NOV 29	0.42	0.28	1.46
DEC 6	0.37	0.23	1.31
DEC 13	0.33	0.18	0.98
DEC 20	0.49	0.41	1.53
DEC 27	0.52	0.38	1.54
JAN 3	0.37	0.27	1.05
JAN 10	0.43	0.40	1.36
JAN 17	0.38	0.36	1.35
JAN 24	0.47	0.35	1.72
JAN 31	0.60	0.43	2.23
FEB 7	0.55	0.41	2.93
FEB 14	0.37	0.27	1.49
FEB 21	0.35	0.26	1.22

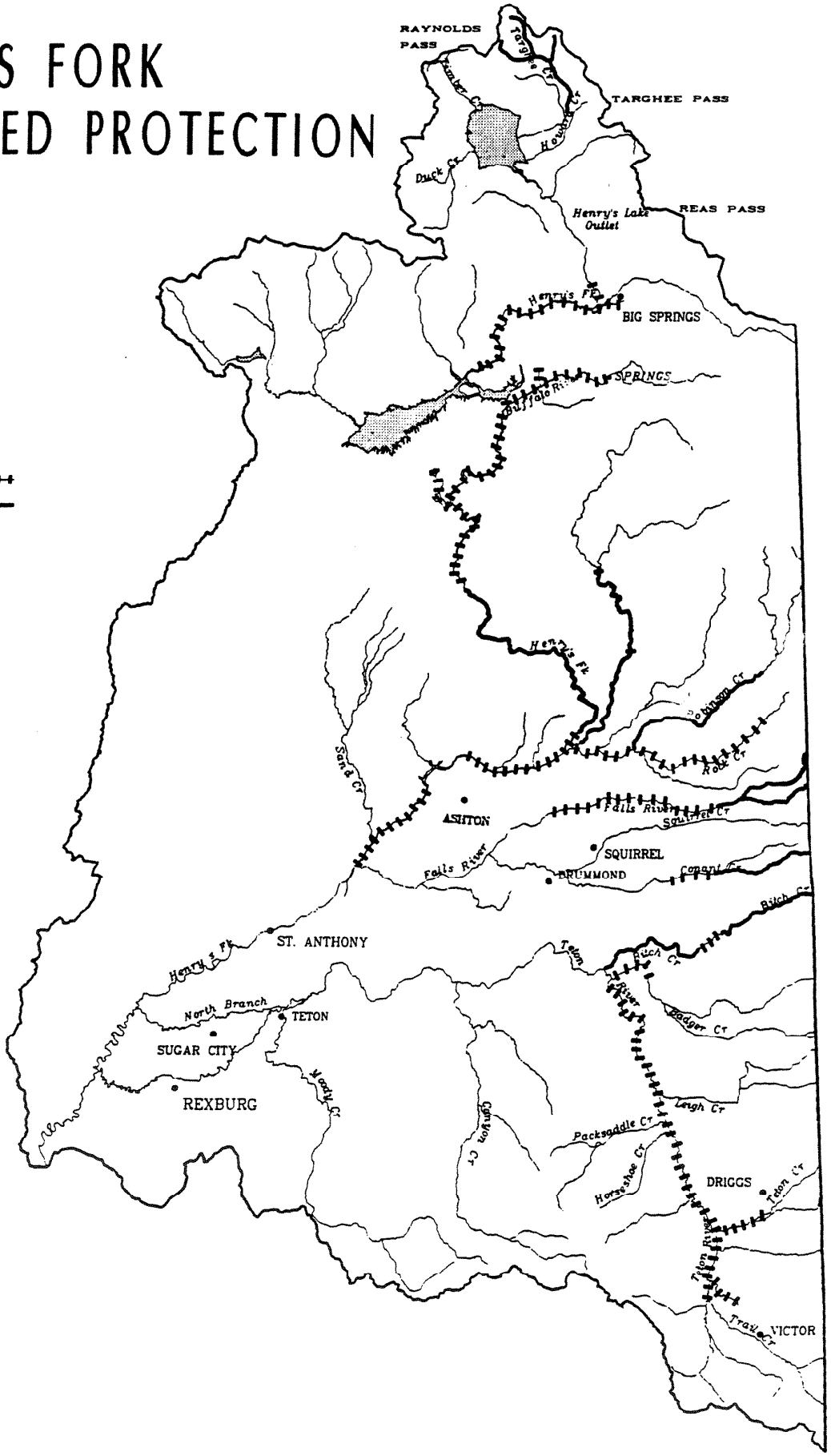
Idaho Falls Airport

WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.15	0.07	0.60
MAR 8	0.12	0.04	0.62
MAR 15	0.16	0.07	0.88
MAR 22	0.15	0.04	0.89
MAR 29	0.12	0.05	0.52
APR 5	0.18	0.07	0.97
APR 12	0.11	0.	0.88
APR 19	0.16	0.07	0.75
APR 26	0.26	0.17	1.06
MAY 3	0.17	0.07	0.49
MAY 10	0.23	0.13	1.21
MAY 17	0.27	0.09	1.77
MAY 24	0.24	0.07	1.08
MAY 31	0.46	0.30	1.77
JUN 7	0.35	0.26	1.58
JUN 14	0.23	0.07	1.54
JUN 21	0.25	0.03	1.61
JUN 28	0.12	0.	1.09
JUL 5	0.06	0.	0.46
JUL 12	0.09	0.	1.05
JUL 19	0.09	0.	0.72
JUL 26	0.11	0.	0.72
AUG 2	0.12	0.	1.39
AUG 9	0.12	0.01	1.08
AUG 16	0.10	0.01	0.53
AUG 23	0.08	0.01	0.67
AUG 30	0.09	0.	1.04
SEP 6	0.15	0.	0.90
SEP 13	0.22	0.02	1.20
SEP 20	0.19	0.05	1.01
SEP 27	0.12	0.	1.16
OCT 4	0.11	0.	1.05
OCT 11	0.14	0.04	0.91
OCT 18	0.12	0.02	0.86
OCT 25	0.14	0.05	1.26
NOV 1	0.16	0.08	0.61
NOV 8	0.19	0.07	0.72
NOV 15	0.20	0.09	1.27
NOV 22	0.10	0.03	0.60
NOV 29	0.15	0.08	0.90
DEC 6	0.14	0.10	0.45
DEC 13	0.10	0.05	0.47
DEC 20	0.24	0.16	1.28
DEC 27	0.21	0.10	1.00
JAN 3	0.16	0.09	1.09
JAN 10	0.24	0.13	1.32
JAN 17	0.21	0.12	1.16
JAN 24	0.17	0.05	1.10
JAN 31	0.26	0.12	0.94
FEB 7	0.25	0.12	1.82
FEB 14	0.12	0.05	0.45
FEB 21	0.13	0.06	0.65

Island Park Dam

WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.56	0.42	2.05
MAR 8	0.81	0.66	2.30
MAR 15	0.53	0.44	1.89
MAR 22	0.43	0.34	1.52
MAR 29	0.37	0.14	1.54
APR 5	0.45	0.29	1.65
APR 12	0.26	0.10	1.02
APR 19	0.49	0.31	2.39
APR 26	0.62	0.54	1.84
MAY 3	0.44	0.23	1.79
MAY 10	0.51	0.34	1.70
MAY 17	0.70	0.61	3.00
MAY 24	0.52	0.22	1.96
MAY 31	0.88	0.77	3.33
JUN 7	0.81	0.45	3.09
JUN 14	0.51	0.30	2.15
JUN 21	0.57	0.31	2.91
JUN 28	0.32	0.23	1.73
JUL 5	0.15	0.10	0.73
JUL 12	0.17	0.	1.67
JUL 19	0.24	0.12	1.36
JUL 26	0.34	0.14	1.78
AUG 2	0.33	0.18	2.05
AUG 9	0.28	0.12	1.78
AUG 16	0.38	0.18	2.81
AUG 23	0.28	0.10	1.72
AUG 30	0.22	0.04	0.91
SEP 6	0.34	0.23	1.40
SEP 13	0.42	0.27	1.78
SEP 20	0.38	0.20	3.27
SEP 27	0.33	0.13	1.60
OCT 4	0.34	0.18	1.24
OCT 11	0.47	0.36	2.45
OCT 18	0.44	0.13	2.61
OCT 25	0.36	0.23	2.98
NOV 1	0.57	0.45	2.65
NOV 8	0.69	0.61	3.11
NOV 15	0.71	0.59	2.55
NOV 22	0.66	0.50	2.54
NOV 29	0.61	0.45	1.90
DEC 6	0.66	0.50	2.34
DEC 13	0.72	0.48	2.20
DEC 20	0.82	0.56	3.11
DEC 27	0.84	0.68	2.57
JAN 3	0.71	0.59	2.78
JAN 10	0.71	0.53	3.05
JAN 17	0.90	0.43	5.14
JAN 24	0.82	0.65	2.94
JAN 31	0.97	0.76	2.80
FEB 7	1.04	0.74	3.78
FEB 14	0.93	0.40	1.49
FEB 21	0.77	0.63	2.55

HENRY'S FORK RECOMMENDED PROTECTION



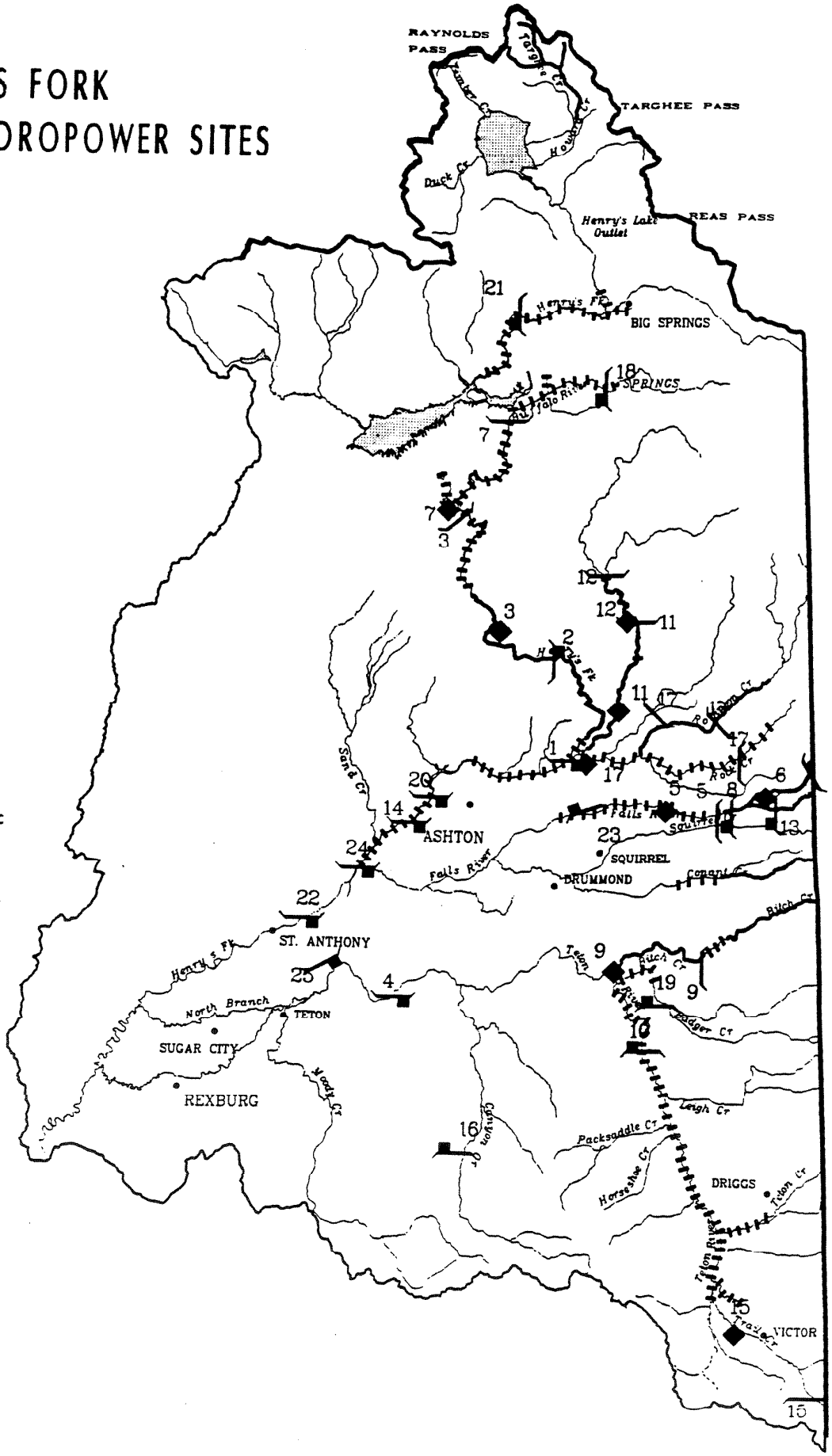
STATE DESIGNATIONS:

Recreational

Natural

HENRY'S FORK
POTENTIAL HYDROPOWER SITES

NUMBER	NAME
1	Warm River
2	Mesa Falls
3	Lookout Butte
4	Teton
5	Anderson
6	Sheep Falls
7	Last Chance
8	Squirrel
9	Judkins
10	Tetonia
11	Warm River Butte
12	Partridge
13	Boone Creek
14	Lower Ashton
15	Victor
16	Canyon Creek
17	Fish Creek
18	Buffalo River
19	Upper Badger
20	Ashton Enlargement
21	Coffee Pot Rapids
22	St. Anthony Canal
23	Marysville Drop
24	Cross-cut Diversion
25	Enterprise Hydroelectric



STATE DESIGNATIONS:

Recreational

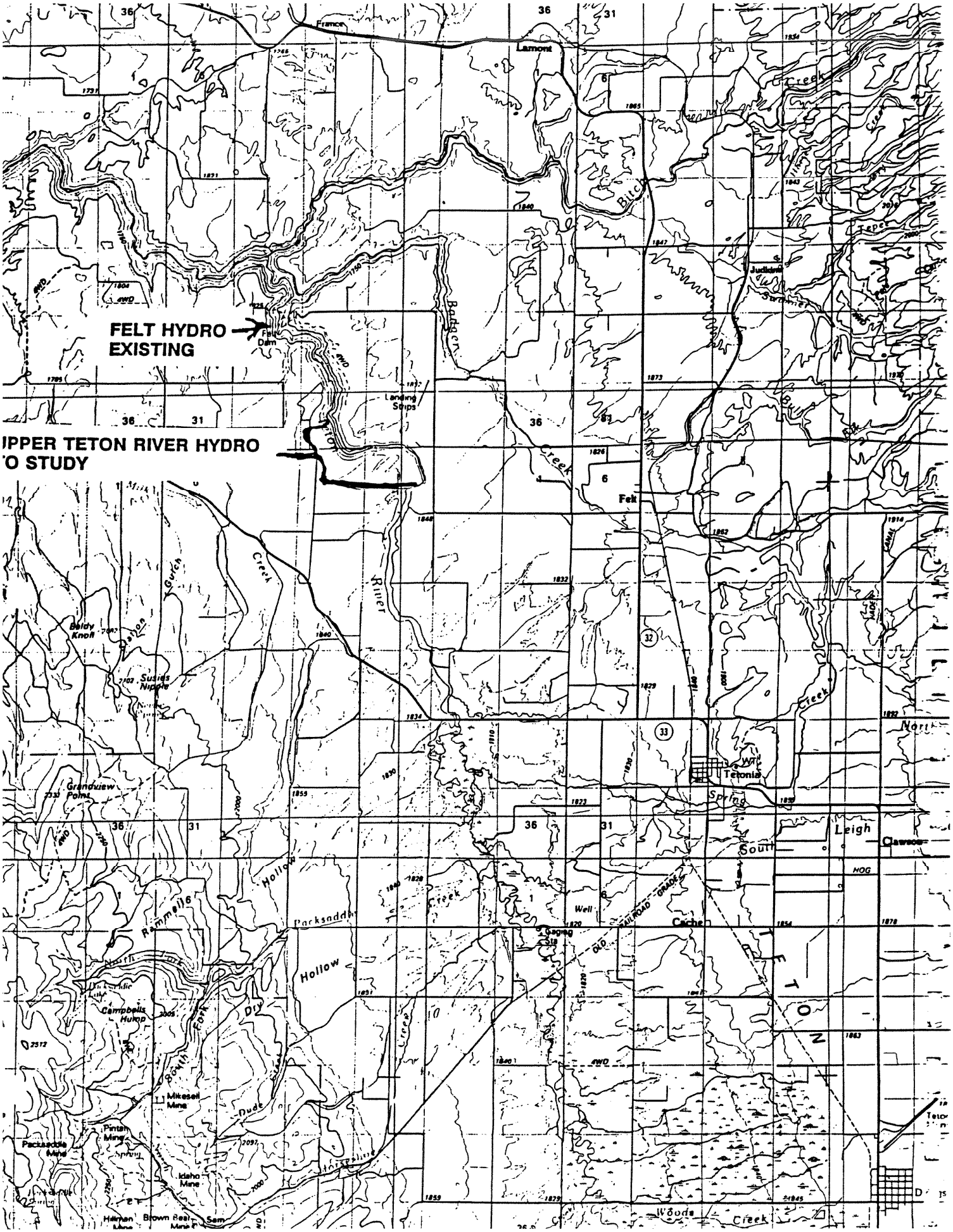
Natural

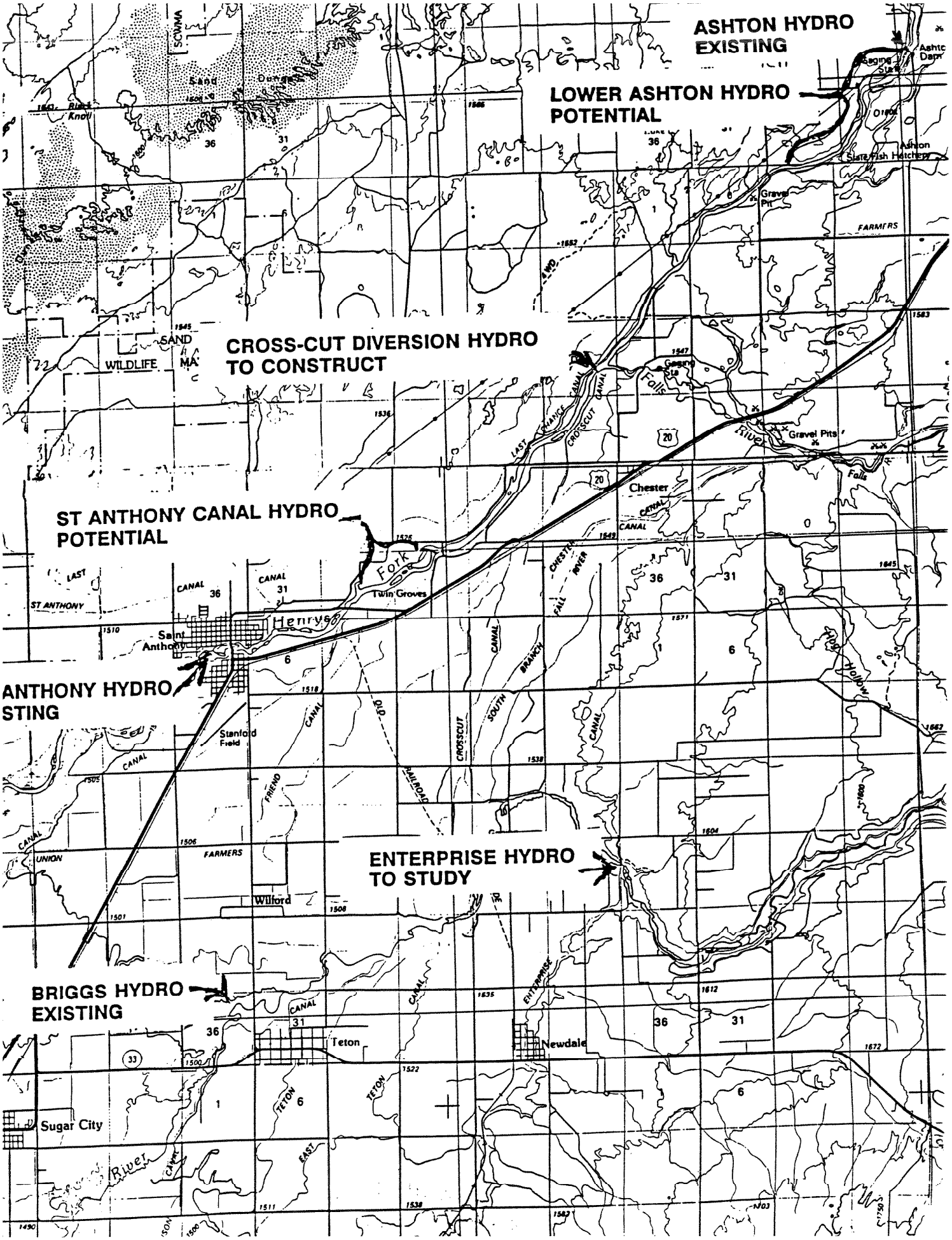
POTENTIAL HYDROPOWER SITES:

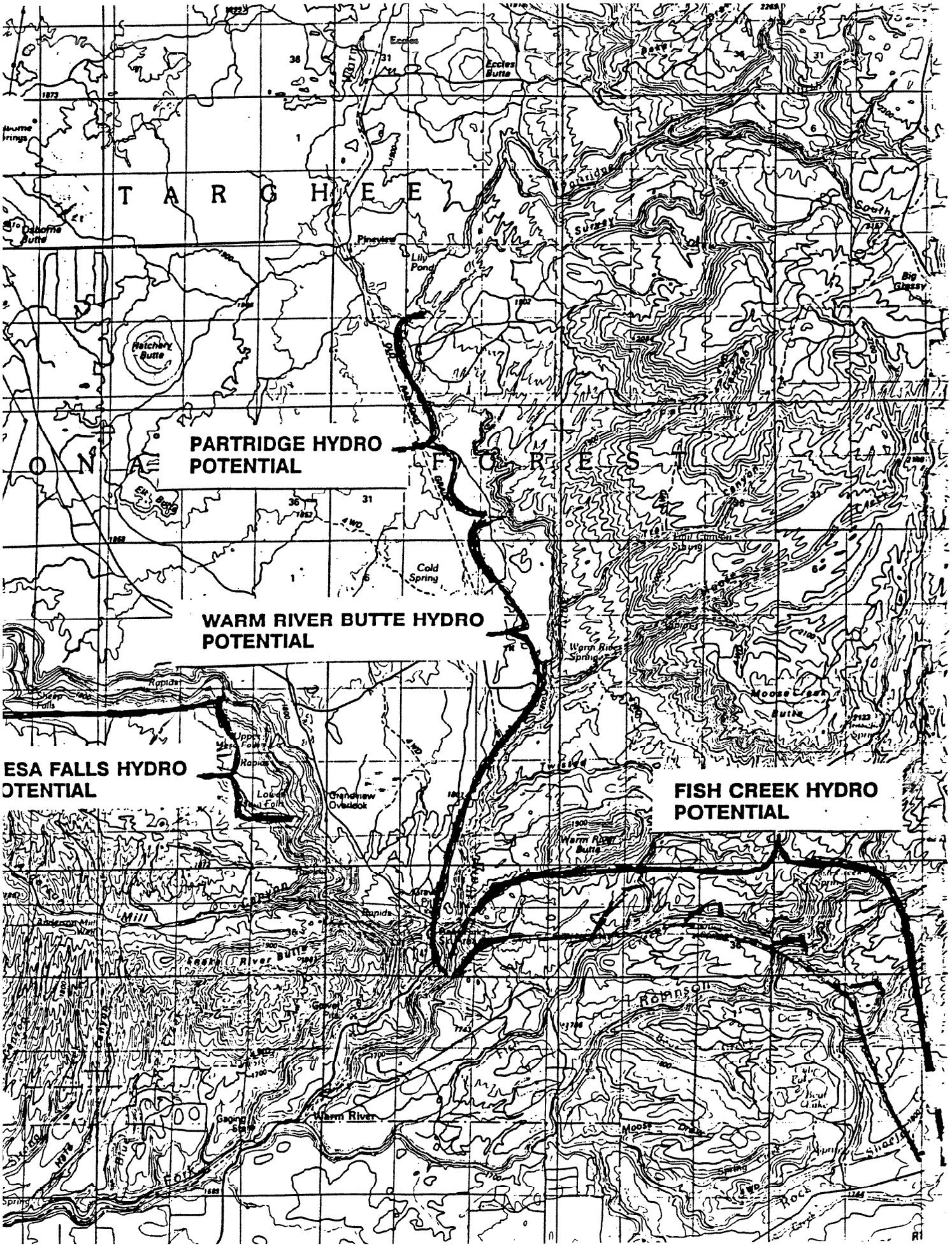
Diversion Dam

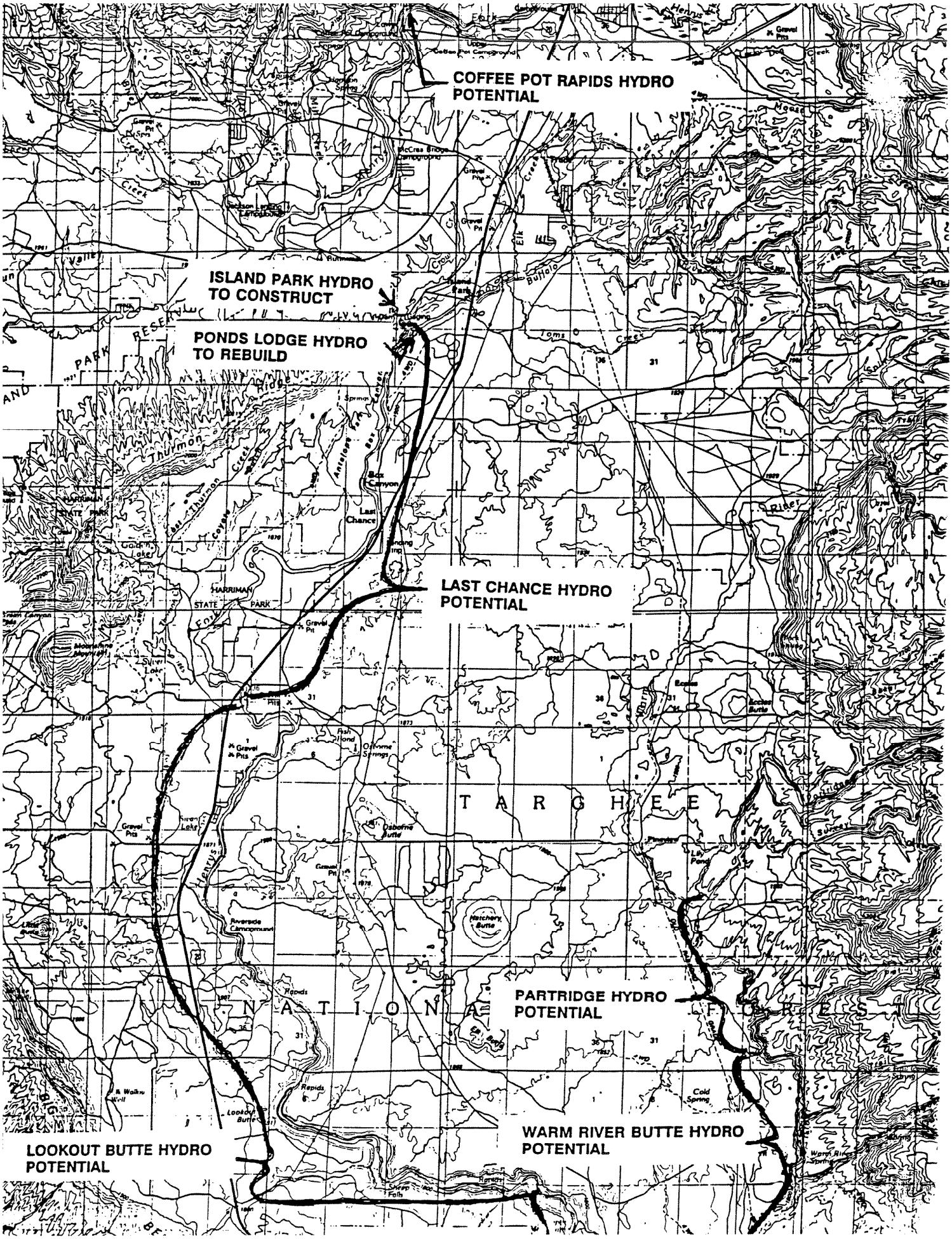
Powerplant

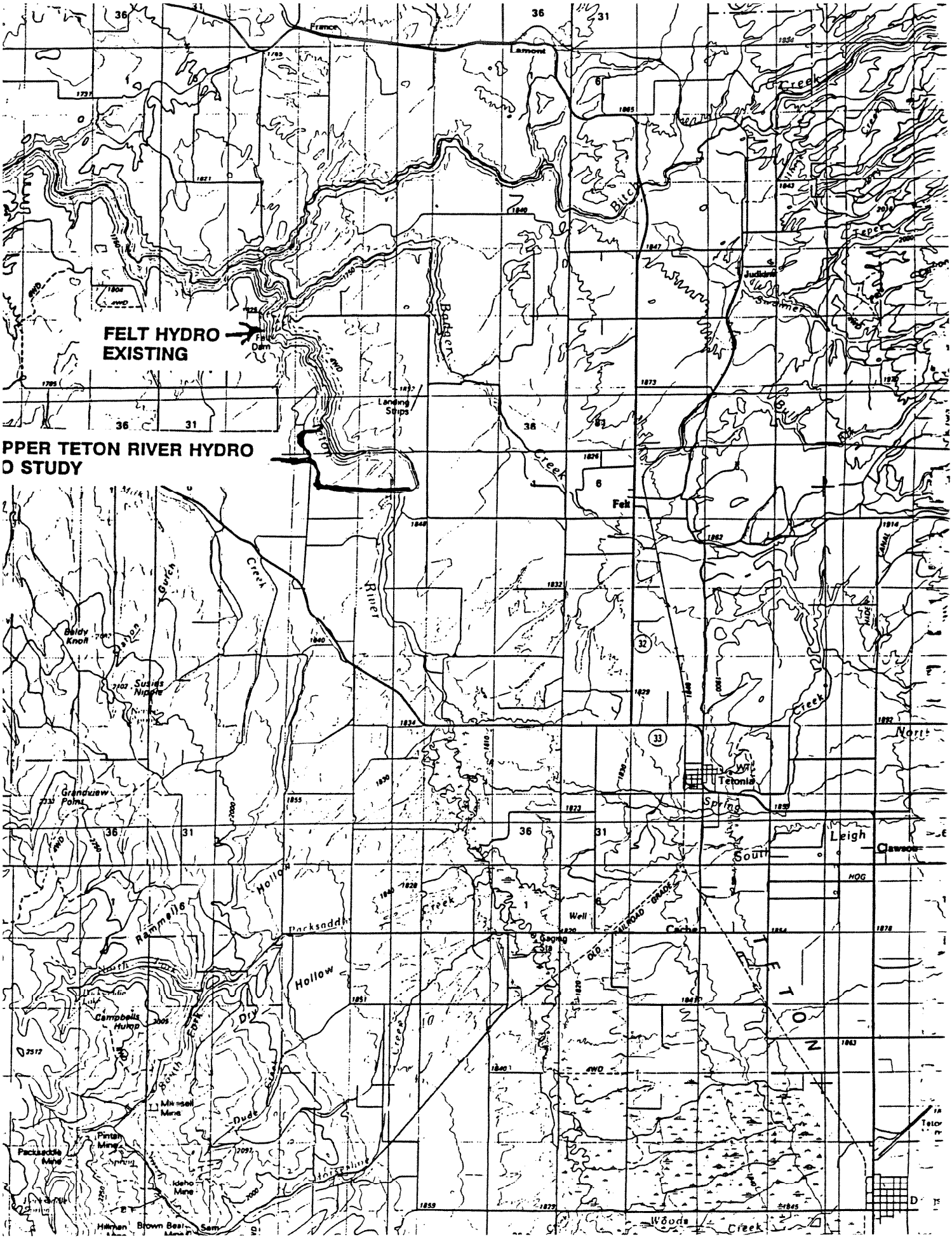
Reservoir or Diversion Dam and Powerplant

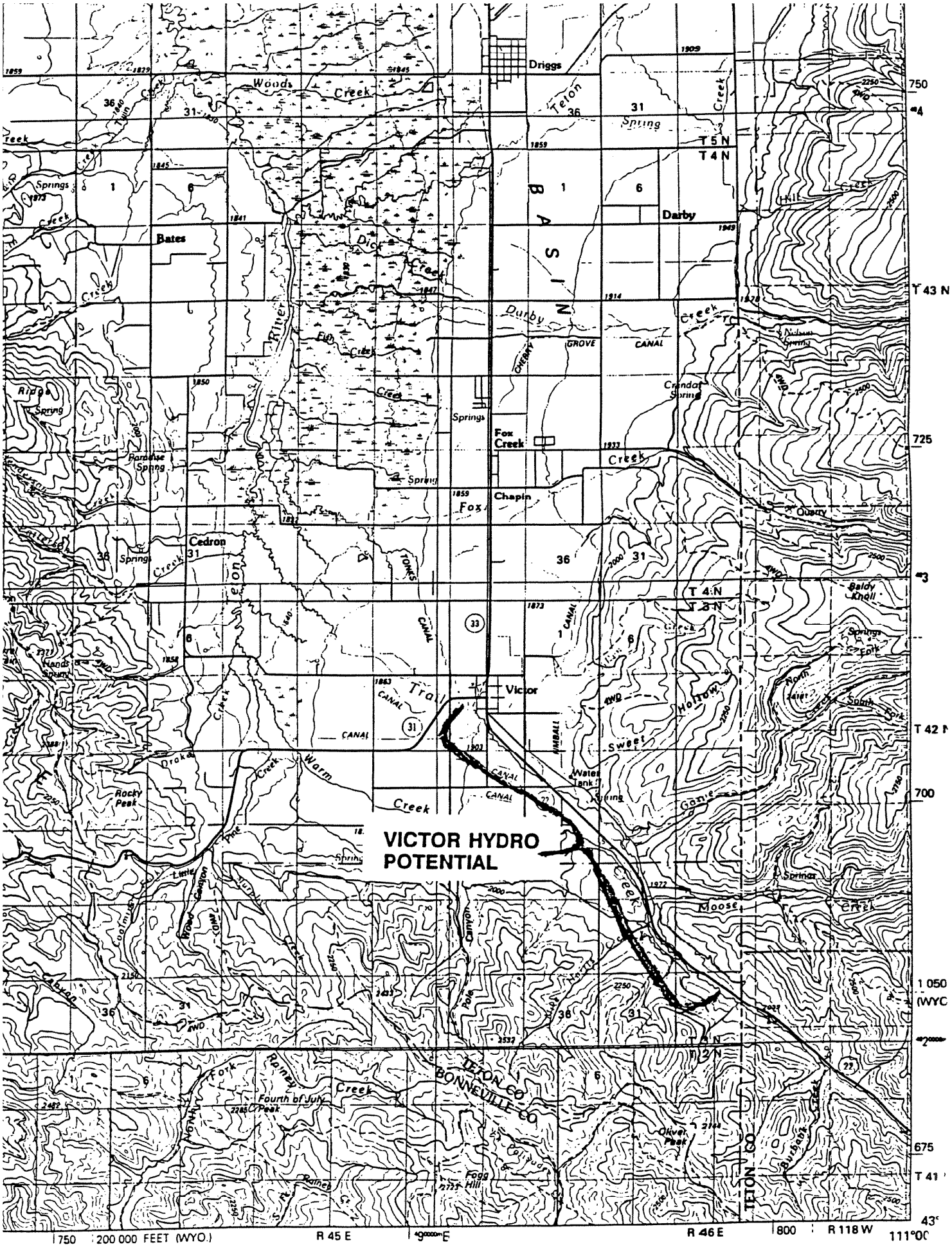

FELT HYDRO
EXISTING
IPPER TETON RIVER HYDRO
'O STUDY
France
Lamont
Felt
Tetonia
Leigh
Clawson
Cache
Felt Dam
Landing Strips
Badger
Bitch
Creek
Teton
River
Spring
Hollow
Dry
Parksadde
Rammell
Campbells Hump
Mikesell Mine
Pintan Mine
Packsaddle Mine
Idaho Mine
Brown Bear Mine
Sam
Woods
Creek
Beldy Knoll
Susies Nipple
Grandview Point
Judkins
Summer
Tepee
Bull
Well
Old Railroad Grade
Hog
Canal
North Fork
South Fork
Dude
Gulch
Dalton
Creek
Tetonia
Spring
Creek
North
South
Well
Creek
Creek
Creek
Creek
Woods
Creek


ASHTON HYDRO
EXISTING
LOWER ASHTON HYDRO
POTENTIAL
CROSS-CUT DIVERSION HYDRO
TO CONSTRUCT
ST ANTHONY CANAL HYDRO
POTENTIAL
ANTHONY HYDRO
STING
ENTERPRISE HYDRO
TO STUDY
BRIGGS HYDRO
EXISTING
Ashton Dam
Ashton State Fish Hatchery
Gravel Pit
Gravel Pits
Chester
Falls
Henrys Fork
Twin Groves
Saint Anthony
Stanford Field
Wilford
Teton
Newdale
Sugar City
SAND
WILDLIFE
MA
Sand Dune
Rivet Knoll
LAST CHANCE CANAL
CROSSCUT CANAL
CHESTER CANAL
CHESTER FALL RIVER
ST ANTHONY CANAL
FRIEND CANAL
OLD CROSSCUT CANAL
SOUTH BRANCH CANAL
ENTERPRISE CANAL
TETON CANAL
EAST TETON CANAL
UNION CANAL
FARMERS
RAILROAD
Fog Hollow
River


PARTRIDGE HYDRO POTENTIAL
WARM RIVER BUTTE HYDRO POTENTIAL
ESA FALLS HYDRO POTENTIAL
FISH CREEK HYDRO POTENTIAL
T A R G H E E
O N A F O R E S T
Eccles Butte
Osborne Butte
Pineview
Lily Pond
Hatchery Butte
Elk Butte
Cold Spring
Warm River Spring
Moose Creek Butte
Rapids
Upper Falls
Lower Falls
Grandview Overlook
Warm River Butte
Mill
Rapids
Robinson
Warm River
Moose Creek
Spring
Rock

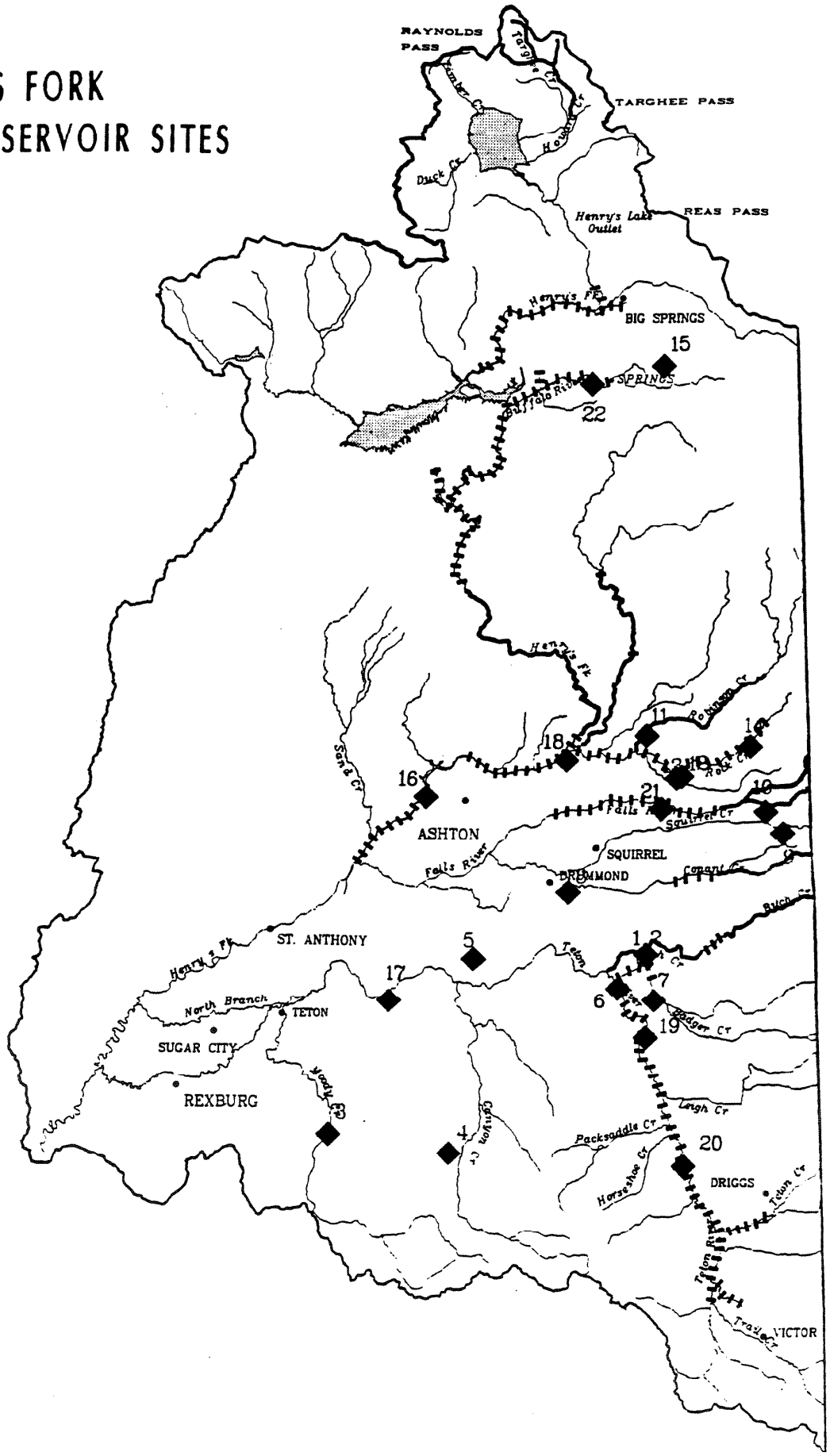

COFFEE POT RAPIDS HYDRO POTENTIAL
ISLAND PARK HYDRO TO CONSTRUCT
PONDS LODGE HYDRO TO REBUILD
LAST CHANCE HYDRO POTENTIAL
PARTRIDGE HYDRO POTENTIAL
WARM RIVER BUTTE HYDRO POTENTIAL
LOOKOUT BUTTE HYDRO POTENTIAL
T A R G H E E
N A T I O N A L F O R E S T
HARRIMAN STATE PARK
Last Chance
Box Canyon
Island Park
Ponds Lodge
Riverside Campground
Hatchery Butte
Osborne Butte
Lookout Butte
Cold Spring
Warm River Spring
Sheep Falls
Rapids
Thurmon Ridge
Thurmon Creek
East Thurmon Creek
Coyote Creek
Anderson Creek
Henrys Fork
Elk Creek
Buffalo
Toms Creek
Crow Creek
Moose Creek
Gravel Pit
Gravel Pits
Silver Lake
Golden Lake
Fish Island
Osborne Springs
Lily Pond
Surveyor
Beaver Butte
Rider
Spring Creek
Cemetery Pit
Little Butte
Warm River


FELT HYDRO
EXISTING
PPER TETON RIVER HYDRO
D STUDY
France
Lamont
Felt Dam
Landing Strips
Badger
Bitch
Creek
Judkins
Summer
Felt
Teton
River
Baldy Knoll
Susies Nipple
Grandview Point
Teton Spring
Teton
Leigh
Cawsey
South
Packsaddle
Hollow
Campbells Hump
Dry
Dude
Mineral Mine
Pintah Mine
Packsaddle Mine
Idaho Mine
Horseshoe
Well
Cache
Woods
Creek
OLD RAILROAD GRADE
HOG
CANAL


VICTOR HYDRO POTENTIAL
Driggs
Woods Creek
Teton
Spring
T 5 N
T 4 N
Darby
Bates
Dick Creek
BASIN
Dunby
GROVE
CANAL
Fox Creek
Chapin
Fox
Cedron
Victor
Trail
Sweet
Hollow
Warm Creek
Rocky Peak
Moose Creek
Fourth of July Peak
Olivet Peak
Fogg Hill
TETON CO
BONNEVILLE CO
T 43 N
T 42 N
T 41
R 45 E
R 46 E
R 118 W
200 000 FEET (WYO.)
111°00'

HENRY'S FORK
POTENTIAL RESERVOIR SITES

NUMBER	NAME
1	Bitch Creek
2	Bitch Creek
3	Moody Creek
4	Spring Creek
5	Lane Lake
6	Lower Badger Creek
7	Upper Badger Creek
8	Conant Creek
9	Squirrel Creek
10	Boone Creek
11	Robinson Creek
12	J.Y. Ranch
13	Howell Ranch
14	Park Lake
15	Moose Creek
16	Ashton Enlargement
17	Teton
18	Warm River
19	Tetonia
20	Driggs
21	Marysville Headworks
22	Buffalo River
23	Squirrel Meadows
•	(in Wyo.- not on map)

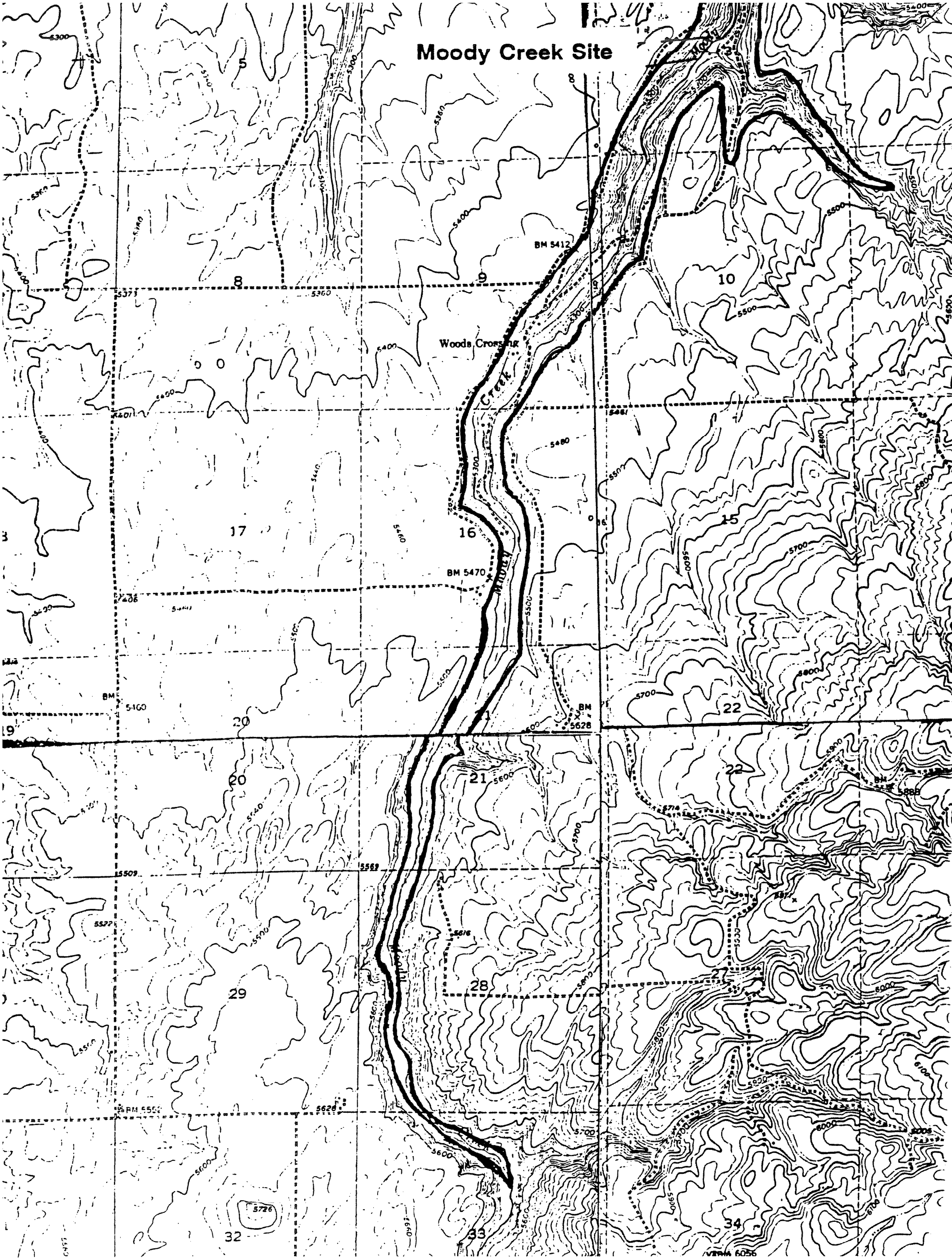


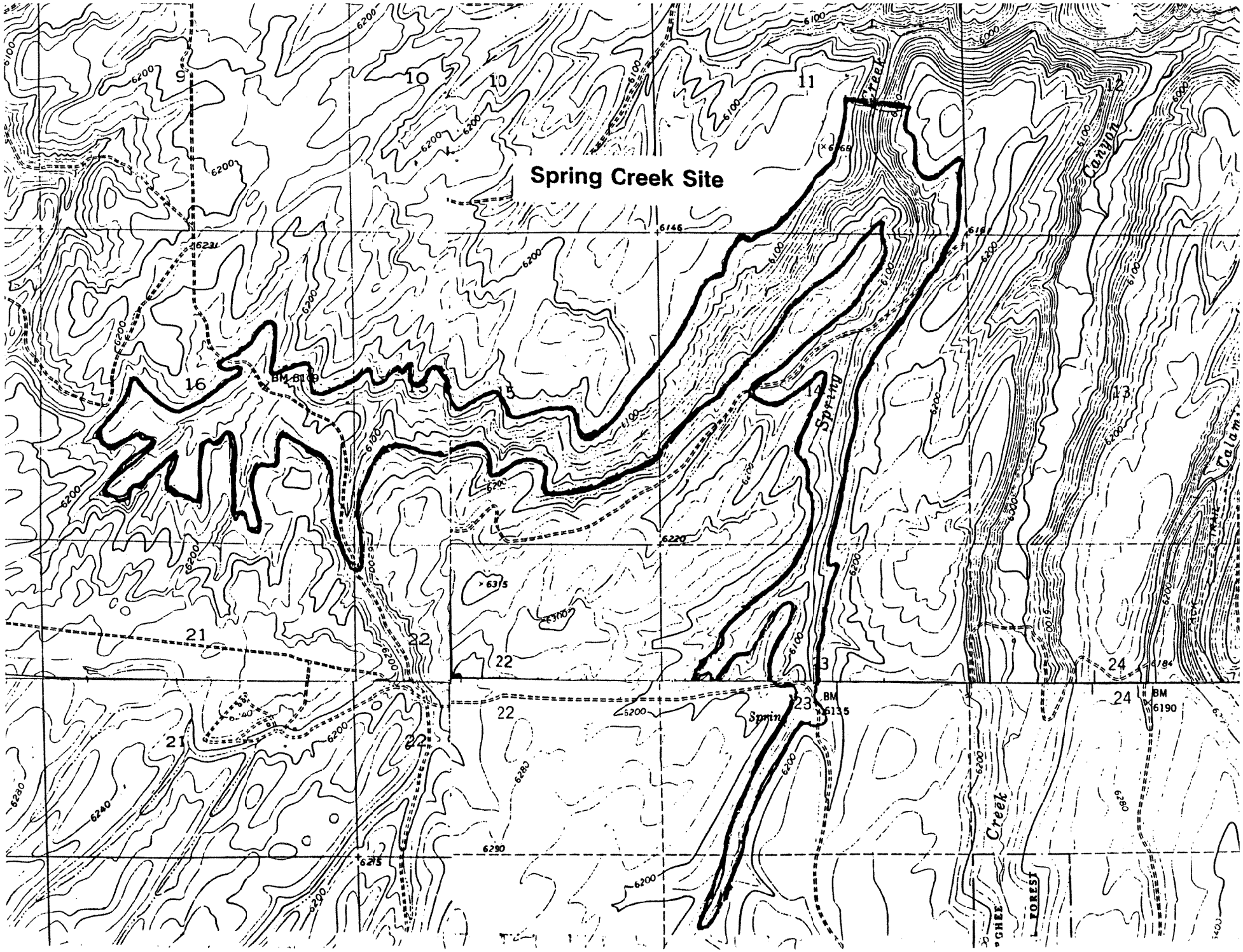
STATE DESIGNATIONS:

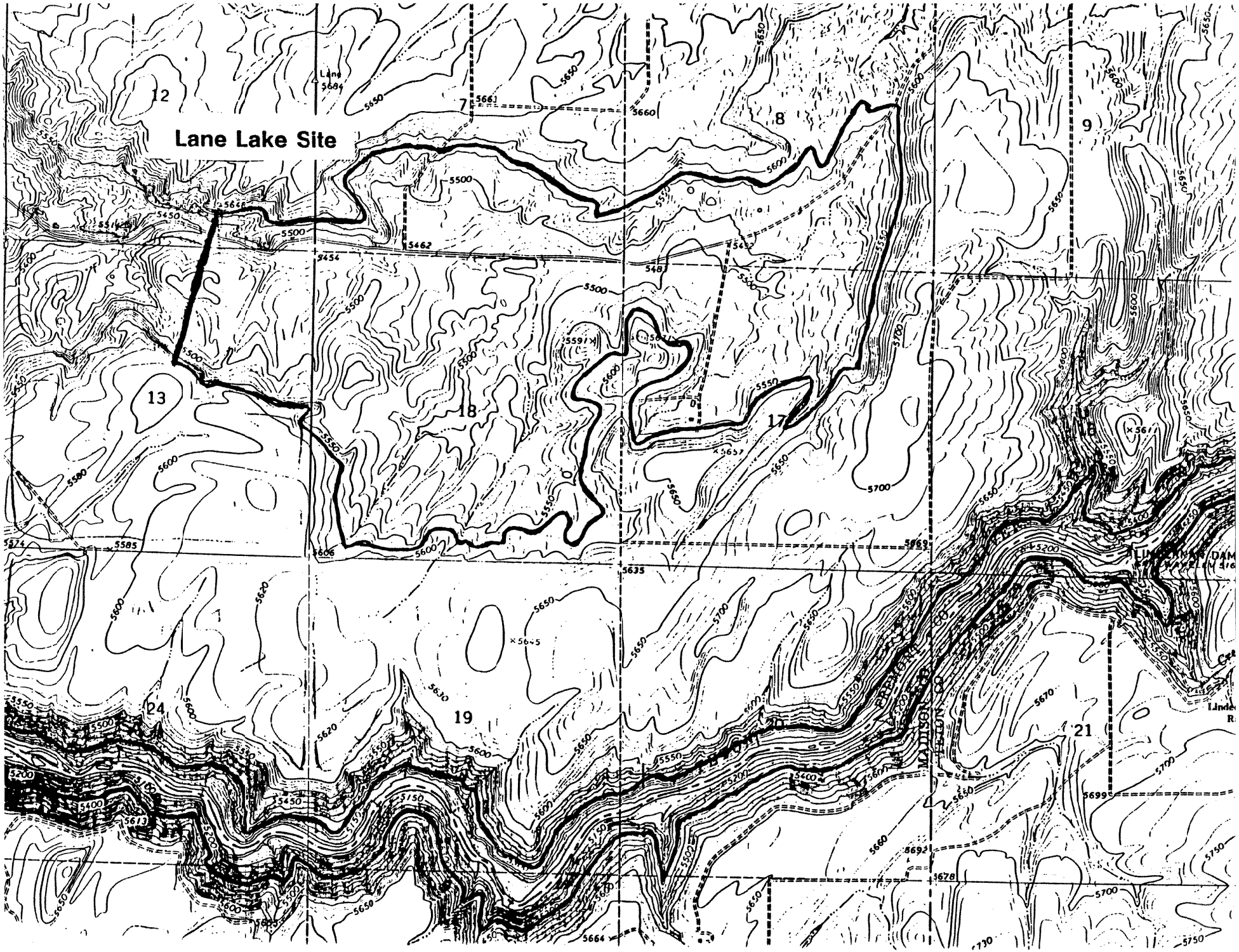
Recreational

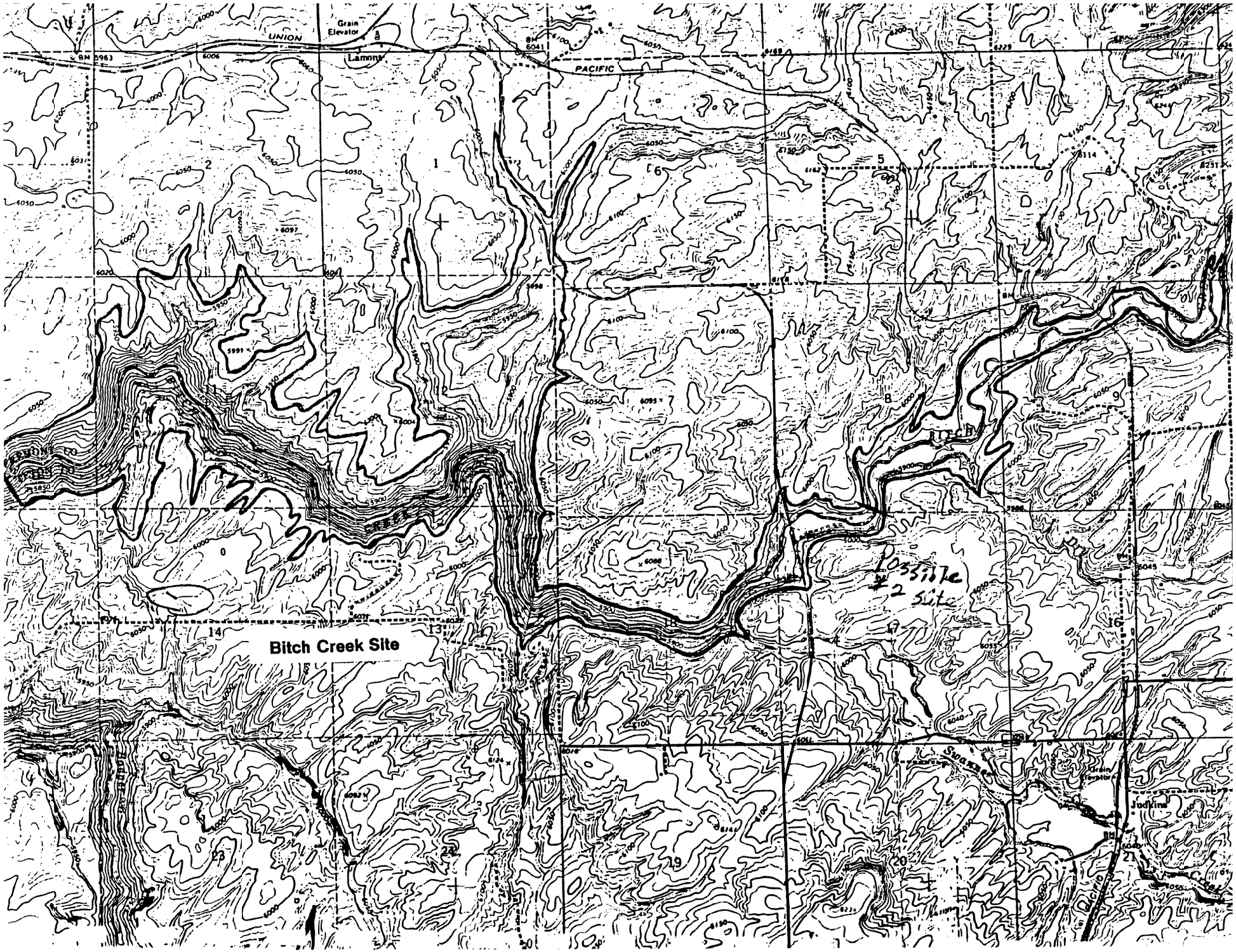
Natural

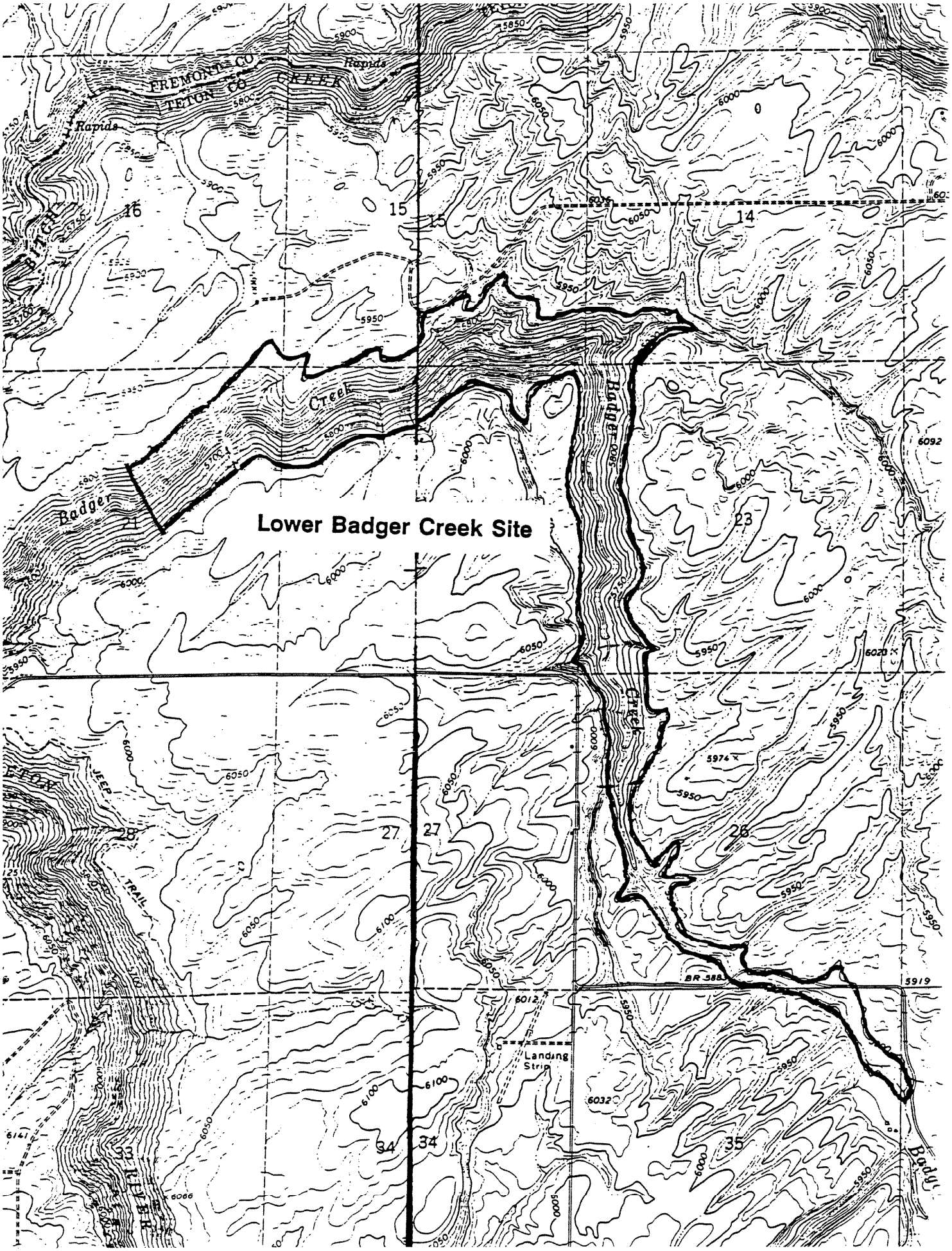
Moody Creek Site

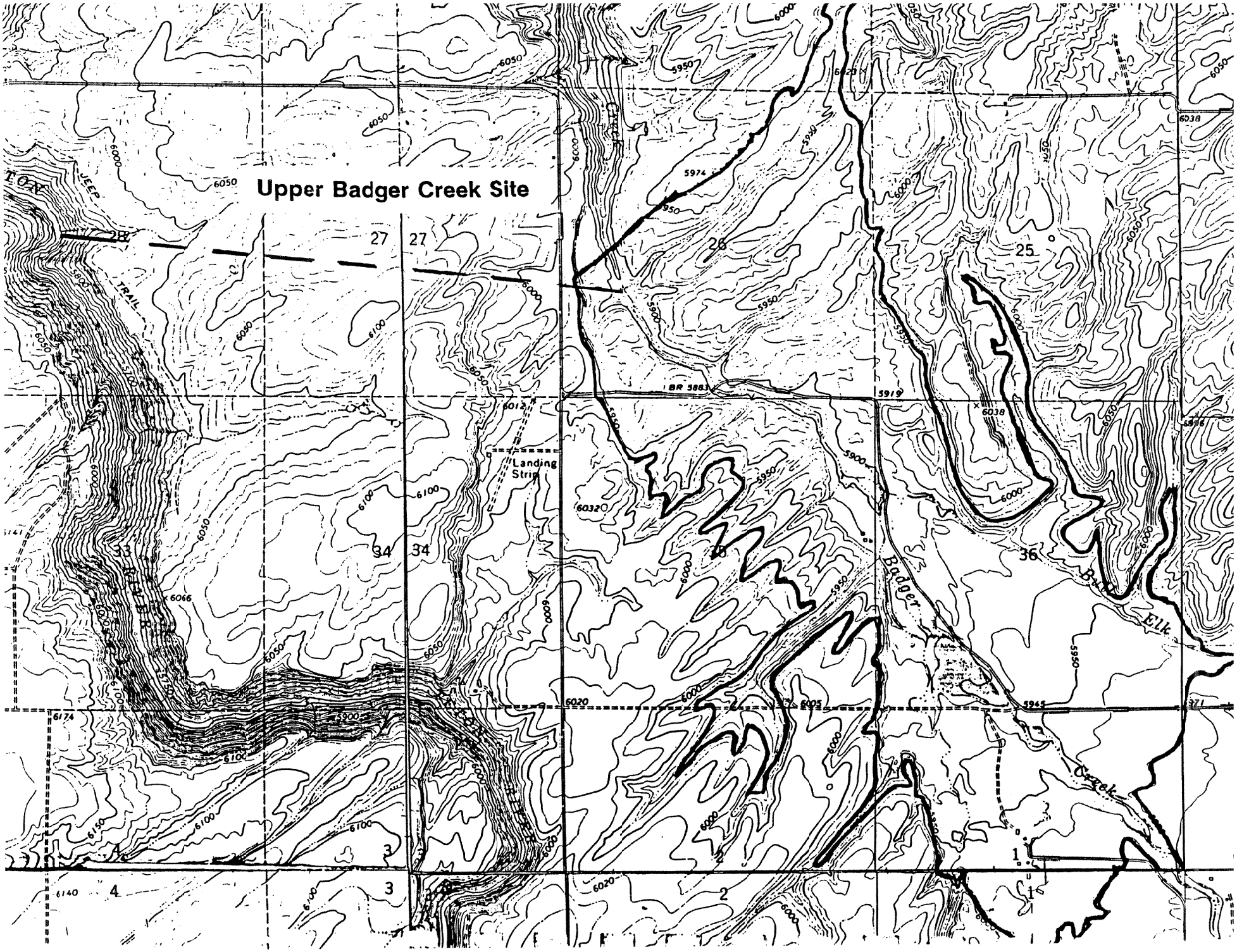


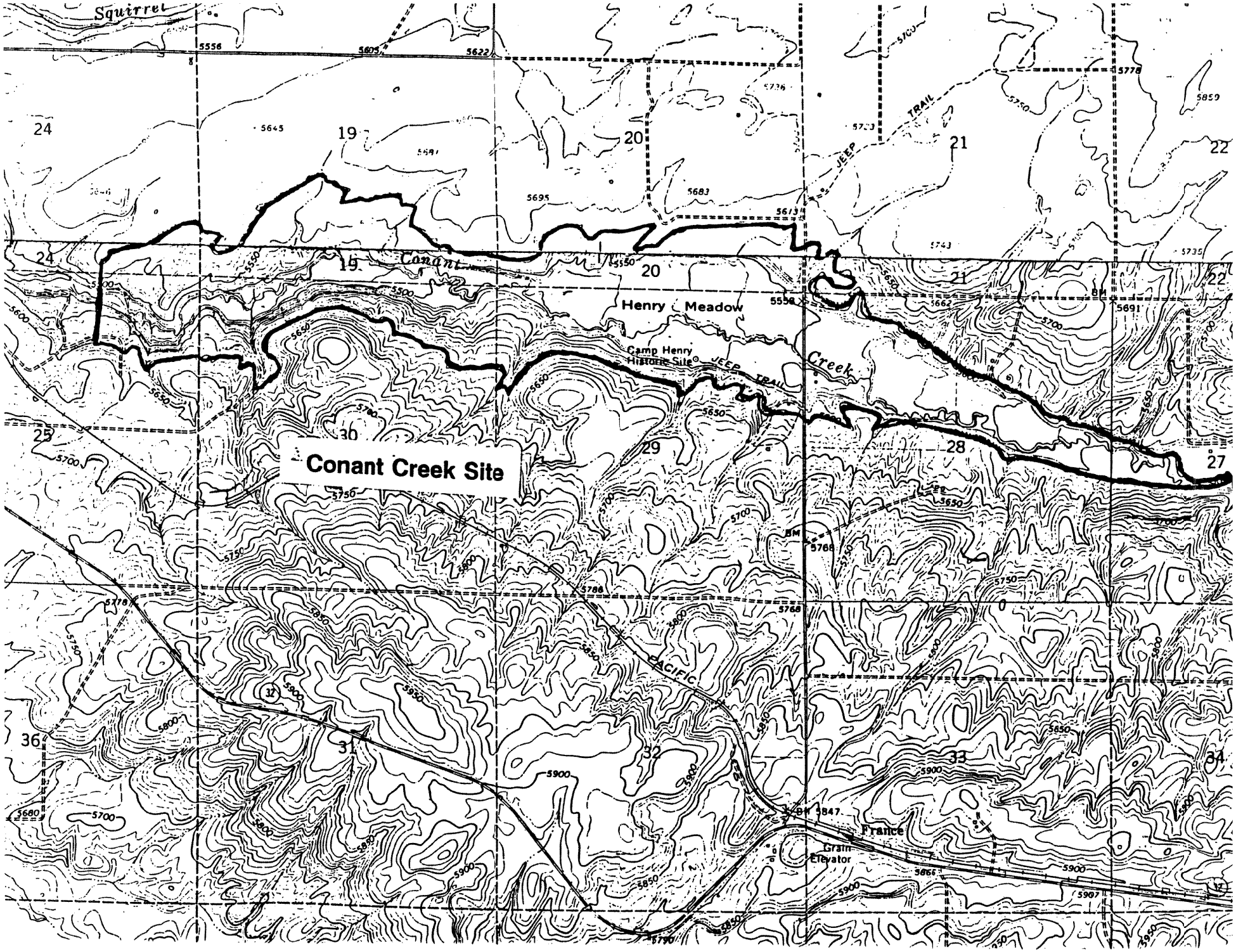

Spring Creek Site
Spring
Creek
Canyon
Creek
BM 6135
BM 6190
6146
6231
6220
6315
6290
6280
6240
6225
6200
6100
6000
6168
6184
10
11
12
13
14
16
21
22
23
24

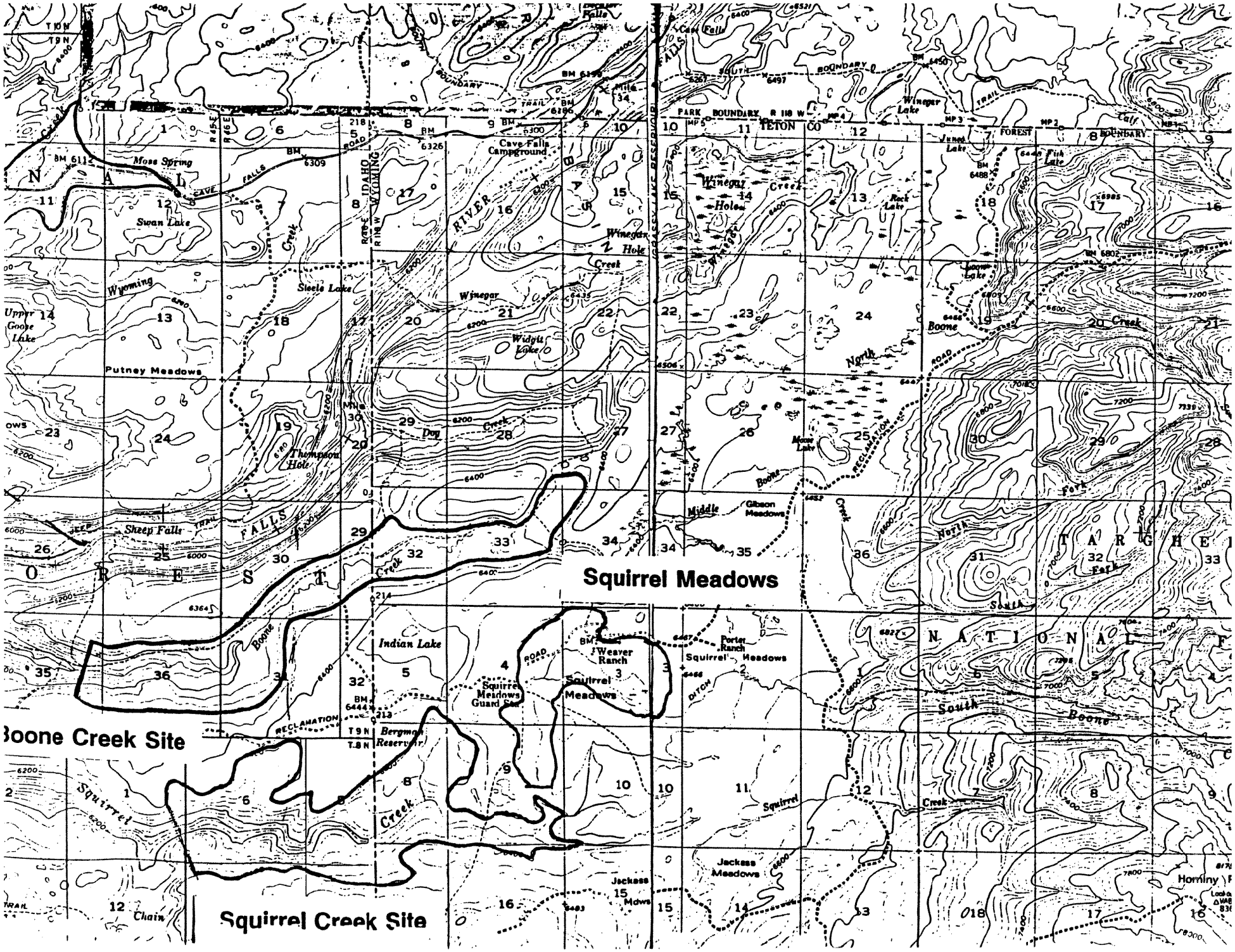

Lane Lake Site
12
7
8
9
13
18
17
24
19
20
21
MADISON
PRESIDENT
5661
5660
5500
5450
5462
5454
5481
5559
5637
5700
5585
5606
5635
5669
5645
5620
5630
5670
5699
5678
5664
5613
5400
5150
5200
5750

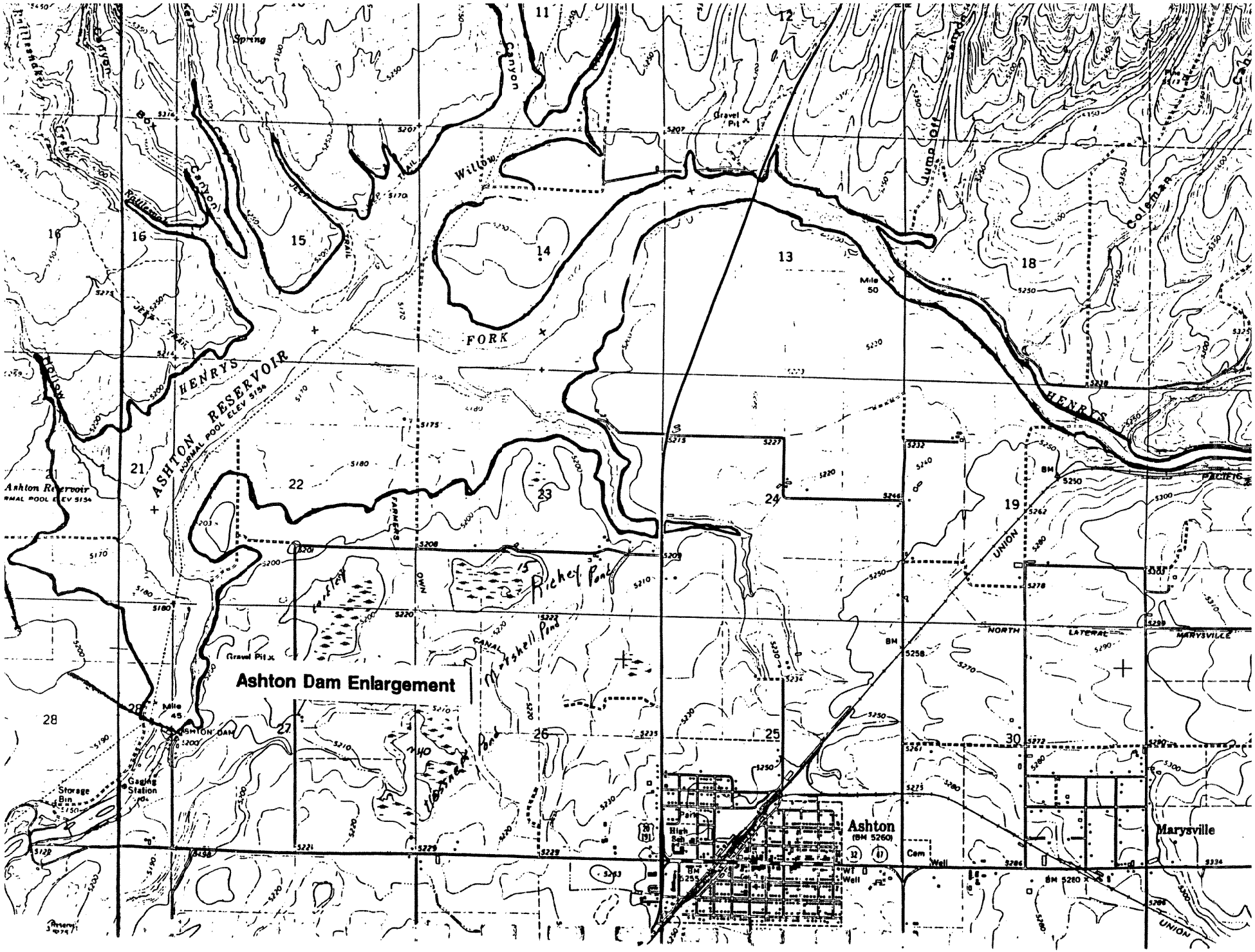

UNION
PACIFIC
Grain Elevator
Lamont
Bitch Creek Site
Possible #2 Site
Judkins
Grain Elevator

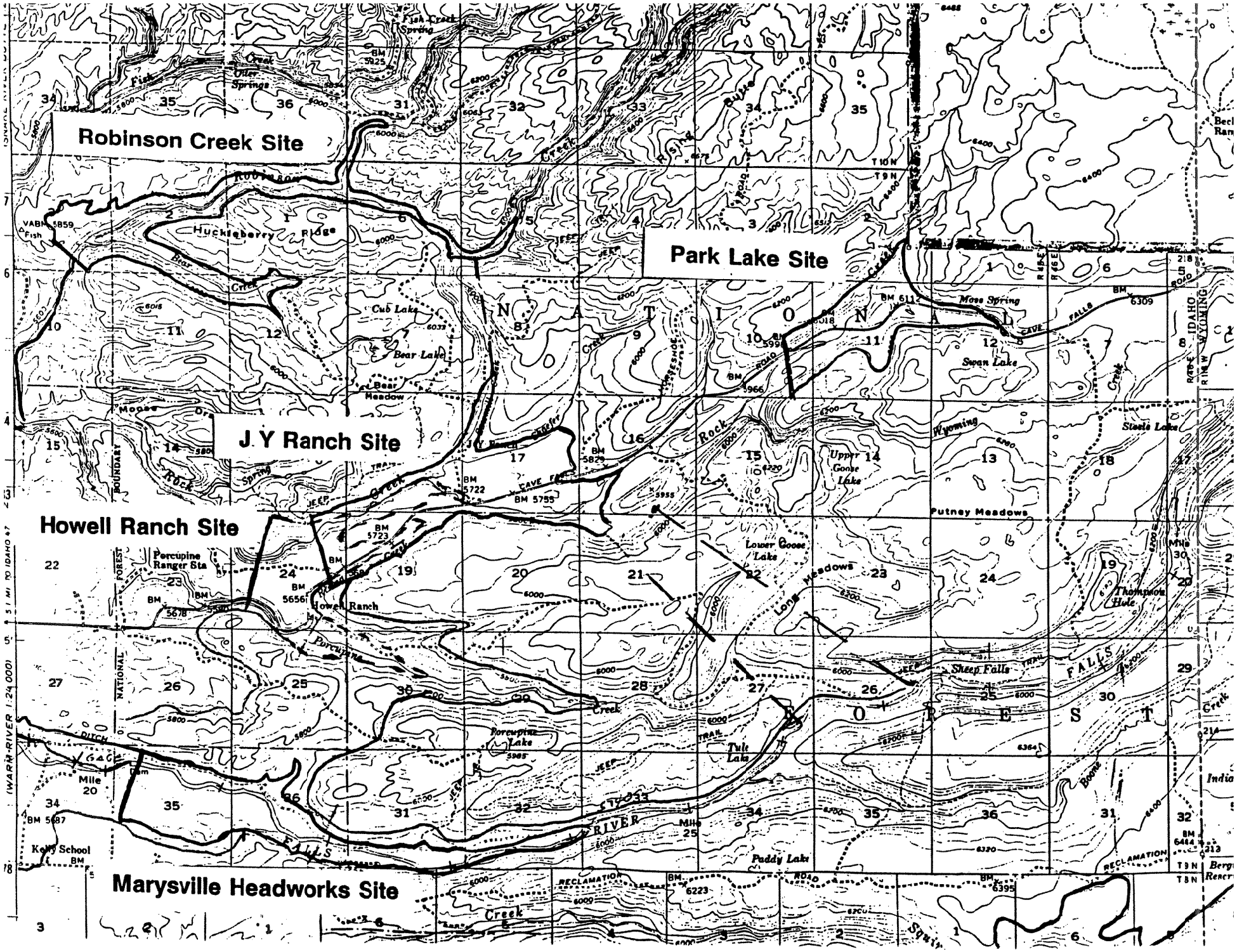

Lower Badger Creek Site
FREMONT CO
TETON CO
CREEK
Rapids
Rapids
Badger
Creek
Badger
Creek
JEEP
TRAIL
BR 388
Landing
Strip
16
15
15
14
21
23
28
27
27
26
34
34
35
5950
6000
6050
6100
6092
6020
5974
5919
6012
6032
6141
6066

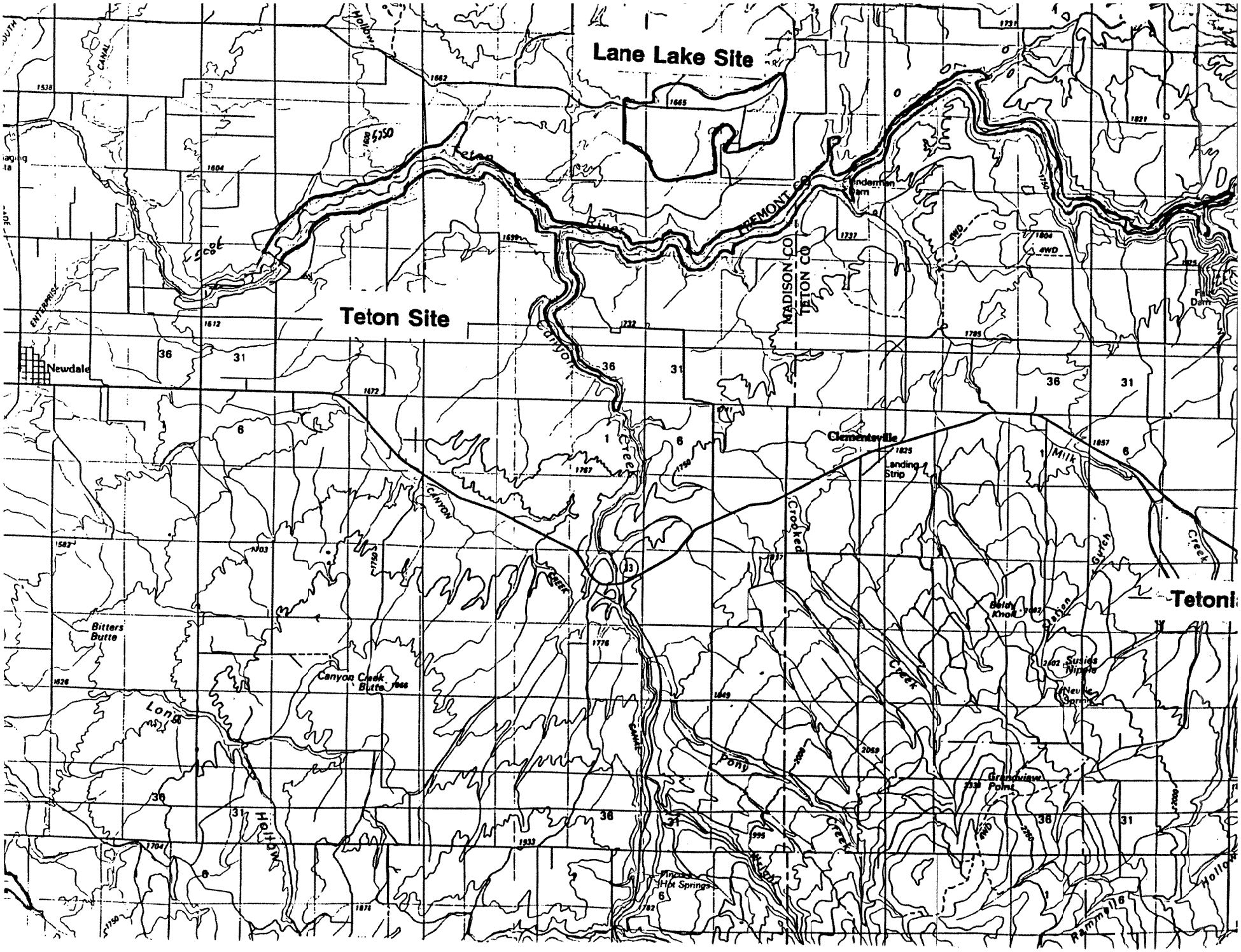

Upper Badger Creek Site
JEEP
TRAIL
Landing Strip
Badger
Elk
Creek
28
27
27
26
25
34
34
36
33
3
4
3
2
1
1
6050
6000
5950
5900
6100
6150
6174
6140
6066
6032
6020
6012
6038
5974
5919
5883
5945

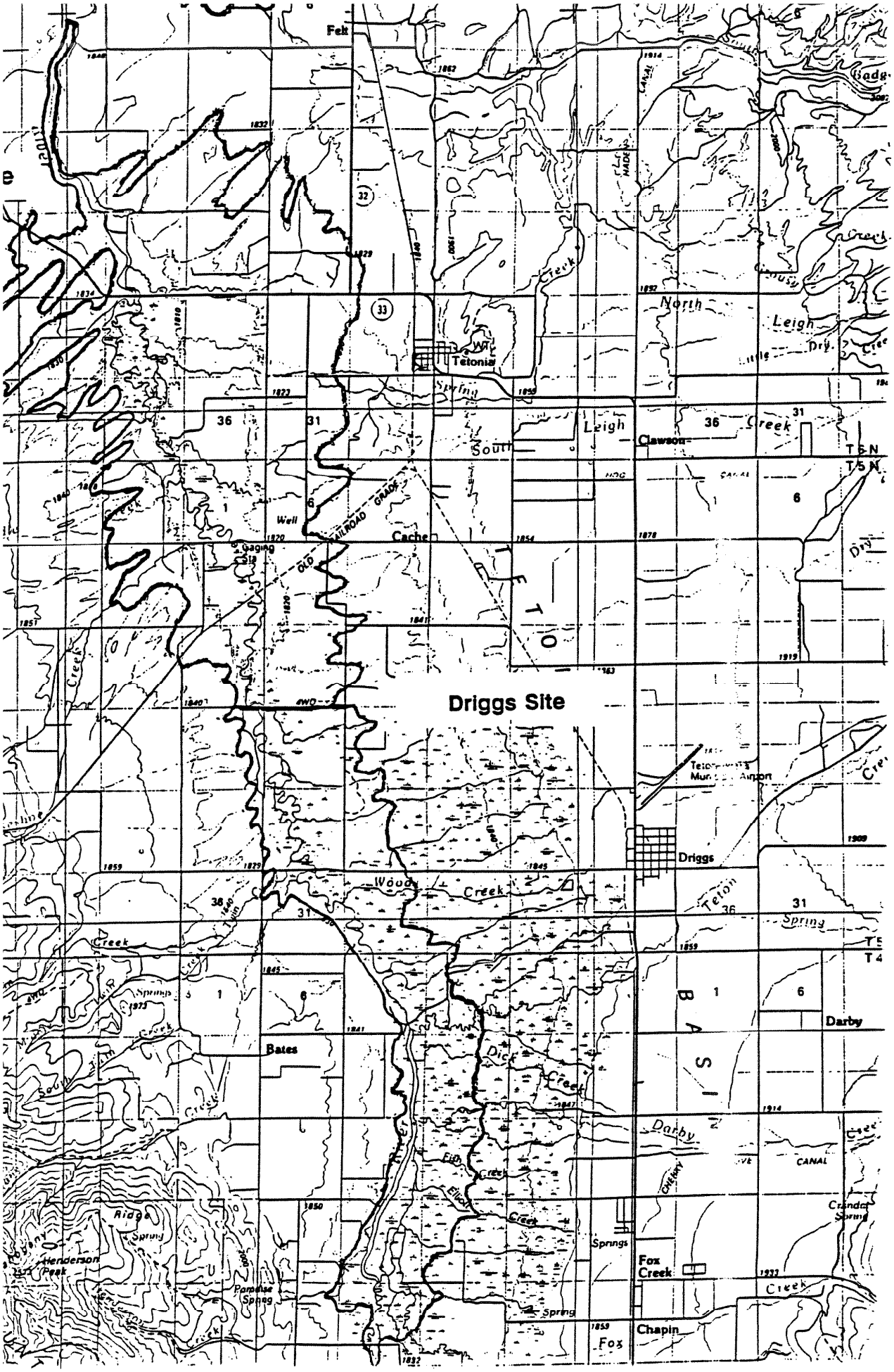

Conant Creek Site
Squirrel
Conant
Creek
Henry Meadow
Camp Henry
Historic Site
JEEP TRAIL
PACIFIC
France
Grain
Elevator
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34

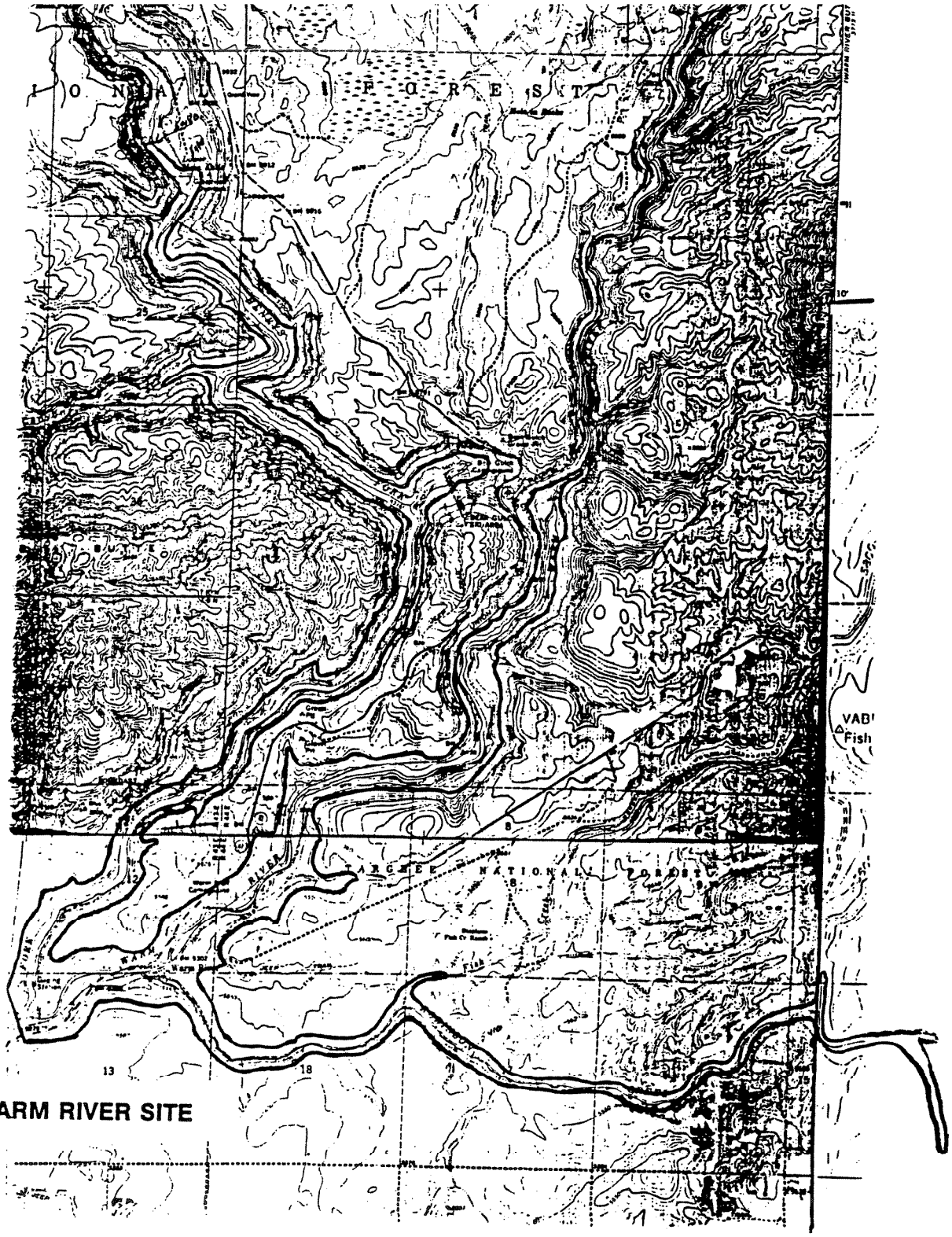

Squirrel Meadows
Boone Creek Site
Squirrel Creek Site
Cave Falls Campground
Moss Spring
Swan Lake
Steele Lake
Putney Meadows
Thompson Hole
Sheep Falls
Indian Lake
Squirrel Meadows Guard Sta.
Weaver Ranch
Porter Ranch
Bergman Reservoir
Jackass Meadows
Winegar Hole
Widgie Lake
Gibson Meadows
Winegar Lake
Rock Lake
Boone Lake
Moose Lake
Fish Lake
Horminy
TETON CO
PARK BOUNDARY
FOREST BOUNDARY
IDAHO
WYOMING
NATIONAL FOREST
TARGHEE
CASSLAKE RESERVOIR
RECLAMATION
Boone Creek
Squirrel Creek
South Boone
North Fork
Dog Creek
Wyoming Creek
Winegar Creek
Upper Goose Lake
Chain


Ashton Dam Enlargement
ASHTON RESERVOIR
NORMAL POOL ELEV 5154
HENRYS
FORK
Willow
Canyon
Spring
Gravel Pit
Mile 50
Mile 45
ASHTON DAM
Storage Bin
Gaging Station
Ashton
(BM 5260)
Marysville
Cem
Well
High Sch
Park
Richey Pond
Marshall Pond
Lassen Pond
CANAL
NORTH
LATERAL
UNION
PACIFIC
Colemar
Jumbo
Ashton Reservoir
NORMAL POOL ELEV 5154

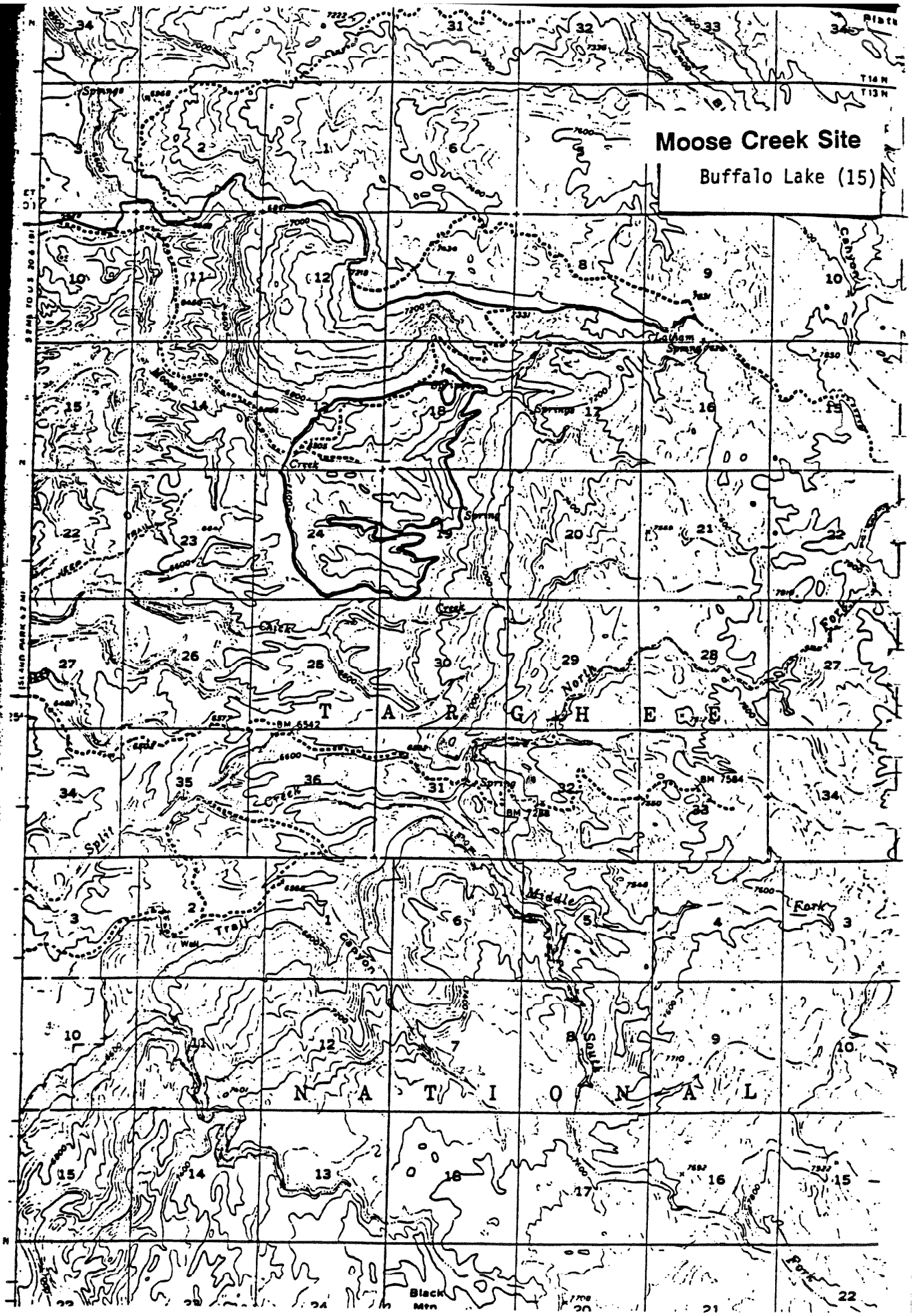

Robinson Creek Site
Park Lake Site
J.Y Ranch Site
Howell Ranch Site
Marysville Headworks Site
Huckleberry Ridge
Bear Creek
Cub Lake
Bear Lake
Bear Meadow
Moose Spring
Swan Lake
Wyoming
Steele Lake
Upper Goose Lake
Lower Goose Lake
Putney Meadows
Long Meadows
Thompson Hole
Sheep Falls
Porcupine Ranger Sta
Howell Ranch
Porcupine Lake
Tule Lake
Paddy Lake
Kelly School
Rock Creek
Fish Creek
Otter Springs
Rising Butte
Cave Falls
Boone
Squirrel
Creek
RIVER
FALLS
NATIONAL
FOREST
BOUNDARY
RECLAMATION
ROAD
TRAIL
JEEP
DITCH
T10N
T9N
R8E
R7E
IDAHO
WYOMING
(WARM RIVER 1:24 000)

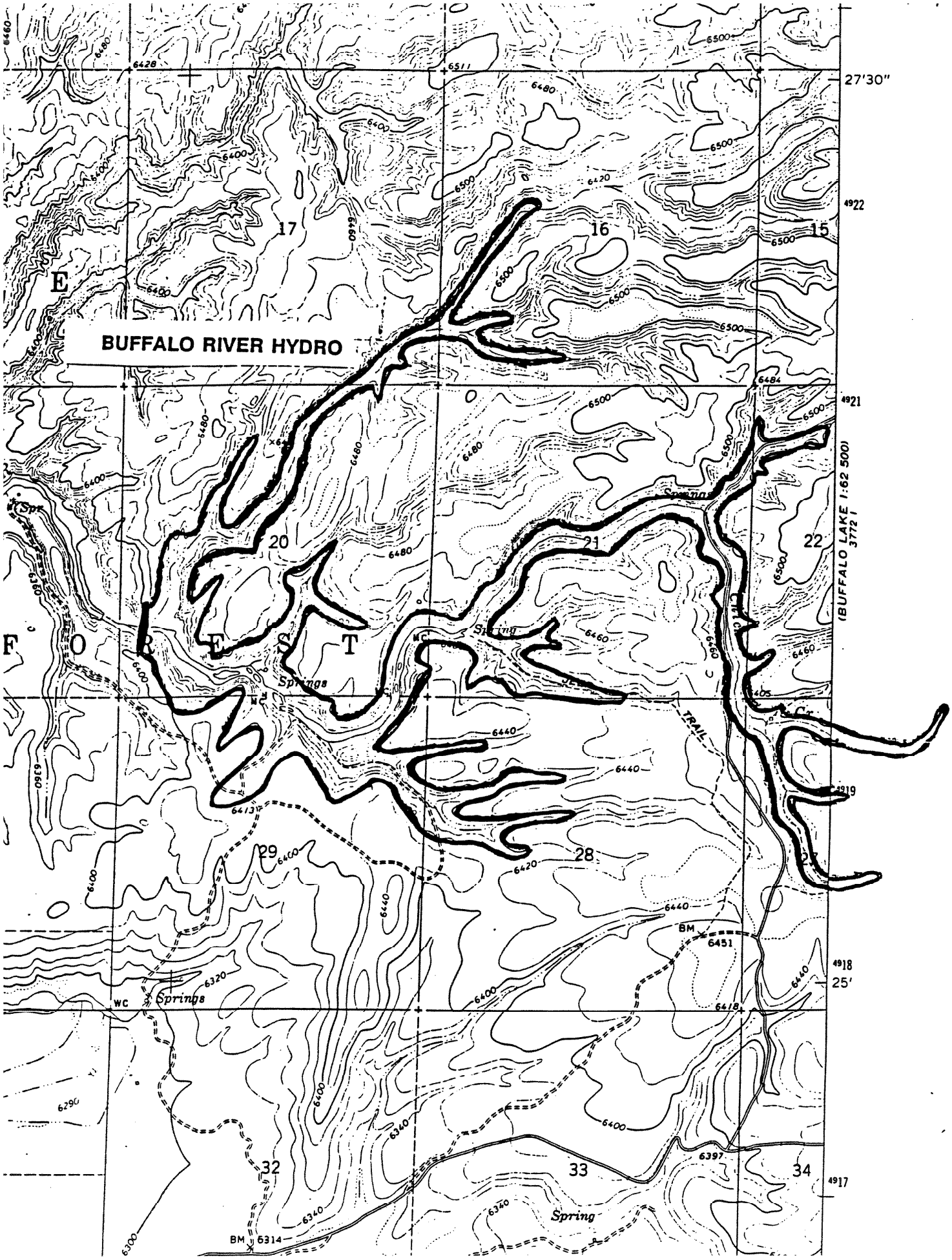

Lane Lake Site
Teton Site
Teton
River
FREMONT CO
MADISON CO
TETON CO
Newdale
Clementsville
Landing Strip
Canyon
Creek
Crooked
Milk
Tetonia
Bitters Butte
Canyon Creek Butte
Long
Hollow
Pony
Creek
Grandview Point
Susies Nipple
Neville Springs
Bailey Knob
Pincus Hot Springs
Ramsey
Hollow
Fall Dam
Indermen Farm
ENTERPRISE
CANAL
4WD

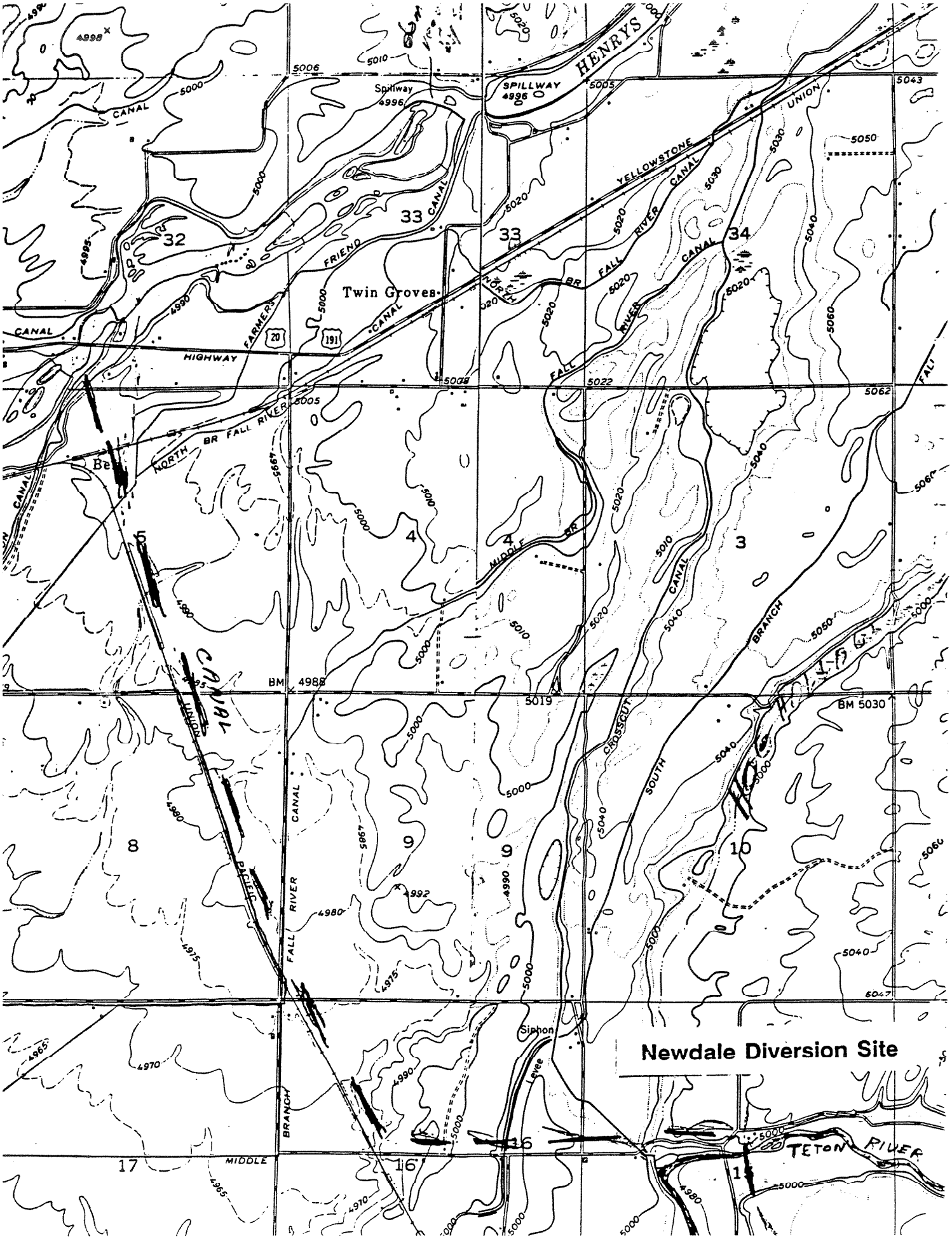

Felt
Tetonia
North
Leigh
Dry
Creek
Spring
South
Leigh
Clawson
T6N
T5N
Well
Cache
Gaging Sta
OLD RAILROAD GRADE
Driggs Site
Teton Municipal Airport
Driggs
Wood
Creek
Teton
Spring
Creek
Springs
Bates
Darby
Dick
Creek
Darby
Fish
Creek
Elbow
Creek
CANAL
Ridge
Spring
Henderson
Peak
Pomelse
Spring
Springs
Fox
Creek
Chapin
Fox
Creek
Spring
Crander
Spring

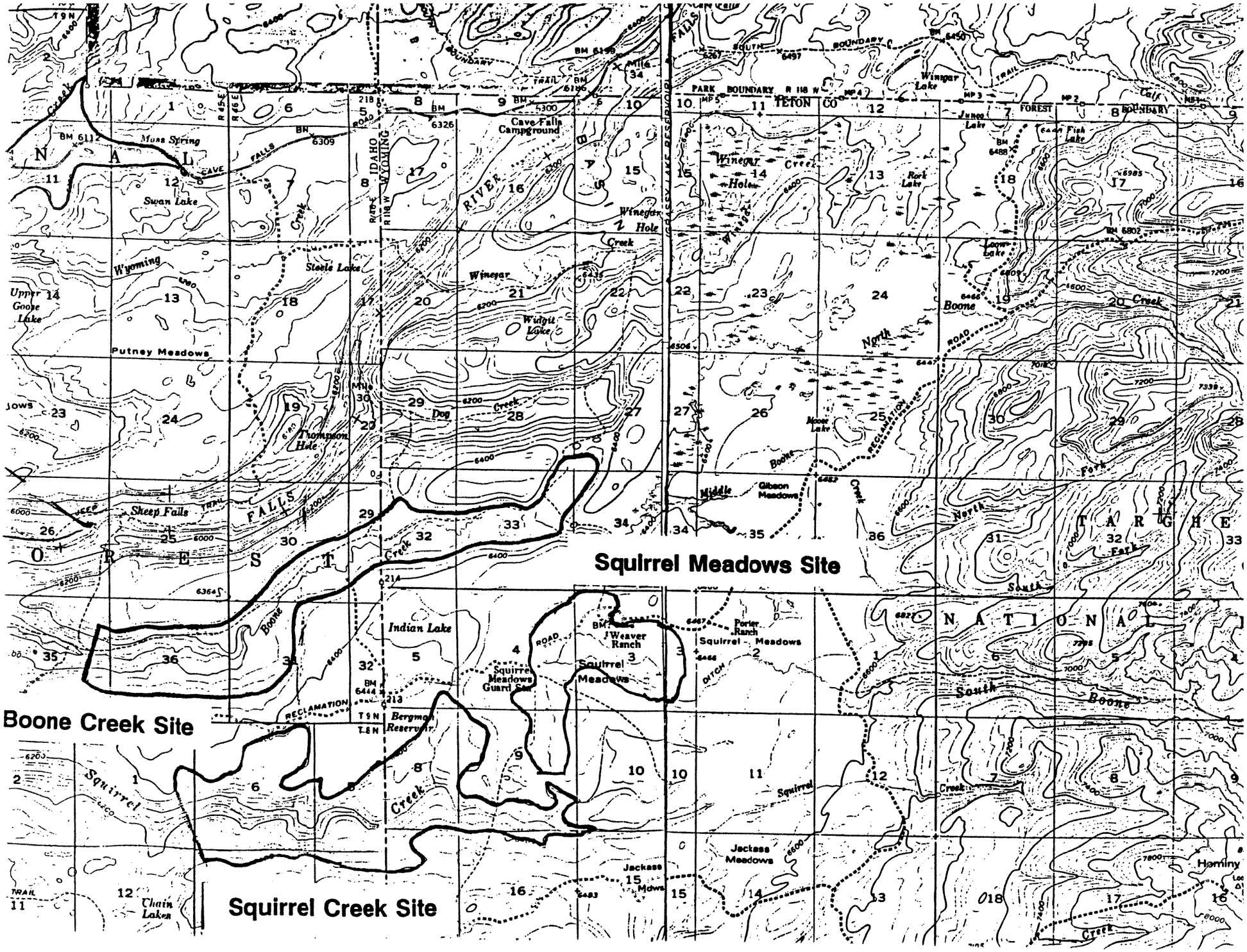


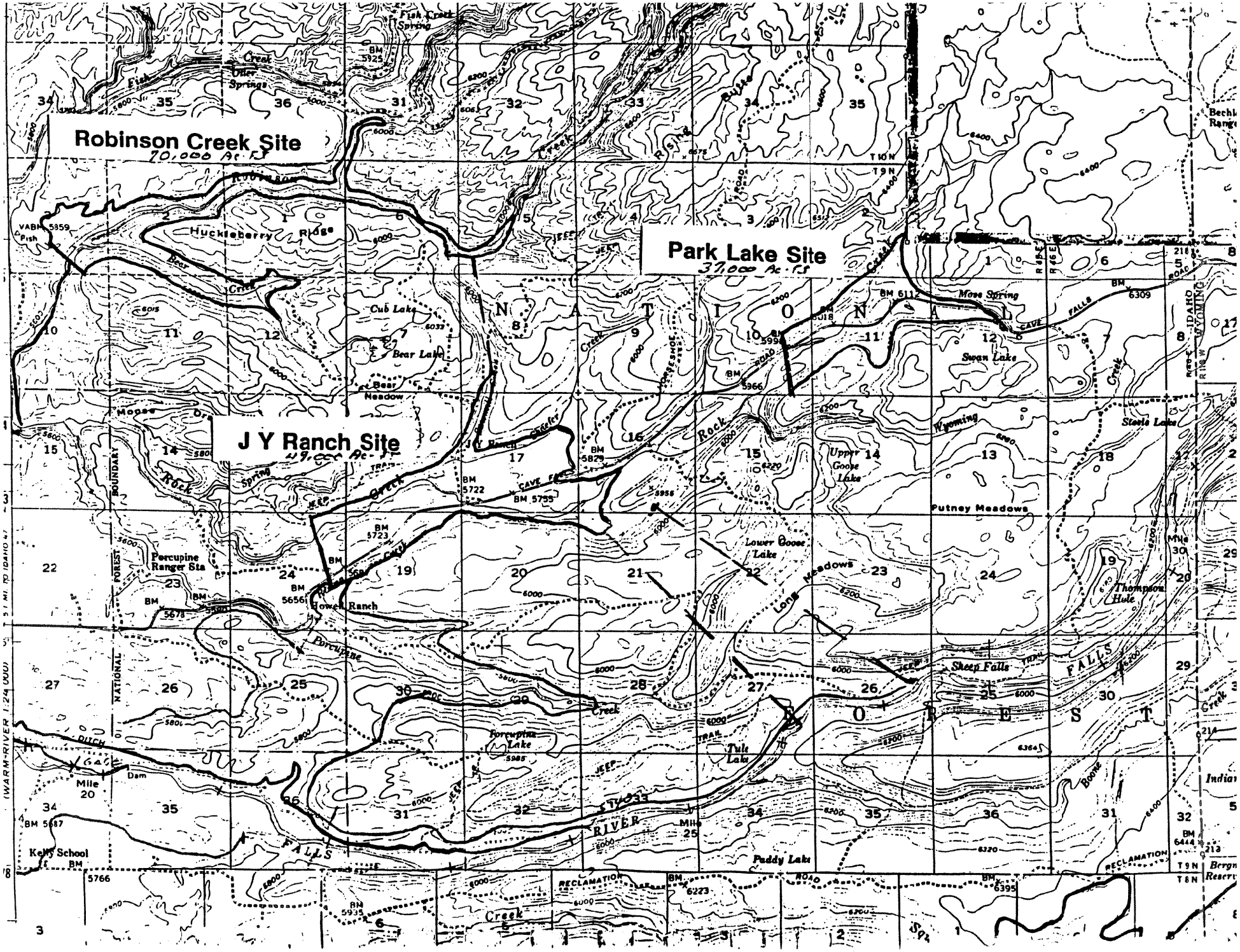
WARM RIVER SITE


Moose Creek Site
Buffalo Lake (15)
T A R G H E E
N A T I O N A L
Lagam Spring
Spring
Creek
North
Fork
Middle
Split
Trail
Canyon
Black Mtn
T14N
T13N


BUFFALO RIVER HYDRO
27'30"
25'
(BUFFALO LAKE 1:62 500)
3772 I
17
16
15
20
21
22
29
28
32
33
34
Springs
Spring
TRAIL
BM 6451
BM 6314
WC
6428
6511
6484
6413
6418
6397
4922
4921
4919
4918
4917


Newdale Diversion Site
HENRYS
SPILLWAY
Spillway
Twin Groves
YELLOWSTONE
UNION
CANAL
FRIEND
FARMERS
HIGHWAY
NORTH BR FALL RIVER
MIDDLE BR
FALL RIVER
CROSSCUT
SOUTH
BRANCH
TETON RIVER
Siphon
Levee
BM 4988
BM 5030
32
33
34
5
4
3
8
9
10
17
16
1


Squirrel Meadows Site
Boone Creek Site
Squirrel Creek Site
Cave Falls Campground
Swan Lake
Steele Lake
Putney Meadows
Thompson Hole
Sheep Falls
Indian Lake
Squirrel Meadows Guard Sta
J Weaver Ranch
Squirrel Meadows
Porter Ranch
Bergman Reservoir
Jackass Meadows
Gibson Meadows
Winegar Hole
Widgit Lake
Winegar Lake
Rock Lake
Moose Lake
Loon Lake
Fish Lake
Chain Lakes
Hominy
Upper Goose Lake
Moss Spring
Dog Creek
Boone Creek
Squirrel Creek
Winegar Creek
Wyoming
IDAHO
WYOMING
TETON CO
PARK BOUNDARY
FOREST BOUNDARY
NATIONAL FOREST
TARGHEE
RECLAMATION
GRASSY LAKE RESERVOIR


Robinson Creek Site
70,000 Ac. Ft.
Park Lake Site
37,000 Ac. Ft.
J Y Ranch Site
49,000 Ac. Ft.
Huckleberry Ridge
Cub Lake
Bear Lake
Bear Meadow
Moose Spring
Swan Lake
Steele Lake
Upper Goose Lake
Putney Meadows
Lower Goose Lake
Long Meadows
Thompson Hole
Sheep Falls
Porcupine Ranger Sta
Howell Ranch
Porcupine Lake
Tule Lake
Paddy Lake
Kelly School
Mile 20
Mile 25
Mile 30
Dam
Gate
Fish Creek Spring
Otter Springs
Fish Creek
Bear Creek
Moose Creek
Rock Creek
Porcupine Creek
Long Creek
Boone Creek
Wyoming
CAVE FALLS
SHOSHONE NATIONAL FOREST
YELLOWSTONE NATIONAL PARK
FALLS RIVER
RECLAMATION
IDAHO
WYOMING
T 10 N
T 9 N
T 8 N
R 45 E
R 46 E
R 47 E
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COMPREHENSIVE STATE WATER PLAN
South Fork Snake River Basin

PLAN SUMMARY

IDAHO WATER RESOURCE BOARD

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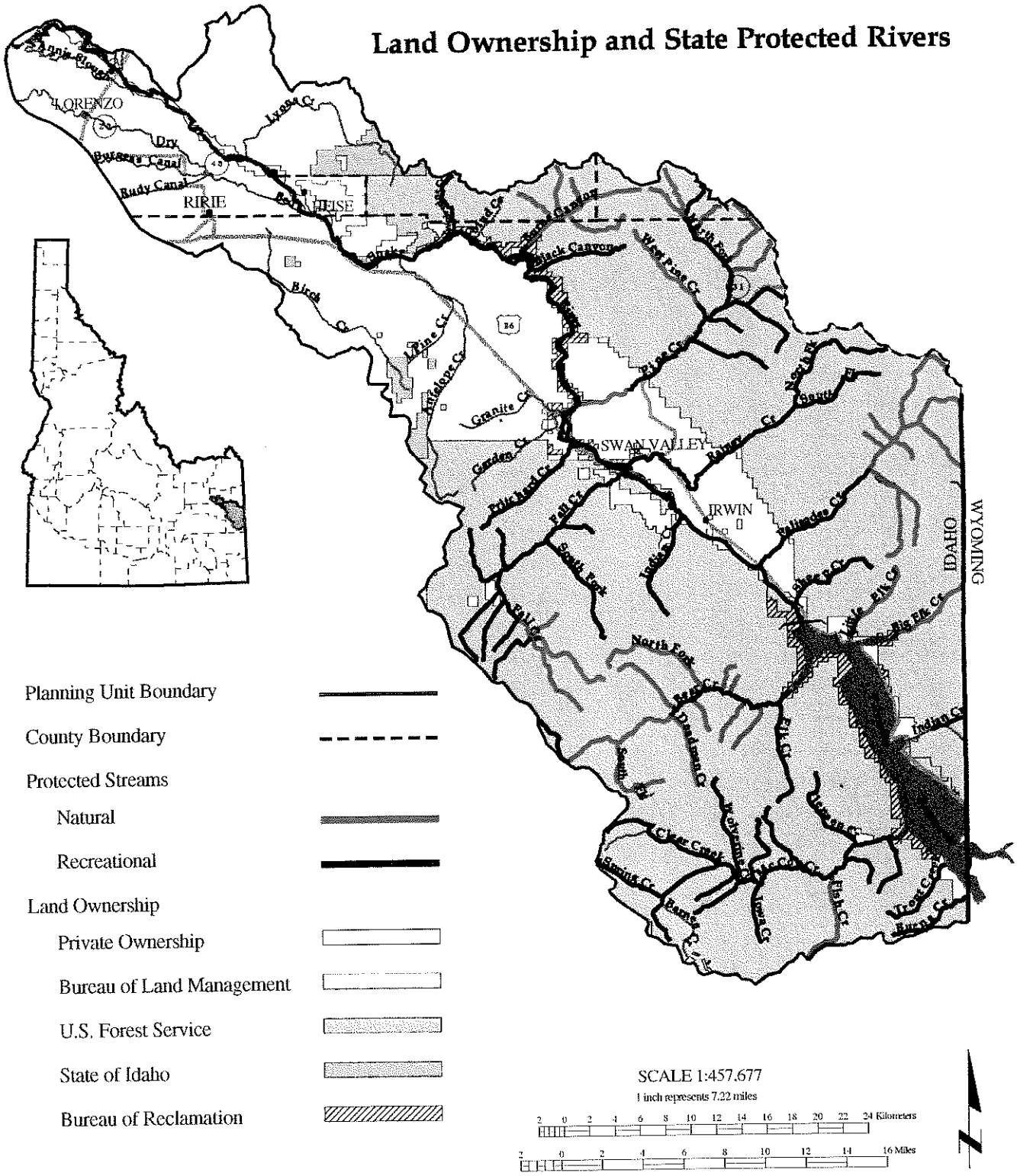
Adopted by the Idaho Water Resource Board
December 13, 1996

Figure 1

Land Ownership and State Protected Rivers



PLAN SUMMARY

The South Fork Snake River Basin encompasses all land draining into the South Fork Snake River from the Idaho-Wyoming state line to the confluence with the Henrys Fork (Figure 1). Technically the South Fork Snake River is not a fork, but the main stem of the Snake River as indicated on U.S. Geological Survey maps. The South Fork Snake is the name commonly used by many people and is used in the plan. The South Fork Snake River originates in Yellowstone National Park. The headwater tributaries originate in the Teton, Gros Ventre, and Salt River mountains located in Wyoming.

Water flow of the South Fork Snake River is regulated by Palisades and Jackson Lake dams. Jackson Lake is in Grand Teton National Park, Wyoming. The portion of Palisades Reservoir located in Idaho defines the upstream boundary of the Board's South Fork Snake River Basin. Storage and releases from Jackson and Palisades reservoirs are coordinated with operation of five other Snake River storage reservoirs located above Milner Dam. The Upper Snake River Reservoir System is operated as a unit by the U.S. Bureau of Reclamation (USBR). Water rights are under the administrative control of the Director of the Idaho Department of Water Resources (IDWR) through the watermaster of Water District 01. Water is stored and distributed according to the water right priorities that have been established for Snake River water. While there are water rights on many of the tributary streams, most of the tributaries in the basin do not have storage impoundments.

Agriculture is a predominant industry in the basin. Dryland and irrigated farming are practiced in the area. Agricultural products include winter wheat, rapeseed, spring barley, potatoes, and alfalfa. Dryland farming mainly occurs upstream of Heise on benches above the river. The most significant irrigation diversions from the river occur below the Heise gage.

The basin possesses many outstanding natural resource values. The South Fork Snake River is a nationally renowned trout fishery supporting two varieties of cutthroat trout and brown trout. The cottonwood riparian complex bordering the river is considered one of "the most extensive and highest quality" in Idaho (U. S. Department of Interior, Fish and Wildlife Service, 1980). The river corridor is also critical bald eagle habitat, supporting 37 percent of Idaho's nesting population and half of the state's production (U. S. Department of Interior, Bureau of Land Management and U. S. Department of Agriculture, Forest Service, 1991). Outstanding scenery, a quality fishery, and wildlife values provide diverse recreation opportunities.

Planning Process

The planning process encompassed six steps which are described below. Not all steps occurred in the order presented. Some occurred throughout the planning process and/or simultaneously with others.

1) ***Inventory of resource attributes*** - The resource attribute inventory is summarized in the *Basin Description* section of the South Fork Snake River Basin Plan. Resource information, figures, and statistics for this plan were obtained through literature review, field reconnaissance, contact with agency personnel, and citizen input. Maps of resource data were prepared at a scale of 1:24,000 or 1:100,000 using a geographic information system (GIS). Resource data were reviewed for accuracy by government agencies, a local advisory group, and interested public.

2) ***Identify local issues and concerns, and develop goals*** - Issues, concerns and goals related to water use help frame the scope of the South Fork Snake River Basin Plan. Issues and concerns were identified through meetings with the public, formation of a local citizens advisory group, and meetings with management agencies and local officials. Goals were developed at the advisory group meetings.

3) ***Assess current and potential water uses and constraints*** - An assessment of current and potential

water uses and constraints is contained in the South Fork Snake River Basin Plan. This information was obtained by review of water right files, pertinent literature, regulations and law, and discussion with agency personnel.

4) ***Assess and identify river segments with outstanding resource values*** - Waterways possessing outstanding fish and wildlife, recreation, scenic or geologic values are eligible for state designation as natural or recreational waterways (Idaho Code, Sec. 42-1731). Outstanding resources are indicated by 1) unique or rare features regionally or nationally, 2) significant public concern voiced for protection, and/or 3) legal protection or special agency management designation to protect important resource values. Specific criteria for defining outstanding fish and wildlife, recreation and scenic resources are described in the *Resource Evaluation* section of the South Fork Snake River Basin Plan.

5) ***Generate strategies*** - Strategies may be actions, recommendations or policies to respond to issues and concerns identified, and achieve the selected goals. They represent alternatives considered by the Board. The strategies considered for the South Fork Snake River Basin are listed in Appendix C of the plan.

6) ***Develop actions and recommendations*** - After considering alternatives and the public interest, actions and recommendations relative to improving, developing, and conserving water resources are proposed by the Board. Many actions and recommendations were the result of consensus achieved at local citizens advisory group meetings, and are described in the *Actions and Recommendations* section of the South Fork Snake River Basin Plan.

PUBLIC PARTICIPATION

Public involvement is an important part of the planning process. Input from local citizens is necessary in assessing viewpoints and conditions in the basin. Information meetings, agency coordination meetings, and local advisory group meetings provided opportunity for public critique and suggestions on the South Fork Snake River Basin Plan. In February and March 1995, public information meetings were conducted in Irwin, Victor, Ririe and Idaho Falls to inform the public about preparation of a South Fork Snake River Basin Plan, and to ask the public to identify issues and concerns.

In April 1995, the Board selected a seventeen member advisory group comprised of local citizens. The South Fork Snake Advisory Group (SFSAG) informed the Board and its staff of local concerns, reviewed information used in the development of the plan, and provided feedback and suggestions for the Board's consideration. Members represented local government, water-users, conservation groups, industry, land owners, recreationists and private citizens. The group met nine times over a period of a year. All advisory group meetings were advertised and open to the public. Newsletters were circulated to more than 200 individuals summarizing the development of the South Fork Snake River Basin Plan, notifying of advisory group meetings, and requesting comment on key pieces of information.

The Idaho Water Resource Board circulated a Draft Comprehensive State Water Plan for the South Fork Snake River Basin on October 11, 1996. Information meetings and hearings were scheduled in Ririe, Rexburg, Boise, Twin Falls and Idaho Falls in October and November 1996 to discuss and receive comment on the draft plan. Twenty people testified at public hearings and 69 written comments were received by the Board prior to the close of the comment period on December 10, 1996.

After considering the record, the Board revised the draft plan. The Board adopted the final plan in 1996. The South Fork Snake River Basin Plan was presented to the Idaho Legislature for its consideration as required by Section 42-1734B, Idaho Code. The Legislature ratified the plan in 1997. The South Fork Snake River Basin Plan is a component of the comprehensive State Water Plan of the Board.

Goals and Objectives

In adopting a comprehensive state water plan, the Board is guided by these criteria from the Idaho Code 42-1734A:

1. Existing rights, established duties, and the relative priorities of water established in the Idaho Constitution shall be protected and preserved.

2. Optimum economic development in the interest of and for the benefit of the state as a whole shall be achieved by integration and coordination of the use of water, the augmentation of existing supplies, and the protection of designated waterways for all beneficial purposes.

3. Adequate and safe water supplies for human consumption and maximum supplies for other beneficial uses shall be preserved and protected.
4. Minimum streamflow for aquatic life, recreation, aesthetics and water quality, and the protection and preservation of waterways shall be fostered and encouraged. Consideration shall be given to the development and protection of water recreation facilities.

5. Watershed conservation practices consistent with sound engineering and economic principles shall be encouraged.

Specific goals and objectives for the South Fork Snake River Basin Plan reflect current local issues, current and future uses of water, and the natural resources of the basin. The top ranking issues identified by the public led to identification of a list of wants and needs, or desired outcomes, for the South Fork Snake River Basin. The South Fork Snake Advisory Group reviewed the desired outcomes at the March 1996 meeting, and developed a list of goals for each of the eleven issue categories. Goals are general statements about the outcome or desired future for the basin. Specific goals for the basin include:

Water Quality

1. Protect water quality of the South Fork Snake and all tributaries.

2. Accumulate data to allow monitoring and verification of water quality impacts.

3. Monitor and manage activities in the river corridor potentially impacting water quality to minimize pollution.

4. Minimize soil erosion.

5. Maintain or improve water in a biologically beneficial condition.

Fisheries

6. Maintain or improve the health of the cutthroat fishery.

7. Prevent over harvest of the fishery.

Riparian Management

8. Maintain or improve the health of the riparian area.

Wildlife

9. Maintain or improve wildlife habitat.

10. Recognize the value of waterfowl, wildlife and birds of prey.

11. Maintain or improve basin ecological integrity.

Recreation

12. Maintain or improve the quality of the outdoor recreation experience.

13. Maintain or improve the quality of the fishing experience.

14. Improve safety at the Big Feeder for boaters.

Development & Growth

15. Minimize or prevent adverse effects from development along the river corridor, particularly the canyon.

16. Protect private property rights.

17. Encourage citizens to be involved in the development or revision of county land use plans.

Agency Management

18. Management decisions should use the best available science.

19. Improve coordination among agencies, private landowners and the public in managing resources in the South Fork Snake River Basin.

Water Allocation

20. Work toward cooperation between all water users.

21. Look at ways to allow greater flexibility in allocating water to different uses and address the changing demands for water in the basin and state while respecting existing rights.

22. Identify areas where instream flows are appropriate.

Operation of Palisades

23. Balance flows and timing from Palisades Reservoir to meet the needs of irrigators, flood management, power generation, private property owners, fisheries, wildlife, cottonwood regeneration, and recreation.

Irrigation

24. Encourage irrigation efficiency.

Flood Management

25. Address future flood management in the South Fork Snake River Basin

Actions and Recommendations

Actions and recommendations of the Board are consistent with the Idaho Code, private property rights, local and state management plans, and recognize public consensus achieved at South Fork Snake Advisory Group meetings conducted April, May and June, 1996. These actions and recommendations reflect the desires of local citizens of the basin and in the region. All local, state, and federal agencies are encouraged to administer their activities to help achieve the actions and recommendations contained in the Comprehensive State Water Plan for the South Fork Snake River Basin.

ACTIONS

The South Fork Snake Plan comprised a review and analysis of the present and future needs and opportunities for fifteen resource categories[1] specified by the Idaho Legislature. A need was identified to provide for state protected river designation to protect current values for Idaho and to preclude federal designation.

State River Protection Designations

A comprehensive state water plan may designate waterways as "natural" or "recreational." As defined by the Idaho Code, a recreational or natural river is "a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values" [Idaho Code 42-1731 (7) and (9)]. Natural rivers are free of substantial man-made development in the waterway, and the riparian area is largely undeveloped. Recreational rivers may include man-made development in the waterway or the riparian area.

The Idaho Water Resource Board considers the impacts of protected river designations on the social, economic and environmental livelihood of the region, and determines the value of preserving the outstanding waterways of the South Fork Snake River Basin with their current beneficial uses outweighs the value of further development at this time. The Board believes state protected river designations are preferable to federal protection, and are in the best interest of the residents of Idaho. Federal protection limits the flexibility of planning for the reach, and removes the option of amending the designation by action of the Idaho Water Resource Board and Idaho Legislature. Federal agencies are encouraged to manage lands to compliment the state protection designations.

To protect the public interest, current resource use, and the multiple-use character of the basin, the Board designates river/stream reaches as natural or recreational as indicated. The Board recognizes that no action using their comprehensive state water planning authorities can interfere with vested rights,

[1] Resource categories include navigation; power development; energy conservation; fish and wildlife; recreational opportunities; irrigation; flood control; water supply; timber; mining; livestock watering; scenic values; natural or cultural features; domestic, municipal, commercial, and industrial water uses; and other aspects of environmental or economic development [Idaho Code 42-1734A(3)] .

or the repair, replacement, or continued operation of existing facilities and works. Figure 1 shows the stream reaches with state protection designations.

Natural Rivers

The Board designates the stream reaches listed below as "natural."

Fish Creek (5.2 miles[2]): Headwaters to confluence with McCoy Creek

Big Elk Creek (4.5 miles): Idaho-Wyoming state line to 100 yards upstream of the Big Elk Creek trail head

Little Elk Creek (3.5 miles): Headwaters to confluence with Spring Run Canyon

Bear Creek and perennial tributaries (36.1 miles): Bear Creek from area where Skyline Road (Forest Road 077) no longer parallels the creek (located in T.2 S., R. 43 E., NE 1/4 of Section 20) downstream to Deadman Creek confluence, and the following perennial tributaries:

- South Fork Bear Creek: headwaters to mouth
- Deadman Creek: headwaters to mouth
- Chaparral Hollow: headwaters to mouth
- Warm Springs Creek: headwaters to mouth
- North Fork Bear Creek: headwaters to mouth
- Small Creek: headwaters to mouth
- Poison Creek: headwaters to mouth
- Currant Creek: headwaters to mouth
- Muddy Creek: headwaters to mouth

Palisades Creek and perennial tributaries (29.7 miles): Headwaters to junction with Forest Trail 099, and the following perennial tributaries:

- North Fork Palisades Creek: headwaters to mouth
- East Fork Palisades Creek: Idaho-Wyoming state line to mouth
- Corral Creek: Idaho-Wyoming state line to mouth
- Lost Spring Canyon: headwaters to mouth
- Dead Man Canyon: headwaters to mouth
- Little Dry Canyon: headwaters to mouth
- Dry Canyon: headwaters to mouth, including Upper Palisades Lake
- Water Fall Canyon: headwaters to confluence with Dry Canyon

Fall Creek and perennial tributaries (13.1 miles): Fall Creek from its headwaters to confluence with Trap Creek, and the following perennial tributaries:

- East Fork Fall Creek : headwaters to mouth
- Willow Springs Creek: headwaters to mouth

Pine Creek and perennial tributaries (2.8 miles): Pine Creek 100 yards downstream of power line crossing (located in T. 2 N., R. 43 E., Section 15) to confluence with South Fork Snake River

North Fork Pine Creek and perennial tributaries (15.0 miles): North Fork Pine Creek from its headwaters to confluence with Elk Flat Fork, and the following perennial tributaries:

- Elk Flat Fork: headwaters to mouth
- Holter Creek: headwaters to mouth
- Red Creek: headwaters to mouth
- Corral Creek: headwaters to mouth

West Pine Creek (5.2 miles): Headwaters, including unnamed headwater tributaries to 100 yards upstream of West Pine Girls Camp (located in T. 3 N., R. 44 E., NW 1/4 of Section 29)

Burns Creek and perennial tributaries (17.3 miles): Burns Creek from its headwaters (and including unnamed headwater tributaries) to the Burns Canyon trail head, and the following perennial tributaries:

- Beartrap Canyon: headwaters to mouth
- Little Burns Canyon: headwaters to mouth
- Jensen Creek: headwaters to mouth
- Hell Hole Canyon: headwaters to mouth

Recreational Rivers

The Board designates the following river/streams as "recreational":

South Fork Snake River (63.9 miles): Palisades Dam to confluence with Henrys Fork

Burns Creek (*tributary to reservoir*) (4.7 miles): Headwaters to Idaho-Wyoming state line

[2]Mileage was calculated with a geographic information system using hydrography at a scale of 1:100,000.

Trout Creek (4.6 miles): Headwaters, including all unnamed headwater tributaries, to confluence with Palisades Reservoir

McCoy Creek and perennial tributaries (62.9 miles): McCoy Creek from its headwaters to back waters of Palisades Reservoir, and the following perennial tributaries:

- Spring Creek: headwaters to mouth
- City Creek: headwaters to mouth
- Clear Creek: headwaters to mouth
- Camp Creek: headwaters to mouth
- Wolverine Creek: headwaters to mouth
- Miners Delight Creek: headwaters to mouth
- Kirk Creek: headwaters to mouth
- Iowa Creek: headwaters to mouth
- Box Canyon Creek: headwaters to mouth
- Hell Creek: headwaters to mouth
- Jensen Creek: headwaters to mouth
- Bitters Creek: headwaters to mouth

Indian Creek *(tributary to reservoir)* (1.8 miles): Idaho-Wyoming state line to Smith Canyon

Big Elk Creek (0.4 miles): One-hundred yards upstream of Big Elk Creek trail head to backwaters of Palisades Reservoir

Little Elk Creek (1.1 miles): Confluence with Spring Run Canyon to the backwaters of Palisades Reservoir

Bear Creek and perennial tributary (16.4 miles): Headwaters to point where Skyline Road (Forest Road 077) no longer parallels the creek (located in T.2 S., R. 43 E., NE 1/4 of Section 20), and from Deadman Creek confluence to backwaters of Palisades Reservoir, and the following perennial tributary:

- Elk Creek: headwaters to mouth

Sheep Creek (5.4 miles): Headwaters to confluence with South Fork Snake River

Palisades Creek (8.2 miles): Junction with Forest Trail 099 to confluence with South Fork Snake River

Indian Creek (*tributary to main stem*)(5.9 miles): Headwaters to confluence with South Fork Snake River

Fall Creek and perennial tributaries (39.3 miles): Confluence with Trap Creek to mouth, and the following perennial tributaries:

- Beaver Creek: headwaters to mouth
- Trap Creek: headwaters to mouth
- Haskin Creek: headwaters to mouth
- Camp Creek: headwaters to mouth
- Gibson Creek: headwaters to mouth
- Blacktail Creek: headwaters to mouth
- South Fork Fall Creek: headwaters to mouth
- Currant Hollow: headwaters to mouth

Rainey Creek and perennial tributaries (25.1 miles): Headwaters to confluence with South Fork Snake River, and the following perennial tributaries:

- North Fork Rainey Creek: headwaters to mouth
- South Fork Rainey Creek: headwaters to mouth

Pritchard Creek (6.5 miles): Headwaters to confluence with South Fork Snake River

Pine Creek and perennial tributaries (21.6 miles): Headwaters to 100 yards downstream of power line crossing (located in T. 2 N., R. 43 E., Section 15), and the following perennial tributaries:

- Tie Canyon: headwaters to mouth
- Poison Creek: headwaters to mouth
- West Pine Creek: one-hundred yards upstream of West Pine Girls Camp to mouth
- Mike Spencer Canyon: headwaters to mouth

North Pine Creek and perennial tributary (8.1 miles): Elk Flat Fork confluence to mouth, and the following perennial tributary:

- Lookingglass Creek: headwaters to mouth

Black Canyon (9.1 miles): Headwaters to confluence with South Fork Snake River

Warm Springs (0.2 miles): Source to confluence with South Fork Snake River

Burns Creek (0.6 miles): Burns Canyon trail head to confluence with South Fork Snake River

Wolverine Creek (3.4 miles): Headwaters to confluence with South Fork Snake River

Cress Creek (0.1 miles): Source to confluence with Sunnydell Canal

Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited within the stream channel or below the highwater mark on the reaches designated a "natural" river:

- construction or expansion of dams or impoundments,
- construction of hydropower projects,
- construction of water diversion works,
- dredge or placer mining,
- alterations of the stream bed, and
- mineral or sand and gravel extraction within the stream bed.

Activities prohibited on "natural" rivers are also prohibited on "recreational" rivers in the South Fork Snake River Basin with the following exceptions.

- Alteration of the streambed necessary to keep the South Fork Snake River within its historical meander below Heise, or other similar activities necessary to fulfill the flood management responsibilities of Flood Control District No. 1 are allowed in the reach from Grassy Banks (one mile above Heise gage) to the confluence with the Henrys Fork. Such activities must comply with the Stream Channel Protection Act and the rules adopted to implement the act.

- Alteration of the stream bed for installation of fisheries enhancement structures is allowed on the following reaches designated recreational: Bear Creek, Big Elk Creek, Fall Creek, North Fork Pine Creek, Palisades Creek, Pine Creek, Pritchard Creek, and Rainey Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

- Stream channel alterations are allowed for public agencies to reconstruct or realign recreation trails to prevent resource damage on the following reaches designated recreational: Cress Creek, Bear Creek, Trap Creek, South Fork Fall Creek, Palisades Creek, North Fork Pine Creek, and Rainey Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

- Stream channel alterations are allowed for public agencies to reconstruct or construct new livestock bridges to prevent resource damage on the following reaches designated recreational: Bear Creek, South Fork Fall Creek, Lookingglass Creek and North Fork Pine Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

- Stream channel alterations are allowed for temporary roads for vegetation management on Burns Creek (tributary to Palisades Reservoir). Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

- Stream channel alterations for recreational dredge mining may continue on McCoy Creek from the headwaters to Fish Creek confluence, and on the following perennial tributaries: City Creek, Camp Creek, Miners Delight Creek and Iowa Creek. This activity is allowed as regulated by the Caribou National Forest through a Special Use Permit issued according to the guidelines established in the "Environmental Assessment for Small Placer Mining Operations in the Caribou Basin Area" (Record of Decision issued December 12, 1994), and with a Stream Channel Alteration Permit from the Idaho Department of Water Resources. Temporary diversions for the purposes of sluicing are allowed, but must obtain a Temporary Approval of Water Appropriation from the Idaho Department of Water Resources.

- Construction of boat ramps and docks may be allowed on the South Fork Snake River with Board and other regulatory agency approval for the reaches between Palisades Dam to Pine Creek confluence and Black Canyon to Henrys Fork confluence. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Regulations and Minimum Standards. This exemption does not apply to the reach between Pine Creek confluence to Black Canyon.

Prohibitions for natural or recreational designations do not interfere with activities necessary to maintain and improve existing utilities, roadways, managed stream access facilities, diversion works, and for the maintenance of private property. State designation does not change or infringe upon existing water rights or other vested property rights. It does not restrict the expansion or maintenance of existing uses.

A recreational designation for the South Fork Snake River is not intended to prevent a water user from cleaning, maintaining, or replacing an existing water diversion structure. A water user may remove obstructions from the stream channel such as gravel bars, if the obstructions interfere with the delivery or use of water under any existing water right.

Minimum Streamflows

It is the policy of Idaho that the Idaho Water Resource Board should seek to appropriate waters in the state for instream flow purposes when it is in the public interest. Idaho Code, Title 42, Chapter 15 provides the authority and spells out procedures for the Board to appropriate water for minimum streamflows. A minimum streamflow is a quantity of water, or lake level, required to protect fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, navigation, transportation or water quality in the public interest. By law, a minimum streamflow is not an ideal flow, but the minimum necessary to achieve the objectives. The water right is held by the Board and is junior to all earlier water rights. It is not a guaranteed minimum flow, but is only achieved after senior water rights are fulfilled.

In order for the Board to acquire a minimum streamflow, a process separate from the development of a comprehensive state water plan must occur. Studies to determine the quantity and timing of the minimum streamflow will need to be conducted. The Director of the Idaho Department of Water Resources determines whether the minimum stream flow right is granted in accordance with Title 42, Chapter 15 of the Idaho Code. Legislative review of minimum stream flow rights granted by the IDWR is required.

To protect fisheries values, minimum streamflow studies to identify critical reaches have been recommended for several important cutthroat spawning tributaries and for kokanee habitat on Big Elk Creek. These include the following tributaries:

- Bear Creek
- Big Elk Creek
- Burns Creek
- Fall Creek
- Palisades Creek
- Pine Creek

Idaho Code requires specific data to support an application for a minimum streamflow. The Board currently does not have the data required by the Code to pursue minimum streamflows on the recommended streams. The Board recommends that the Idaho Department of Fish and Game (IDFG), in cooperation with the Bureau of Land Management (BLM) and the Forest Service, conduct studies to quantify flows and acquire other necessary information to process minimum streamflow applications for the above-mentioned streams within the next five years. If the appropriate information is available and indicates a minimum streamflow is warranted, the Board will take action.

Amendments to the Idaho State Water Plan

The *Idaho State Water Plan* contains a policy which provides for protection of potential reservoir sites from significant land use change, and lists sites to reserve within Idaho (IWRB, 1992). The Lynn Crandall site on the South Fork Snake River near the Burns Canyon confluence was one of the sites identified (IWRB, 1992). Information received at public meetings and recommendations from the South Fork Snake Advisory Group asked for removal of Lynn Crandall as a potential reservoir site in the *Idaho State Water Plan*. Some input was received supporting continued consideration of the site as a future storage site.

The public expressed concerns about impacts to the cutthroat fishery, wildlife, recreation and scenic values with construction of the Lynn Crandall project. The resource inventory and evaluation described in the plan document outstanding fish and wildlife, recreation and scenic values for this reach of the South Fork Snake River.

The Board was revising the *Idaho State Water Plan* simultaneous to preparing the South Fork

Snake Plan. Based on input received during public participation for the South Fork Snake Plan, and weighing the environmental and social values impacted by construction of Lynn Crandall, the Board removed Lynn Crandall as a potential reservoir site from the *1996 Idaho State Water Plan*. Additionally, the Board requests the U. S. Bureau of Reclamation (USBR) to relinquish land withdrawals reserved for the project site. The USBR filed a water right application for storage for the Lynn Crandall Project with IDWR having a 1969 priority date. No action has been taken to pursue a permit or license. The Board requests that the USBR withdraw this application.

RECOMMENDATIONS

The Board does not have the authority or funding to implement many of the recommendations contained in the Comprehensive State Water Plan. However, the Board does have the authority to establish water policy for the state, planning for the improvement, development and conservation of water resources. These plans are also submitted to the Idaho Legislature for review and ratification. The plan for the South Fork Snake River Basin was developed with significant input and participation by citizens and agencies. The Board requests the agencies and organizations referenced implement the recommendations contained in the plan, and state agencies "exercise their duties in a manner consistent with the comprehensive state water plan" [Idaho Code 42-1734B (4)]. Federal agencies are encouraged to manage their lands in a manner consistent with the recommendations contained in the plan.

Northwest Power Planning Council (NWPPC) Protected Area Designations

The Board has designated the rivers listed on pages 5 and 6, and shown in Figure 1 as state protected rivers. The Board recommends that NWPPC actions be in accordance with these designations.

Operation of Palisades Reservoir

Discussion at advisory group meetings regarding instream flows below Palisades Dam did not result in consensus with final recommendations forwarded to the Board. However, many suggestions and ideas were presented that merit further exploration.

Much of the discussion about releases at Palisades Dam indicate a need for all water interests to gather collectively and discuss their concerns. The Board believes this approach would benefit water interests in the South Fork Snake River Basin. The Board recommends that the U. S. Bureau of Reclamation work cooperatively and meet at least semiannually (before and after the irrigation season) with all water interests in a facilitated forum to exchange information and ideas about releases from the Upper Snake System (including Palisades Dam). A watershed council could be the ideal forum to facilitate these meetings. Semiannual meetings would provide a means for all water interests to talk to each other and understand others' concerns. Water interests would have an opportunity to collectively evaluate options for water resource management within legal, administrative and operating constraints to maximize benefits for all interests.

The USBR's Snake River Resource Review Project provides an outstanding opportunity to model different management scenarios for the Upper Snake System. The project will develop a decision support system helping managers to analyze different operation alternatives for the Snake System above Brownlee Reservoir. The Board supports the cooperative efforts of the Idaho Department of Water Resources and the USBR to develop an improved river management decision-making system for the Upper Snake. The Board encourages an analysis of the potential risks associated with filling the Upper Snake System reservoirs under various release scenarios at Palisades Dam, including winter flows for fishery maintenance.

Snake Plain Aquifer Recharge

The Snake Plain Aquifer provides an opportunity to store water for beneficial use. The Board makes use of water in the basin as part of the recharge program. To efficiently manage the state's water, a technically sound, hydrologic-based aquifer recharge plan needs to be prepared. The plan needs to establish clear objectives for the recharge program, determine locations and timing to apply recharge water to maximize recharge objectives, and determine consistency with conjunctive management

policies. As part of this effort, some of the constraints associated with winter water savings should be reexamined.

Wild and Scenic River System

The Forest Service and BLM have found the South Fork Snake River and other waterways in the basin eligible for further study as potential federal wild and scenic rivers. Because of the comprehensive scope of state water planning, the Board encourages the BLM and Forest Service to work within the state water planning process rather than pursuing federal protection of waters within Idaho. State water planning provides a means of ensuring coordinated water planning with federal and state governments. Additionally, the Board requests that the Forest Service and BLM manage lands in a manner compatible with state protection designations.

Land Development in the Basin

Issues and concerns associated with land development pressures in the basin frequently were mentioned during public meetings. Although a priority issue, the advisory group did not have an opportunity to work towards agreement on recommendations for this issue topic. The Board believes that maintenance of the outstanding resource values inventoried in the South Fork Snake River Basin is largely dependent on the direction and character of future development. Counties and local communities have the most influence over the future character of the basin through their planning and zoning decisions.

The Board supports the efforts of county commissioners, community officials and planning departments to work closely with the public when making decisions about land use development in the South Fork Snake River Basin. Formation of a watershed council with active participation by local government may improve communication further, and help identify local concerns and goals to achieve the future landscape setting and community desired by local citizens. The Board encourages the communities of Swan Valley and Irwin to work cooperatively in coordinating planning activities with each other and Bonneville County.

Cooperative agreements for watershed protection need to be established between developers, farmers, and land managers in the basin, to insure that the impending changes to the South Fork Snake River Basin do not have adverse consequences for the water quality and the biological communities. Increased urbanization, soil types and the hydrologic conditions of the basin indicate conventional septic systems will not be adequate. The Board recommends that counties investigate options for financing and constructing sewage systems in the Swan Valley, Conant Valley and Irwin areas to prevent pollution of ground and surface water.

It is recommended that authorities closely monitor permitting and installation of septic systems to ensure protection of the water quality of the South Fork Snake River and its tributaries. Site planning should consider the soil assimilative capacity in selecting lot sizes. Careful review and establishment of stringent guidelines by county officials and Health District VII personnel for implementation of sewage systems should continue. The IDWR and Health District should continue to coordinate installation and permitting of septic systems and wells to protect ground water in the basin.

Flood Management

As the basin sees an increase in population and development, potential impacts from flooding will increase. The counties and communities in the basin participate in the National Flood Insurance Program (NFIP). Participation has resulted in adoption of floodplain ordinances which outline land use measures to minimize flood damage. The Board encourages these entities to continue their participation in the NFIP so that risks from flooding can be minimized, and land owners have the opportunity to purchase flood insurance. The Board encourages the counties and communities to continue to take responsibility for monitoring development in the floodplain to ensure floodplain ordinances are followed, and development does not increase potential flood damage.

Flood control operations of Palisades Dam are guided by flood control rule curves with a flood stage flow of 24,500 cubic feet per second (cfs) (Beus, 1996). Flows in excess of 25,000 cfs at Heise have occurred on four occasions since construction of Palisades Dam (1957). The Board recommends development should not encroach into

the area inundated by these flows to minimize flood damage.

The levees below Heise were constructed to provide protection for 100-year flood events. Deposition in the South Fork Snake River channel has, and will continue, to decrease the effectiveness of these levees to contain flows of 30,000 cfs (the 100-year flood event). Sustained high velocity flows may erode levees and increase flooding risks. Major river channel shifts could impinge the levees in this reach. Currently levee maintenance by Flood Control District No.1 has consisted of riprap repairs. Current values of lands adjacent to the levees are not high enough to justify significant investments for maintenance of the levee system. However, future development may increase land values and require more expensive options. The counties are encouraged to manage lands adjacent to the levees so that land values do not require expensive flood control measures. The Board recommends that the U.S. Corps of Engineers conduct a study to identify appropriate and cost-effective flood management options to address the issue of deposition in the river channel.

Management of Recreation Resources

The demands on recreation resources in the South Fork Snake River Basin have increased significantly in the past five years. These demands are the result of the outstanding recreation opportunities available on the South Fork Snake River and the growing regional and local populations. The budgets of agencies responsible for managing recreation opportunities in the basin are not keeping pace with the demand, and many have experienced reduced budgets in recent years. In order to maintain the quality of the recreation experience and protect associated resources contributing to the experience, sufficient funding must be procured.

The Omnibus Consolidated Rescissions and Appropriation Act of 1996 provides authority for the BLM and Forest Service to manage recreation fee demonstration projects. The program would allow collection of fees, and return 100 percent of the revenues for the operation, maintenance, improvement and expansion of projects at the site of collection. The Board encourages the BLM and Forest Service, in cooperation with state and county recreation management agencies, to explore the option of collecting fees for facilities along the South Fork Snake River corridor under this program. Revenues should be used to help offset the cost of operations, maintenance and enforcement in the river corridor, and protect outstanding resource values identified in the South Fork Snake River Plan.

South Fork Snake River Basin Planning Boundaries

Public comment has identified some tributaries to the Salt River that would best be evaluated as part of the South Fork Snake River Basin. Adequate evaluation of these tributaries has not occurred as part of the Board's comprehensive state water planning process for the current effort. During the next review or revision to the South Fork Snake River Basin Comprehensive State Water Plan, the Idaho Water Resource Board will expand the planning basin boundaries to include tributaries to the Salt River originating in Idaho. The tributaries include: Jackknife Creek, Tincup Creek, Stump Creek, Tygee Creek, Crow Creek, Jack Creek and their tributaries.

Additional Recommendations

The following recommendations were generated during South Fork Snake Advisory Group meetings conducted in April, May and June 1996. The recommendations that follow reflect strategies that received support during group discussions at advisory group meetings. The Board adopts these recommendations as part of the Comprehensive State Water Plan for the South Fork Snake River Basin.

Water Quality

1. Agencies and property owners are encouraged to use appropriate best management practices (BMPs) for all land uses. Soil conservation districts can encourage implementation of BMPs to minimize soil erosion appropriate to farming and grazing operation and needs.

2. Local soil conservation districts are requested to seek funding and identify additional drainages that could benefit from the State Agricultural Water Quality Program, promoting voluntary participation and local decision-making.

3. Soil conservation districts are asked to review the Conservation Reserve Program (CRP) to identify additional incentives for farmers to reduce erosion.

4. Land management agencies are encouraged to increase education and enforcement to reduce erosion from off-road vehicle use.

5. The Division of Environmental Quality (DEQ) and Idaho Department of Fish and Game (IDFG) are encouraged to work to maintain or improve water quality in a condition suitable for the preservation of healthy populations of the native cutthroat trout.

6. DEQ and the Health District VII are encouraged to study the impacts of possible pollution from septic tank discharge in the South Fork Snake River Basin. This would include determining appropriate housing densities and sanitation technologies given soil types and other relevant factors.

7. BLM and Forest Service requirements to pack out human waste in the canyon section of the South Fork Snake River should continue.

8. The soil and water conservation districts, landowners and a watershed council are encouraged to work together to retain Conservation Reserve Program (CRP) lands in grass cover after contracts expire, or determine other feasible alternatives.

9. Agencies collecting water quality data, including DEQ, IDWR, U. S. Geological Survey (USGS), IDFG, and universities, are encouraged to develop a common database to allow sharing of information between agencies.

10. The Board supports citizen involvement in the formulation of water quality monitoring plans and reporting by DEQ and the Health District. These data should be reported regularly.

11. DEQ is encouraged to implement an appropriate water quality monitoring program to ensure that adverse water quality trends are detected in a timely manner.

12. The Idaho Department of Agriculture and canal companies are encouraged to educate people about the potential effects to downstream users of dumping into canals and other waterways.

13. DEQ, the Health District, and counties are encouraged to explore feasible options for counties in the basin to finance sewage systems for water quality protection.

14. Idaho Department of Agriculture is encouraged to educate pesticide users that any rinsing, dumping or spilling of pesticides into waterways is prohibited and can adversely impact water quality.

Fisheries

1. To safeguard against over harvest in the future while providing for increasing recreational demand, the Board supports IDFG efforts to continue focusing on trout habitat maintenance, and increasing overall habitat quality and quantity. If over harvest occurs, Idaho Department of Fish and Game is encouraged to develop more restrictive regulations.

2. IDFG is encouraged to continue working with other land management agencies and land owners to increase spawning habitat by protecting spawning tributaries and screening tributary diversions.

3. The Board recommends the Natural Resource Conservation Service (NRCS), IDFG and Trout Unlimited initiate further planning and evaluation of the Rainey-Palisades Creek irrigation project to determine if other alternatives are available to improve irrigation efficiency and fish passage. These entities should also explore cooperative funding options.

Riparian Management

1. Land management agencies are encouraged to educate the community about the importance of cottonwood regeneration.

2. The Board recommends the Legislature pass legislation to allow tax incentives for leaving riparian areas undeveloped, or improving riparian habitat and badly eroded areas.

3. Control noxious weeds through use of biological control by encouraging and supporting continued efforts by the South Fork Biological Weed Control Committee.

4. Recommend state and federal agencies, and local governments work cooperatively to identify options to preserve and enhance the cottonwood forest.

Options to consider include fencing high use areas on the main stem or tributaries, beaver control, or creative land zoning.

5. The BLM, Forest Service and IDFG are encouraged to investigate the feasibility and expense of planting cottonwoods.

6. A cooperative study involving state and federal agencies investigating the feasibility of using flood flows to help promote cottonwood regeneration is recommended. Determine the most plausible flows that will not significantly impact property. Determine other beneficial and adverse impacts that would occur with these flows.

Wildlife

1. Encourage BLM, Forest Service, U.S. Fish and Wildlife Service and/or IDFG to install posters at boat put-ins to warn people about disturbing or harassing birds (especially bald eagles) and other wildlife.

2. The IDFG is encouraged to work cooperatively with USBR regarding releases to ensure Canada geese nesting success.

3. Organization by IDFG of an annual volunteer effort for regular maintenance of goose nesting boxes is recommended.

Recreation

1. Idaho Department of Parks and Recreation, county sheriffs, and boating organizations are requested to encourage, educate and promote proper boating etiquette on the South Fork Snake River. This could involve implementation of a program to help various recreation users resolve conflicts and learn to respect each other.

2. Legislation is needed allowing the Idaho Outfitters and Guides Licensing Board to issue larger fines to ensure strict enforcement of outfitter and guide regulations. Legislation should allow confiscation of property, in addition to monetary fines, for individuals who illegally practice outfitting.

3. The Board supports establishing a Memorandum of Understanding (MOU) between the Idaho Department of Fish and Game, Idaho Outfitters and Guides Licensing Board, U. S. Forest Service, Bureau of Land Management, and Bonneville County to coordinate efforts to enforce regulations for the outfitting and guiding industry and recreational activities on the South Fork Snake.

Agency Management

1. Concerned citizens are encouraged to establish a watershed council for the South Fork Snake River Basin to help coordinate management agencies' and local officials' activities and ensure that citizens' concerns are accommodated in the decisions. Membership and participation should be broad-based, including all interest groups and agencies.

Use the watershed council as a forum to:

- Establish agreements in cooperation with landowners along the river to protect water quality.
- Coordinate with landowners and agencies to resolve conflicts.
- Educate homeowners about the sources of pollution harmful to aquatic life, i.e., lawn chemicals, septic tank discharge, automotive and household fluids, and siltation.
- Educate landowners about the opportunity to obtain loans and grants from the Soil and Water Conservation Districts (through the Idaho Soil Conservation Commission) for range and riparian improvements.

2. The watershed council should explore funding opportunities to support council activities, including the availability of mitigation monies from the Bonneville Power Administration.

Water Allocation

1. Agencies and organizations desiring instream flows, such as IDFG and Trout Unlimited, are encouraged to explore ways to secure these flows. Options to consider might include buying reservoir storage space, purchasing from the water bank, and/or working with irrigators to identify minimum flows in the river.

Operation of Palisades Project

1. If possible within operating constraints, the USBR is encouraged to release water early enough from Palisades and Jackson dams with the goal of maintaining flows less than 18,000 cfs during July to enhance recreation.

2. Wildlife agencies and organizations are encouraged to work with irrigators and the USBR on any compromises to achieve flow rates to better balance wildlife needs.

3. The USBR is requested to establish ramping rate protocols for Palisades Dam that can be accommodated in the constraints of the system.

4. The USBR is encouraged to manage releases from the Upper Snake projects to integrate flows needed for fisheries, recreation, wildlife and riparian habitat, in addition to irrigation and flood control objectives

Irrigation

1. The IDWR is encouraged to quantify how improved efficiency effects aquifer recharge and water levels at wells and springs.

2. The watermaster and canal companies are encouraged to investigate options for improving voice messaging and posting messages over the weekend to Water District One to improve efficiency in managing water.

Flood Management

1. A study to address the high water table and flooding concerns in Ririe and surrounding areas is recommended.

2. Flood Control District No. 1 should maintain existing dikes/levees/riprap for property currently protected. Do not allow expansion of dikes/levees/riprap to make additional land available for development.

3. The counties are encouraged to discourage building in the floodplain.

4. The counties are encouraged to restrict development adjacent to the South Fork Snake River corridor that would infringe upon the U.S. Bureau of Reclamation's ability to release flood stage flows of 24,500 cfs from Palisades Dam.

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IDAHO COMPREHENSIVE STATE WATER PLAN

South Fork Snake River Basin

Idaho Water Resource Board

Clarence A. Parr, Chairman
F. Dave Rydalch, Vice-Chairman
J. David Erickson, Secretary
Robert Graham
Joseph L. Jordan
Erval Rainey
Jerry R. Rigby
Terry T. Uhling

December 1996

BEFORE THE WATER RESOURCE BOARD
OF THE STATE OF IDAHO

IN THE MATTER OF THE SOUTH FORK SNAKE RIVER BASIN COMPONENT OF THE COMPREHENSIVE STATE WATER PLAN	))))	A RESOLUTION

WHEREAS, the Board, pursuant to its planning authorities in 42-1734A and 42-1734B, Idaho Code, has developed a Comprehensive State Water Plan for the South Fork Snake River Basin; and

WHEREAS, the Board is directed to identify goals and objectives, as well as make recommendations for improving, developing or conserving the water resources of the planning area; and

WHEREAS, the Board as part of its planning process is authorized to designate protected river reaches as "natural" or "recreational" and to prohibit certain activities within the stream bed; and

WHEREAS, the Board has sought and received substantial public participation throughout the planning process for the South Fork Snake River Basin component of the Comprehensive State Water Plan.

NOW, THEREFORE, BE IT RESOLVED that, having considered the draft plan and the public comment received, the Board hereby adopts the attached Comprehensive State Water Plan - South Fork Snake River Basin.

PASSED AND APPROVED this 13th day of December, 1996.

Clarence Parr
CLARENCE PARR, Chairman

ATTEST:

J David Erickson
J. DAVID ERICKSON, Secretary

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INTRODUCTION

The Idaho Water Resource Board (Board) is a constitutional agency responsible for developing a plan for the State's water resources (Article XV, Section 7 of the Idaho Constitution). Legislation in 1988 provided for the development of a "comprehensive state water plan" based upon river basins or other geographic considerations. Each basin or waterway plan becomes a component of the State Water Plan.

The South Fork Snake River Basin Plan examines existing and planned resource uses in the basin, and discusses the Board's goals, objectives, recommendations and actions for improving, developing, and conserving water resources in the public interest. The area covered is the watershed draining into the Snake River from the Idaho-Wyoming state line to the Henrys Fork confluence. This reach of the Snake River is commonly called the South Fork Snake.

The 1988 legislation authorized the Idaho Water Resource Board to prepare comprehensive state water plans for conservation, development, management and optimum use of all unappropriated water resources and waterways in the state. As part of that plan, some highly-valued waterways may be designated as state protected rivers. If the Board decides that the values of preserving a waterway in its existing condition outweigh the values of future development, it can, subject to legislative approval, designate that waterway either a "natural" or a "recreational" river to protect existing values and resources.

Because public concerns, values, and demands change over time, the Board will review and reevaluate each component of the Comprehensive State Water Plan at least every five years [Idaho Code 42-1734B(7)]. Private parties and public agencies may propose plan amendments. The Board will decide whether to amend the plan based on an evaluation of the impact of such change on the protection and preservation of the state's waterways, its economic impact on the State as a whole, whether it affects existing water rights, whether it is necessary to provide adequate and safe water for human consumption, and whether it is necessary to protect life. All amendments to the Comprehensive State Water Plan are submitted for review to the Idaho Legislature as required by law.

Planning Process

The planning process encompassed six steps which are described below. Not all steps occurred in the order presented. Some occurred throughout the planning process and/or simultaneously with others.

1) ***Inventory of resource attributes*** - The resource attribute inventory is summarized in the *Basin Description* section of the South Fork Snake River Basin Plan. Resource information, figures, and statistics for this plan were obtained through literature review, field reconnaissance, contact with agency personnel, and citizen input. Maps of resource data were prepared at a scale of 1:24,000 or 1:100,000 using a geographic information system (GIS). Resource data were reviewed for accuracy by government agencies, a local citizens advisory group, and interested public.

2) ***Identify local issues, concerns, and goals*** - Issues, concerns and goals related to water use help frame the scope of the South Fork Snake River Basin Plan. These were identified through meetings with the public, formation of a local citizens advisory group, and meetings with management agencies and local officials. Issues, concerns and goals for the South Fork Snake River Basin Plan are described in the *Issues, Considerations and Plan Objectives* portion of the plan, and summarized in Appendix B.

3) ***Assess current and potential water uses and constraints*** - An assessment of current and potential water uses and constraints is contained in the Water Resources portion of the *Basin Description* section and the *Institutional Constraints and Opportunities* section of the South Fork Snake River Basin Plan. This information was obtained by review of water right files, pertinent literature, regulations and law, and discussion with agency personnel.

4) ***Assess and identify river segments with outstanding resource values*** - Waterways possessing outstanding fish and wildlife, recreation, scenic or geologic values are eligible for state designation as natural or recreational waterways (Idaho Code, Sec. 42-1731). Outstanding resources are indicated by 1) unique or rare features regionally or nationally, 2) significant public concern voiced for protection, and/or 3) legal protection or special agency management designation to protect important resource values. Specific criteria for defining outstanding fish and wildlife, recreation and scenic resources are described in the *Resource Evaluation* section of the South Fork Snake River Basin Plan.

5) ***Generate strategies*** - Strategies may be actions, recommendations or policies to respond to issues and concerns identified, and achieve the selected goals. They represent alternatives considered by the Board. The strategies considered for the South Fork Snake River Basin are listed in Appendix C.

6) ***Develop actions and recommendations*** - After considering alternatives and the public interest, actions and recommendations relative to improving, developing, and conserving water resources are proposed by the Board. Many actions and recommendations were the result of consensus achieved at local citizens advisory group meetings, and are described in the *Actions and Recommendations* section of the South Fork Snake River Basin Plan.

Public Involvement

Public involvement is an important part of the planning process. Input from local citizens is necessary in assessing viewpoints and conditions in the basin. Information meetings, agency coordination meetings, and local advisory group meetings provided opportunity for public critique and suggestions on the South Fork Snake River Basin Plan. In February and March 1995, public information meetings were conducted in Irwin, Victor, Ririe and Idaho Falls to inform the public about preparation of a South Fork Snake River Basin Plan, and to ask the public to identify issues and concerns.

In April 1995, the Board selected a seventeen member advisory group comprised of local citizens. The South Fork Snake Advisory Group (SFSAG) informed the Board and its staff of local concerns, reviewed information used in the development of the plan, and provided feedback and suggestions for the Board's consideration (Rule 30.01.b, Comprehensive State Water Plan Rules, Idaho Water Resource Board, 1992). Members represented local government, water-users, conservation groups, industry, land owners, recreationists and private citizens. The group met nine times over a period of a year. All advisory group meetings were advertised and open to the public. A list of the South Fork Snake Advisory Group members and a summary of advisory group meetings is furnished in Appendix A. Newsletters were circulated to more than 200 individuals summarizing the development of the South Fork Snake River Basin Plan, notifying of advisory group meetings, and requesting comment on key pieces of information.

The Idaho Water Resource Board circulated a Draft Comprehensive State Water Plan for the South Fork Snake River Basin on October 11, 1996. Information meetings and hearings were scheduled in Ririe, Rexburg, Boise, Twin Falls and Idaho Falls in October and November 1996 to discuss and receive comment on the draft plan.

Twenty people testified at public hearings and 69 written comments were received by the Board prior to the close of the comment period on December 10, 1996.

After considering the record, the Board revised the draft plan. The Board adopted the final plan in 1996. The South Fork Snake River Basin Plan was presented to the Idaho Legislature for its consideration as required by Section 42-1734B, Idaho Code. The Legislature ratified the plan in 1997. The South Fork Snake River Basin Plan is a component of the comprehensive State Water Plan of the Board.

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BASIN DESCRIPTION

Area Overview

The South Fork Snake River Basin encompasses all land draining into the South Fork Snake River from the Idaho-Wyoming state line to the confluence with the Henrys Fork (Figure 1). Technically the South Fork Snake River is not a fork, but the main stem of the Snake River as indicated on U.S. Geological Survey maps. The South Fork Snake is the name commonly used by many people and is used in this plan. The South Fork Snake River originates in Yellowstone National Park. The headwater tributaries originate in the Teton, Gros Ventre, and Salt River mountains located in Wyoming.

Water flow of the South Fork Snake River is regulated by Palisades and Jackson Lake dams. Jackson Lake is in Grand Teton National Park, Wyoming. The portion of Palisades Reservoir located in Idaho defines the upstream boundary of the Board's South Fork Snake River Basin. Storage and releases from Jackson and Palisades reservoirs are coordinated with operation of five other Snake River storage reservoirs located above Milner Dam. The Upper Snake River Reservoir System is operated as a unit by the U.S. Bureau of Reclamation (USBR). Water rights are under the administrative control of the Director of the Idaho Department of Water Resources (IDWR) through the watermaster of Water District 01. Water is stored and distributed according to the water right priorities that have been established for Snake River water. While there are water rights on many of the tributary streams, most of the tributaries in the basin do not have storage impoundments.

Agriculture is a predominant industry in the basin. Dryland and irrigated farming are practiced in the area. Agricultural products include winter wheat, rapeseed, spring barley, potatoes, and alfalfa. Dryland farming mainly occurs upstream of Heise on benches above the river. The most significant diversions from the river for irrigation occur below Heise.

The basin possesses many outstanding natural resource values. The South Fork Snake River is a nationally renowned trout fishery supporting two varieties of cutthroat trout and brown trout. The cottonwood riparian complex bordering the river is considered one of "the most extensive and highest quality" in Idaho (U. S. Department of Interior, Fish and Wildlife Service, 1980). The river corridor is also critical bald eagle habitat supporting 37 percent of Idaho's nesting population, and half of the state's production (U. S. Department of Interior, Bureau of Land Management and U. S. Department of Agriculture, Forest Service [BLM and Forest Service], 1991). Outstanding scenery, a quality fishery, and wildlife values provide diverse recreation opportunities.

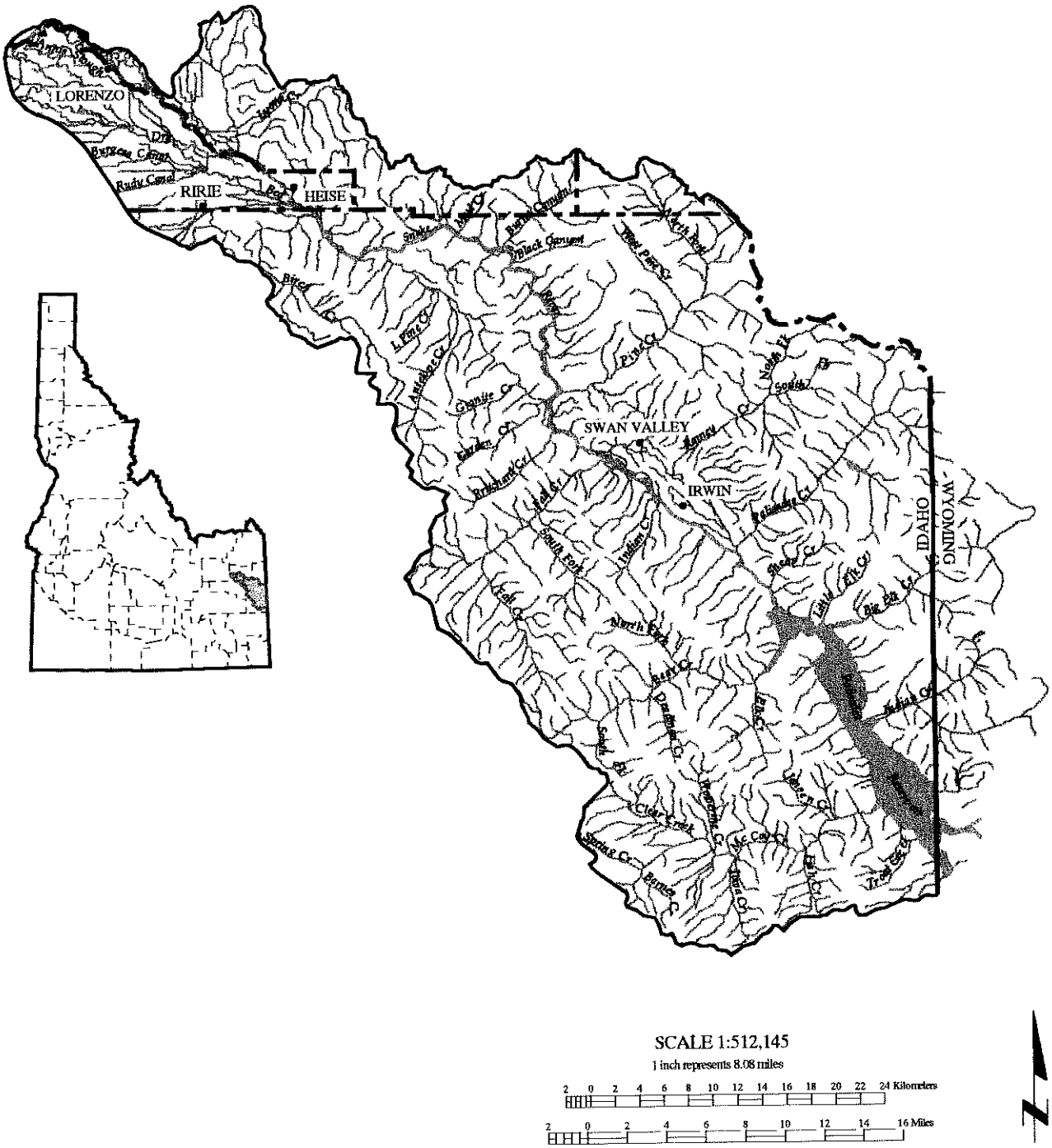
GEOLOGY AND SOILS

The basin straddles two physiographic provinces. The eastern portion encompasses the Middle Rocky Mountain province and the western half contains the eastern edge of the Snake River Plain province. The Middle Rocky Mountain province is characterized by the heavily forested Yellowstone Plateau of volcanic origin, and complexly folded and faulted ranges.

The Snake River, Big Hole and Caribou mountain ranges in the basin illustrate the folding and faulting processes that formed the Rocky Mountains. Rocks of Paleozoic and Mesozoic sedimentary formations moved along the thrust faults in Cretaceous time about 70 to 90 million years ago (Alt and Hyndman, 1989). The Caribou Range is composed of rocks from Mesozoic formations deposited during Triassic and Jurassic time. The Snake River range is an older formation deposited during Paleozoic time. The Big Hole range contains formations from Mesozoic and Paleozoic eras.

Figure 1

Water Resources



The ranges along the Idaho-Wyoming border are commonly referred to as the Idaho-Wyoming thrust belt. The belt is a part of the North American Cordillera, a chain composed of numerous mountain ranges extending from Alaska into Mexico. Faults were formed by the compression of the earth's shallow crust from west to east, causing the sheets to override each other. The older western plate overlies the younger rocks, deviating from expected sequences. Streams later cut valleys through the thrust plates. The eastern edge of the Basin and Range faults are beginning to alter the mountains in the overthrust belt (Alt and Hyndman, 1989). The Grand and Swan valleys are in a dropped Basin and Range fault block carved into the overthrust belt.

The eastern edge of the Snake River Plain physiographic province flanks the Caribou and Snake River ranges on the west. The Snake River Plain is a lava-filled basin formed by the eruption of rhyolite volcanoes that became extinct as the hot spot moved northeastward, currently located at Yellowstone (Alt and Hyndman, 1989). Stretching of the earth's crust followed along the Basin and Range faults, causing basalt to flow and cover the rhyolite.

Menan Buttes, located at the confluence of the South Fork Snake River and Henrys Fork, is at the edge of the Rexburg caldera. The buttes are composed of basaltic glass, formed by quick chilling of the magma as it erupted in the saturated alluvium of the Snake River Valley. The glassy tuff cones are found in only a few places in the world, leading to designation as a National Natural Landmark. National Natural Landmarks are "sites determined to be one of the best examples of a natural region's characteristic biotic or geologic features" (U. S. Department of Interior, National Park Service, 1987).

Soils located in the South Fork Snake River floodplain above Heise comprise the Hobacker-Badgerton Variant-Typic Cryaquolls unit (USDA Soil Conservation Service [SCS], 1981a). Soils are very deep from 30-32 inches, located on nearly level to moderately steep slopes, and well-drained to poorly drained. Hobacker series soils are formed in alluvium derived material, mainly sedimentary rock and quartzite. Badgerton Variant soils are found on river terraces and alluvial fans, forming in mixed alluvium. Typic Cryaquolls have high water tables (at a depth of 12 to 24 inches) during the growing season.

Soils on the Pine Bench and on loess foothills and mountainsides in the Swan Valley area consist of the Tetonia-Rin-Ririe unit (SCS, 1981a). These soils are very deep and well-drained. The soils are classified as silt loams.

Below Heise, soils adjacent to the South Fork Snake River include the Hayeston-Heiseton-Blackfoot units on the south, and the Labenzo-Blackfoot and Bannock-Bockston-Wardboro on the north (SCS, 1979 and 1981b). Hayeston-Heiseton-Blackfoot units are located on river terraces and lake beds. They are characterized by moderately, well-drained to well-drained soils (SCS, 1979). Labenzo-Blackfoot soils are found on river terraces and floodplains, and are somewhat poorly to moderately, well-drained (SCS, 1981b). Bannock-Bockston-Wardboro soils are well-drained and sometimes excessively drained, and located on river terraces. (Excessively drained soils remove water from the soil rapidly.)

CLIMATE

The climate in the basin is influenced by air masses from the Pacific Northwest, Gulf of Mexico and Central Canada. The basin has a semiarid climate with cool, moist winters, and warm, dry summers. The average annual precipitation ranges from 12-15 inches on the Snake River Plain, 20 inches in the Swan Valley area, to over 26 inches in higher elevations (Molnau, 1993). Variations are caused primarily by topographic relief. Snowpacks of 60 to 70 inches are common in the mountains. Mean annual air temperature is 42 degrees F. Frost free days range from 60-70 in the eastern portion of the basin to 105 days in the western portion (SCS, 1979; 1981a; and 1981b).

LAND OWNERSHIP AND USE

Over 67 percent of the basin is managed by several federal agencies including the Targhee and Caribou national forests, Idaho Falls District Bureau of Land Management (BLM) and the U.S. Bureau of Reclamation (USBR). Approximately 1 percent are state endowment lands, and the remaining 28 percent is privately owned. Table 1 lists acreage by ownership. Figure 2 illustrates land ownership patterns. Mixed land ownership occurs along the river, consisting mainly of land managed by the BLM and Targhee National Forest, with private and some state lands.

The South Fork Snake River reach is characterized by four landscape settings. The upper reach contains Palisades Reservoir. The reservoir was constructed to provide irrigation storage, flood protection, hydropower production, and fish and wildlife benefits. Developed recreation facilities are located around the perimeter (Figure 17, page 57). Residences occur on private land parcels located on the north side tributaries to the reservoir.

Foothills and forested mountains enclose the river valley from Palisades Dam to Conant Valley. National Forest lands and associated recreation development border the south side of the river, and some homes are being developed on the private land. Private lands and a few parcels managed by the BLM occur on the north. Farmlands and pastures occur in the valley and on benches above the river. Limited commercial activity occurs at Swan Valley, located at the intersections of Highway 26 and 31, and in Irwin along Highway 26. Residential and second home development is increasing.

From Conant Valley to above Heise the river flows through a deep rhyolite canyon. The upper portion of the canyon is unroaded. The lower portion is paralleled by an unpaved road on the east. Land ownership is predominately Forest Service and BLM with a few private parcels. The lands above the canyon are privately owned and used for dryland farming. Some of these lands have been platted for subdivisions. A few of the private parcels along the river have residential development.

Table 1. Ownership Within the South Fork Snake River Basin, Idaho.

	Acres
U.S. Forest Service	413,963
U.S. Bureau of Land Management	10,548
U.S. Bureau of Reclamation (withdrawals)	11,242
Idaho Department of Lands	7,930
Private	183,220
Water	18,072
TOTAL	644,975

Below Heise the river enters a broad, open floodplain and is characterized by extensive braiding. Land ownership consists of private and BLM lands. Irrigated farming and grazing are the principal land uses. Figure 3 depicts the land uses in the basin.

BASIN HISTORY

Prehistory

Human occupation has been documented for the past 9,000-10,000 years in the basin (McDonald, 1983; BLM and Forest Service, 1991). The earliest inhabitants were from the pre-Shoshonean period (Willingham, 1993). Early inhabitants were thought to be small, highly mobile bands which hunted big game (Butler, 1986).

As the climate became more arid, many species of big game disappeared (Butler, 1986; McDonald, 1983). Native societies shifted from specialized big game hunting to a more generalized hunting and gathering way of life. These societies developed seasonal, migratory routes to camas fields, fishing waters and other food gathering areas, utilizing natural routes along rivers and mountain passes. The Conant Pass was used to travel to winter camps to the west. In the spring the Fall Creek drainage was used to travel to Jackson Hole (McDonald, 1983).

Figure 2

Land Ownership

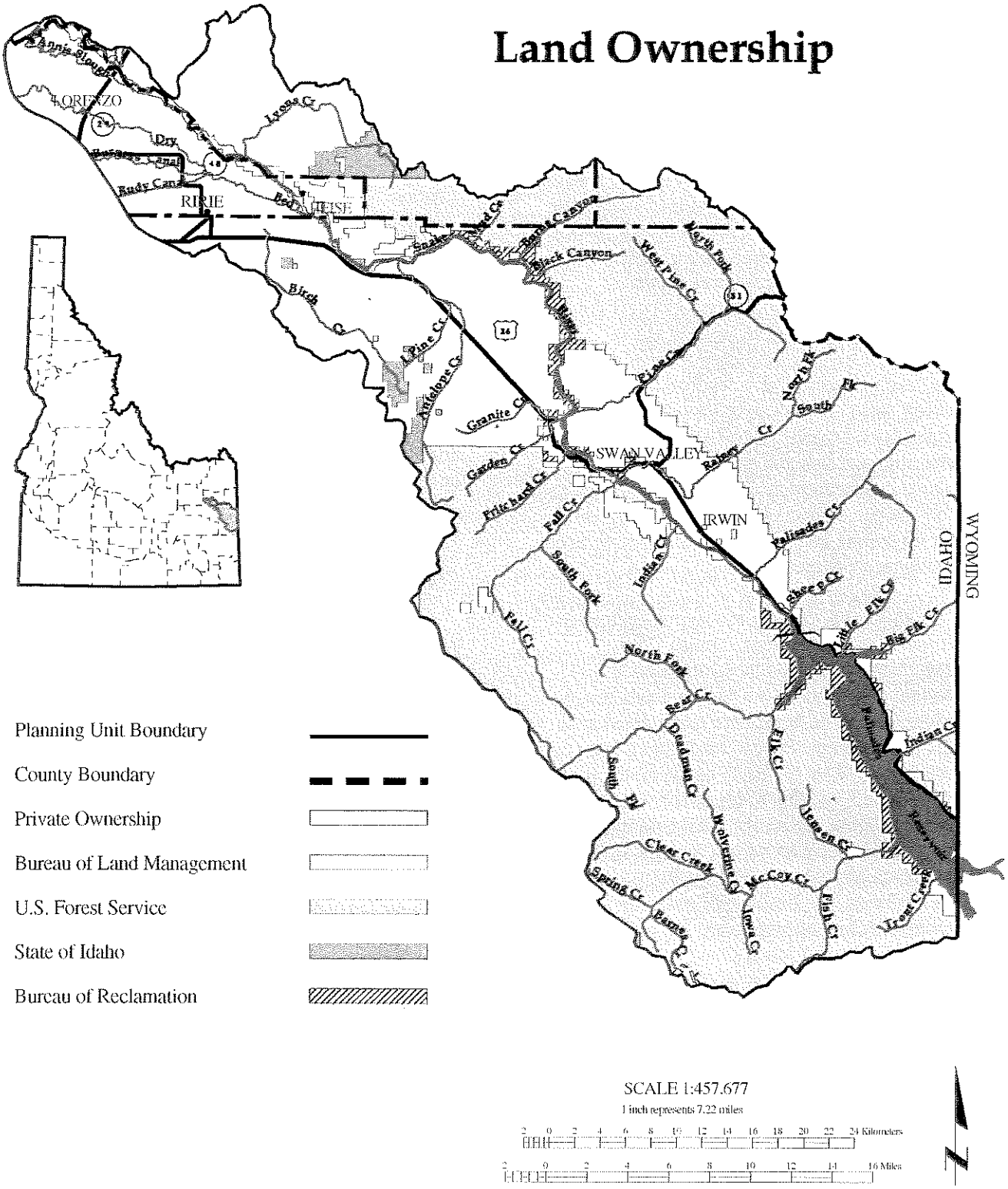
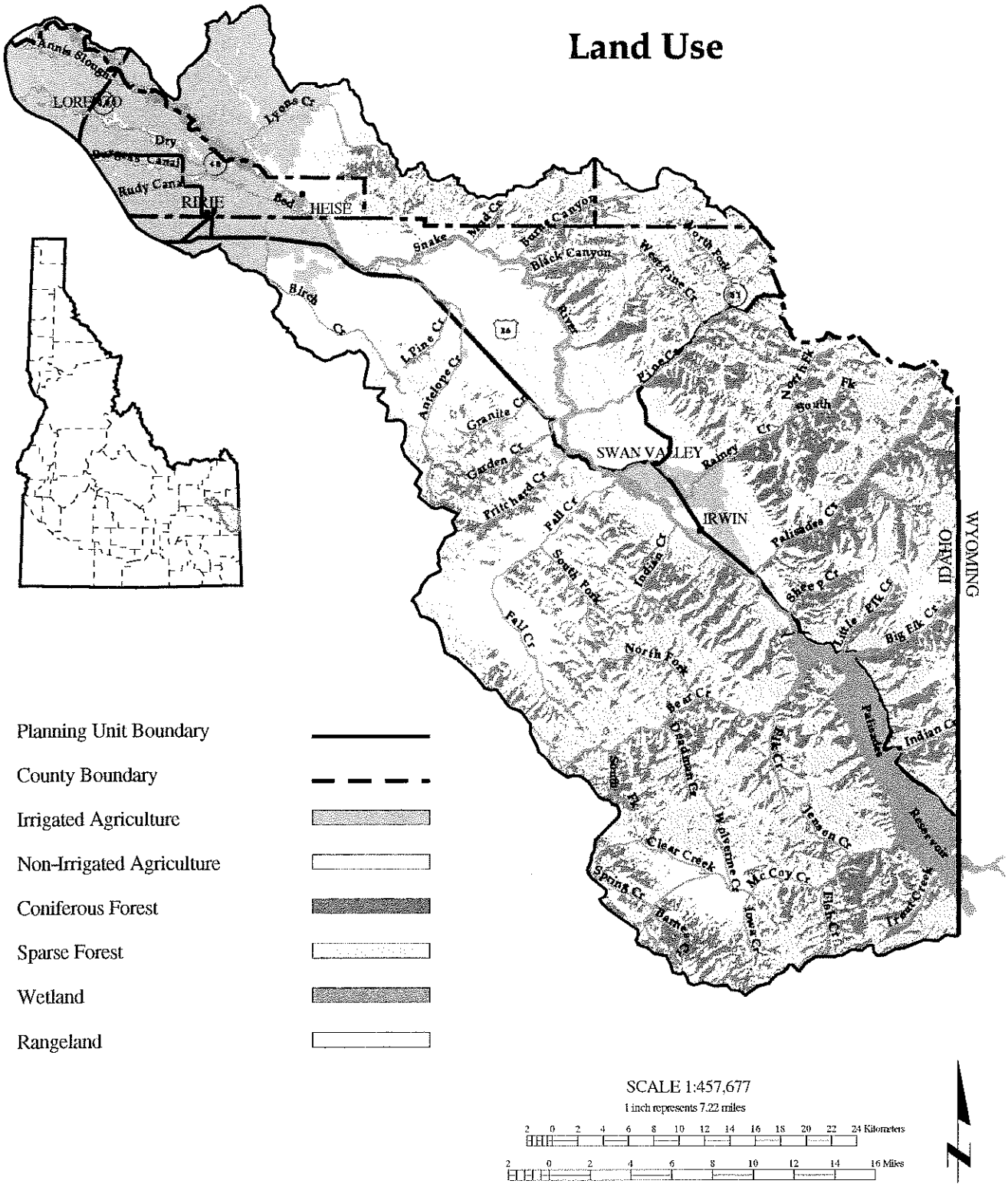


Figure 3

Land Use



The Shoshone are known to have occupied the area for the past 650 years (BLM and Forest Service, 1991). The Shoshone people expanded into the area from the Great Basin, outcompeting and displacing the indigenous population (McDonald, 1983). The Bannocks arrived afterwards, migrating from the Idaho-Oregon border following their acquisition of the horse (sometime in the early-1700's) (McDonald, 1983). By the nineteenth century, the Bannock and Shoshone were culturally identical (Liljeblad, 1957).

The horse changed the Shoshone-Bannock culture, allowing increased mobility to pursue bison and other food sources. In the winter, the people resided in the lower elevations along rivers. In the spring, they would hunt game in the mountains and gather plant materials. Fall hunting parties traveled from Camas Prairie to Jackson Hole and Yellowstone along the South Fork Snake River to pursue elk (McDonald, 1983). These parties traveled above the South Fork Snake canyon (Butler, 1958).

The South Fork Snake River Basin is part of the traditional home territory of the Shoshone-Bannock Tribes. The basin and surrounding lands have spiritual significance to the Tribes, and historically have been used for hunting, fishing and gathering activities. The Fort Bridger Treaty of 1868 secures the right of the Tribes to hunt and fish ". . .on the unoccupied lands of the United States." This includes lands under the jurisdiction of the Forest Service, BLM and USBR in the South Fork Snake River Basin. The American Indian Religious Freedom Act of 1978 and other federal laws preserve the right to believe, express and exercise traditional religions. This would include access to sites in the basin, possession of sacred objects, and practice of traditional rites and ceremonies.

History

An abundance of fur bearing animals along the Snake River and tributaries attracted trappers, the first Euro-American men, in the early 1800's. Major Indian tribes in the basin at the time included the Shoshone, Bannock, Blackfoot, and Crow (BLM and Forest Service, 1991). The basin and surrounding lands were the site of much activity from 1810 to 1840 as various fur trade companies competed for domination in the area. Rendezvouses occurred every year with trappers and Indians to celebrate and trade. One gathering spot, Pierce's Hole, located just north of the basin between Victor and Driggs is remembered for a battle that occurred between the trappers and Blackfeet Tribe in 1832 (Clements, 1974). Pine Creek drainage was one of the travel routes to Pierce's Hole (Willingham, 1993). While a few independent trappers remained, by the late 1830's and 1840's the fur companies were no longer prevalent in the territory because the price for beaver furs had dropped and the animal populations were sparse.

Settlement of the area by Euro-Americans began in the 1870's attracted by farming, ranching, logging and mining opportunities. White emigration with the discovery of gold and agricultural settlement led to conflicts with the Shoshone and Bannock peoples. Wintering grounds were occupied by the settlements, and fish and game were depleted by the miners, disrupting significant components of the Shoshone and Bannock cultures. Several conflicts occurred resulting in the establishment of the Fort Hall Indian Reservation in 1867 and the signing of the Fort Bridger Treaty of 1868 (McDonald, 1983).

Gold was discovered in the Caribou Mountains (called Mount Pisgah at the time) in 1870. Fifteen years of placer mining followed. Lode claims were discovered in 1874 and pursued for more than a decade. During this gold rush, two settlements were established -- Keenan City and Caribou City. Keenan City was the first town in Bonneville County, having a population of 500 and a Chinese community of several hundred (Sparling, 1974). In 1885 Caribou City was populated by 1500 people. The town burned that year and was never rebuilt (Sparling, 1974).

Many people migrated from Utah and the eastern United States to settle in the basin and adjoining Snake River Valley from a period of mid-1870's through the early 1900's. Much of

the colonization was the result of organized efforts by Mormon colonists from Utah (Beal, 1942). During this period, many pioneers organized irrigation companies to divert water from the South Fork Snake River. One of the oldest settlements in the Snake River country is present day Menan, originally named Poole's Island. While employed with Utah Northern Railroad, John Poole of Ogden explored the area and decided to homestead (Carter, 1955). Poole developed one of the first irrigation canals, the Long Island Canal, in 1880 to bring South Fork Snake River water from the Dry Bed to the island.

Numerous canals were constructed during this period by local, cooperative irrigation companies. Many of the projects diverted water from a branch of the river commonly referred to as the Dry Bed. The South Fork Snake River was constantly changing, leaving inadequate flow in the Dry Bed to meet the demand. To rectify the situation, the canal companies dependent on this channel of the river organized to construct the Great Feeder. The canal was completed in 1895 (Carter, 1955).

The Reclamation Act of 1902 provided an opportunity to get federal assistance in storing water for late season irrigation and controlling floods. Several federal projects on the Upper Snake River were constructed upstream and downstream of the South Fork Snake River Basin. The Reclamation Project Act of 1939 resulted in authorization of Palisades Dam with re-authorization in 1950. The project was completed in 1957.

POPULATION AND ECONOMICS

Population

Estimated population for the South Fork Snake River Basin and surrounding rural area (including Rigby) is about 7,205 based on 1990 U.S. Census data. Most of the basin is located within Bonneville County with small portions of Jefferson and Madison counties. The projected population growth for these counties is shown in Table 2.

Population information is available for a few of the communities within the basin. The communities of Ririe and Swan Valley experienced a population increase while Irwin experienced a decrease between 1980 and 1990 (Table 3). By comparison, Bonneville County experienced a 9.4 percent growth, Jefferson County an 8.1 percent increase, and Madison County a 21.5 percent increase (Table 4).

Table 2. Population and Projections for Bonneville, Jefferson and Madison Counties.

Population	1980	1990	1995	2000	2005	2010	2015
Bonneville	65,980	72,207	81,112	88,720	93,510	99,380	105,490
Jefferson	15,304	16,543	18,869	21,110	22,700	24,420	26,150
Madison	19,480	23,674	24,312	29,570	32,180	34,690	37,160

Source: Idaho Power Company, 1994; Idaho Department of Commerce, 1994; Idaho Department of Employment, 1995a.

Table 3. Population for Some Communities in the South Fork Snake River Basin.

Community	1980	1990	Percent Change
Irwin	113	108	-4.4
Ririe	555	596	7.4
Swan Valley	135	141	4.4

Source: U. S. Census, 1990.

Table 4. Percent Population Change in Bonneville, Jefferson and Madison Counties.

County	1970-1980	1980-1990	1990-1995	Annual Average 1990-1995	Annual Average 1995-2015
Bonneville	25.8	9.4	12.3	2.4	1.3
Jefferson	30.4	8.1	14.1	2.7	1.6
Madison	44.8	21.5	2.7	0.5	2.1
State of Idaho	32.4	6.6	15.2	2.9	
United States	11.1	9.7	5.1	1.0	

Source: Idaho Department of Commerce, 1994; Idaho Department of Employment, 1995a; Idaho Power Company, 1994; U.S. Bureau of the Census, 1993.

From 1990 to 1995 the population has increased at an annual average rate of 2.4 percent in Bonneville County, 2.7 percent in Jefferson County, and 0.5 percent in Madison County.

The population in southeastern Idaho is projected to continue increasing at an annual average rate of 1.3 to 2.1 percent for the next 20 years. The population of Bonneville County is projected to increase 30 percent by the year 2015 (Table 2). All communities in the basin are expected to see increases in population and dwellings in the future as development pressures continue. A portion of this development is expected to include second homes. The 1990 census identified 429 second homes in the Swan Valley division. These projections foretell increased residential growth, resulting in increased demands for the resources of the South Fork Snake River Basin including public services and outdoor recreation opportunities.

Employment and Income

Agriculture represents one of the primary industries in the three county area, with manufacturing, atomic energy research, and recreational travel also significant contributors. Much of the manufacturing is the processing and production of potato and dairy products, cement products, farm equipment, and foundry products (Idaho Department of Employment, 1995b). Employment and personal income by industry for the three counties in the South Fork Snake River Basin are listed in Tables 5 and 6. Employment by industry for the South Fork Snake River Basin is shown in Table 7 based on 1990 U. S. Census data.

Bonneville County relies heavily on the service sector for its economic base with the Idaho National Engineering and Environmental Laboratory employing the largest portion of the service sector. Retail trade accounts for the second largest group of workers. Jefferson County, like other counties in the area, has many people employed in the agriculture and food processing industries. Madison County, although rural, functions as a diversified trade and service center due to the influence of Ricks College. For the basin and surrounding area, retail and educational services are the largest employers for area residents (Table 7).

As in any economy, employment growth is not uniform. Some industries have experienced strong growth, some remain unchanged, and some have experienced declines in employment (Table 5). Farm employment has declined in all three counties from 1980 to 1992 -- 36 percent in Bonneville, 27 percent in Jefferson, and 30 percent in Madison, resulting in a loss of 1451 jobs. Productivity gains through the use of more efficient machinery contributed to the loss of jobs. Many agricultural producers have cited the cost of labor and an overall shortage of labor as a factor in their decision to move to automated technologies (Idaho Power Company, 1994). While farm employment has experienced declines, employment in agricultural services, forestry and fisheries has doubled.

Table 5. Employment Statistics for Bonneville, Jefferson and Madison Counties.

Employment by Industry	1980	1984	1988	1992	% Change
BONNEVILLE COUNTY					
Farm	1,971	1,767	1,385	1,252	-36.48
Ag. Serv., Forest, Fish.	261	362	589	547	109.58
Manufacturing	1,847	1,903	1,776	2,404	30.16
Mining	59	93	79	27	-54.24
Construction	2,626	2,360	2,347	2,914	10.97
Transport. Com.& Util.	1,214	1,042	1,040	1,199	-1.24
Wholesale Trade	2,534	2,621	2,659	3,160	24.70
Retail Trade	5,442	6,304	7,681	8,852	62.66
Finance, Ins. & Real Estate	1,925	1,885	2,353	2,380	23.64
Services	9,506	9,757	10,889	13,866	45.87
Federal Civilian	819	743	704	924	12.82
Federal Military	539	415	533	504	-6.49
State & Local Government	2,918	2,877	3,307	3,925	34.51
Total Employment	31,661	32,129	35,378	41,954	32.51
JEFFERSON COUNTY					
Farm	1,573	1,543	1,263	1,145	-27.21
Ag. Serv., Forest, Fish.	--	248	588	633	155.24
Manufacturing	718	554	691	704	-1.95
Mining	<10	13	13	15	15.38
Construction	271	313	317	489	80.44
Transport. Com. & Util.	209	253	186	210	0.50
Wholesale Trade	565	538	361	378	-33.10
Retail Trade	534	593	596	778	45.69
Finance, Ins. & Real Est.	237	198	179	190	-19.83
Services	--	559	545	847	51.52
Federal Civilian	58	54	65	48	-17.24
Federal Military	101	84	112	106	4.95
State & Local Govern.	730	767	853	942	29.04
Total Employment	5,701	5,717	5,769	6,485	13.75
MADISON COUNTY					
Farm	1,044	1,052	822	740	-29.12
Ag. Serv., Forest, Fish.	131	154	265	--	102.29
Manufacturing	756	1,123	1,211	1,170	54.76
Mining	<10	<10	<10	--	--
Construction	585	377	320	390	-33.33
Transport. Com. & Util.	234	211	248	234	0
Wholesale Trade	687	832	717	784	14.12
Retail Trade	1,095	1,105	1,521	1,937	76.89
Finance, Ins. & Real Est	409	297	346	409	0
Services	2,479	3,063	3,056	3,485	40.58
Federal Civilian	53	47	48	56	5.66
Federal Military	129	115	159	154	19.37
State & Local Govern.	796	883	1,023	1,242	56.03
Total Employment	8,399	9,260	9,379	10,897	29.74

Source: Idaho Department of Commerce, 1994.

Table 6. Personal Income by Major Source and Earnings by Industry for Counties, 1994 (in thousands of dollars).

Item	COUNTIES Bonneville	Jefferson	Madison	State of Idaho	% of State Total
Income by place of residence					
Total personal income	1,499,763	251,552	263,213	20,703,335	9.73%
Nonfarm personal income	1,462,044	232,002	245,014	19,901,009	9.74%
Farm income	37,719	19,550	18,199	802,326	9.41%
Per capita personal income	18.9	13.6	11.1	18.3	--
Earnings by industry					
Agriculture services, forestry, fish & other	10,934	10,108	3,612*	221,950	11.11%
Mining	324	2,633	0*	217,683	1.36%
Construction	97,994	10,882	10,475	1,283,915	9.30%
Manufacturing	79,831	19,981	28,461	3,128,673	4.10%
Transportation & public utilities	37,364	6,004	9,034	865,584	6.05%
Wholesale trade	88,502	6,877	11,687	806,055	13.28%
Retail trade	128,573	9,075	27,131	1,662,953	9.91%
Finance, insurance, & real estate	34,287	2,021	4,559	855,452	4.78%
Services	426,992	7,432	71,137	3,123,179	16.19%
Government & gov. enterprises	149,395	22,107	29,151	2,498,986	8.03%
Population	79,200	18,400	23,700	1,133,100	10.71%

* **Note:** 1994 data for Agriculture and Mining categories for Madison County were not available. 3,612 and 0 are 1991 data.
Source: U. S. Department of Commerce, Bureau of Economic Analysis, 1996.

Table 7. Employment by Industry in the South Fork Snake River Basin and Surrounding Area (including Rigby).

Industry	Number Employed	% of the Total Employed
Agriculture, forestry, and fisheries	166	5.9
Mining	8	0.3
Construction	276	9.8
Manufacturing	275	9.8
Transportation	151	5.4
Communications & other public utilities	48	1.7
Wholesale trade	200	7.1
Retail trade	564	20.1
Finance, insurance & real estate	9	3.5
Business & repair services	102	3.6
Personal services	50	1.8
Entertainment & recreation services	24	0.9
Health services	89	3.2
Educational services	356	12.7
Other professional & related services	268	9.5
Public administration	136	4.8

Source: U.S. Census, 1990.

Although layoffs at the Idaho National Engineering and Environmental Laboratory have resulted in a reduction in service jobs, other sectors of the economy have continued to grow. Between 1988 and 1992, the service sector has generated the largest number of new jobs, almost 3,708 jobs in Bonneville, Jefferson and Madison counties (Table 5). Growth areas for all three counties include retail trade and state and local government. In the three counties, unemployment has remained below or near the state average since 1993 (Table 8).

The median family income in Bonneville, Jefferson and Madison counties is lower than the national median of $39,700 per year (Table 9). In Jefferson and Madison counties, median family incomes are lower than the state median of $32,900 per year. Between 1990 and 1995 personal income grew in all three counties at an annual average rate of 7.2 percent for Bonneville County, 6.8 percent for Jefferson and 9.8 percent for Madison (Table 10).

Table 8. Unemployment Rates for Bonneville, Jefferson and Madison Counties from 1991 - 1995.

	1991	1992	1993	1994	1995
Bonneville	4.5	5.0	4.7	4.4	5.0
Jefferson	6.4	6.8	5.8	5.6	5.9
Madison	5.2	4.5	4.4	4.1	4.3
Idaho	6.1	6.4	6.2	6.2	5.9

Source: Idaho Department of Employment 1994 and 1995a.

Table 9. 1995 Median Family Income in Bonneville, Jefferson and Madison Counties.

	Median Family Income
Bonneville	$39,600
Jefferson	$31,500
Madison	$30,800
Idaho	$32,900
United States	$39,700

Source: Idaho Department of Employment, 1995a.

Table 10. Personal Income for Bonneville, Jefferson and Madison Counties (current dollars).

Income	1980	1990	1992	1994	1995	% Annual Ave.
Bonneville County						
Personal income (millions)	587.2	1,191.0	1,369.0	1,577.7	1,686.0	7.2
Personal income per capita	8,850	16,400	17,700	19,400	20,300	4.4
Jefferson County						
Personal income (millions)	101.3	204.0	226.0	263.9	283.7	6.8
Personal income per capita	6,600	12,300	12,950	14,100	14,750	3.3
Madison County						
Personal income (millions)	125.2	230.0	245.0	341.4	367.5	9.8
Personal income per capita	6,350	9,700	10,250	13,200	13,800	7.3

Source: Idaho Power Company, 1994.

ENERGY SUPPLY AND CONSERVATION

Large quantities of electrical energy are produced within Idaho. Hydropower has traditionally been the principal source of electricity. Idahoans use more electricity per capita than the national average, which reflects the energy requirements of the agricultural industry and use of electrical energy for space heating. The electrical demand in Idaho continues to rise, and may be attributed to the growing population.

Electrical power service in the basin is provided by the Pacificorp-Utah Power and Light Division, and Lower Valley Power and Light and Fall River rural electric cooperatives. The Ririe, Heise and Lorenzo areas are served by Pacificorp and Fall River Electric. The Swan Valley and Conant Valley areas are served by Lower Valley Power and Light.

Pacificorp's electric generating facilities are located outside the basin, and include two hydroelectric projects on the Henrys Fork and six hydroelectric facilities elsewhere in southeast Idaho (Idaho Department of Water Resources [IDWR], 1995b). Although energy demands are increasing in the area, the corporation has existing capacity to meet future demands in the next five years (Barker, 1996). Fall River Electric also has seen an increase in energy demands in the basin (Jones, 1996). This cooperative purchases power from Bonneville Power Administration (BPA) and operates a hydroelectric facility at the Island Park Reservoir on the Henrys Fork. They also own the Felt project, located on the Upper Teton River, which is leased to Pacificorp.

Lower Valley Power and Light services the portion of the basin upstream of Heise with about 1000 residential accounts (Robinson, 1996). The cooperative primarily purchases power from the BPA, but also owns a 1.5 megawatt (MW) hydropower generating facility located in Wyoming on Strawberry Creek (U. S. Department of Interior, Bureau of Reclamation [USBR], 1996). Between 1979 and 1992, Lower Valley Power and Light had a 594 percent increase in electricity sales in Idaho (Idaho Department of Water Resources, 1994). Much of this increase is attributed to growth in the Teton Valley. Demands in the basin have increased about 2 percent a year since 1990, but are expected to increase at a greater rate in the near future (Robinson, 1996; Case, 1996). Within the next five years the cooperative plans to upgrade existing transmission lines to Teton Valley and along the Pine Creek drainage to address increased energy demands.

Currently liquefied gas is available in the Afton and Jackson areas as an alternative energy source. A pipeline is planned for construction into Swan Valley in the next five years (Case, 1996). This may shift some electric energy demands to natural gas.

Energy conservation is the more efficient use of energy by using less energy to produce a given service at a given amenity level. Conservation is widely regarded as a key method of meeting future energy demand. However, it is difficult to estimate how much energy will be gained through conservation measures, because it is dependent on the degree of implementation. Implementation depends largely upon the actions of individual homeowners, irrigators, and commercial entities, and therefore can vary widely.

Available conservation programs designed to increase energy use efficiencies play a major role in meeting part of the current and future increases in energy requirements. The Northwest Energy Code, locally-adopted building codes, and the Super Good Cents program support modern conservation standards for new residential and other construction. Other conservation advancements are also becoming increasingly feasible.

The Idaho Department of Water Resources' Energy Division provides information, technical assistance and financial support to promote cost-effective conservation, and utilization of energy efficient resources. One program works with manufactured home builders to construct energy-efficient homes. Since 1992, twenty-two manufactured homes have been built in the South

Fork Snake River Basin which exceed the U. S. Department of Housing and Urban Development and state energy standards. Energy-efficient homes built in the basin have resulted in a savings of about 117,300 kilowatt hours (kwh) annually, or $5,865 each year (at $.05 kwh). Compared to a site-built home constructed to the Idaho Residential Energy Standards, these same energy-efficient manufactured homes also represent a savings of 268,712 kwh per year, or $13,435 a year (Reece, 1996).

Existing facilities are eligible for energy conservation upgrading through several programs sponsored by state and federal agencies, and utility industries. These programs promote space and water heating conservation upgrades by providing low-interest loans to fund the installation costs of the measures. Existing public nonprofit schools and hospitals are eligible for energy conservation grants under the Institutional Conservation Program, funded by the U.S. Department of Energy and administered by the Energy Division of the Idaho Department of Water Resources.

While not part of any established conservation program, conversions to alternative sources of energy have been proposed to reduce dependence on over-committed sources. The increasing conversion from electrical space and water heating to natural gas is one example which is finding public favor. The proposed natural gas line into Swan Valley will provide this opportunity in the basin. Other alternative energy sources suggested include use of Idaho's geothermal, and renewable wood, solar, and wind resources. Geothermal energy is used in the form of hot water or steam produced within the earth for space heating in some local areas. Geothermal is used at Heise Hot Springs Resort to heat water in the pools. Use of wood for space heating has been popular in some areas, but potential problems with air pollution make it less attractive.

Water Resources

A standardized set of watershed boundaries were established for Idaho through a cooperative effort of several federal, state and private entities. These watershed boundaries allow consistency in referencing, data collection and reporting. These hydrologic units are indexed using the eight digit USGS Hydrologic Unit Code (HUC) and a two-digit extension. The South Fork Snake River Basin boundaries were delineated before watershed boundaries were finalized for the state. Consequently, the South Fork Snake Basin boundary does not perfectly match the watershed coverage established for the state. The Basin includes watersheds within hydrologic unit 17040104 and portions of watersheds within hydrologic unit 17040201. Future revision to the South Fork Snake River Basin Water Plan will include adjustment of basin boundaries to correspond to established watershed boundaries.

WATER QUANTITY

Surface Water

The South Fork Snake River basin comprises 1,000 square miles in eastern Idaho between the Idaho-Wyoming state line and the confluence with the Henrys Fork. Above Heise, the basin is mountainous and extensively forested; Palisades Reservoir and its tributaries delineate the upstream bounds. Below Heise, the South Fork Snake River traverses an alluvial fan opening on the Snake River Plain. Palisades, Rainey, Fall, and Pine creeks are the primary tributaries to the South Fork Snake River between Palisades Dam and the Henrys Fork confluence. The Snake River basin upstream of Palisades Dam drains an area of 5,208 square miles primarily in Wyoming.

USGS maintains four stream gaging stations within the basin by contract with State Water District 01 and USBR (Figure 4 and Table 11), and one reservoir gage at Palisades Reservoir. Forty-one additional gages measure diversions from the South Fork Snake River and Dry Bed. The historic data for these gages indicate that the average annual runoff at the Heise gage is approximately five million acre-feet (AF). Eighty-two percent of the Heise discharge is attributed to the Snake River drainage upstream of Palisades Reservoir in Wyoming. Annual reach gains from tributaries within the planning

Figure 4

Stream Gaging Stations

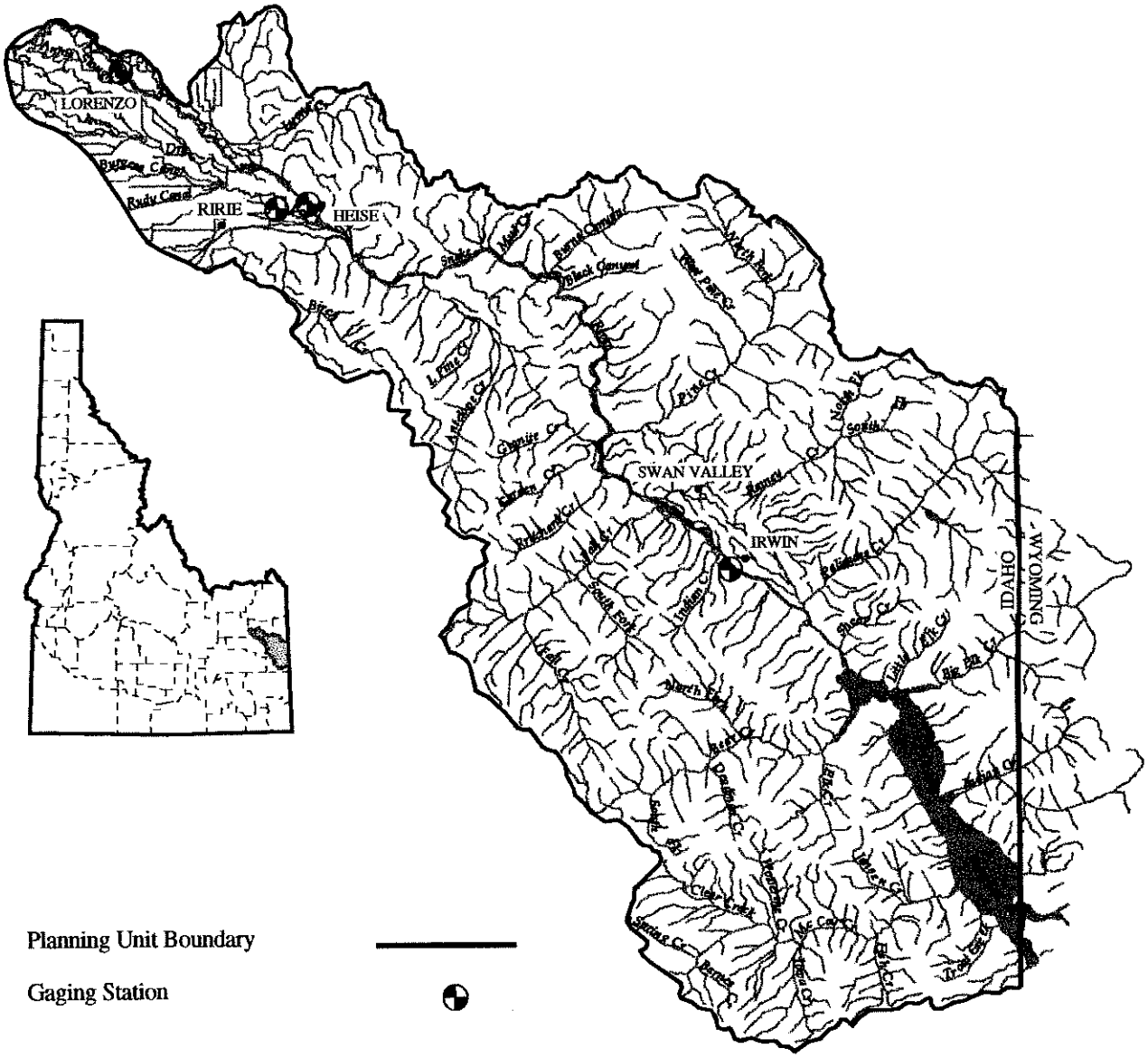


Table 11. Key Gaging Stations - South Fork Snake River.

Station	Gage	Period of Record	Drainage Area (sq. mi.)	Average Runoff Volume (ac-ft/yr)	Period of Record (acre-feet) Max.	Min.
#13032500 South Fork Snake River at Irwin	River	1949 to Present	5,225	4,814,200	6,707,500	2,621,900
#13037500 South Fork Snake River at Heise	River	1911 to Present	5,750	5,252,500	7,276,400	2,980,000
#13038500 South Fork Snake River at Lorenzo	River	1978 to Present	5,810	3,043,600	5,209,500	1,760,000
#130380 Dry Bed	Canal	1977 to Present	NA	1,169,500	1,287,200	1,069,300

basin average 400,000 AF to Palisades Reservoir, and 500,000 AF below Palisades Dam.

Although precipitation records for Swan Valley show that 56 percent of total annual precipitation falls during the growing season (April through September), the South Fork Snake River and its tributaries are fed largely by snowmelt (Molnau, 1993). About 50 percent of the basin runoff occurs in the May-July period. Snow water content at Lewis Lake Divide (elevation 7,860 feet), located in Yellowstone National Park Wyoming, averages 34.4 inches by May 1 (Ondrechen, 1996).

South Fork Snake River flows are regulated by releases at Jackson Lake (Wyoming) and Palisades Reservoir. During the summer irrigation period releases from these reservoirs are made to meet irrigation demand, flood control requirements and to balance stored water between the reservoirs. Factors influencing operation are described in the *Snake River Regulation* section of the Institutional Constraints and Opportunities chapter.

Winter releases from Palisades Dam are dictated by storage carried over the end of the irrigation season. In the driest years, releases in the late fall and winter have been less than 1,000 cubic feet per second (cfs). Flows at Heise are in the range of 1,300 to 1,500 cfs (Figure 5). When carry over allows, typical low flows are in the range of 2,500 to 3,000 cfs through the winter.

Floods of the South Fork Snake River and its tributaries result primarily from snowmelt and occur during late May, June, and early July in years when above normal snow packs have accumulated. Jackson Lake and Palisades Reservoir are operated as a system to control flows at Heise to 20,000 cfs or less during the spring snowmelt. The year of greatest runoff on record was 1986, when the computed natural discharge at Heise was over 7.6 million acre-feet, or 149 percent of normal. Precipitation and temperatures that occur during the flood runoff season, and Palisades Reservoir storage space determine the concentration of high flows and peak magnitudes.

The lowest natural runoff year of record was 1977. Runoff was 52 percent of normal at the Heise gage. The 1931-36 drought was the most severe in the basin's recorded history. Flows were 80 percent of the historical average over that period. The drought period of 1987-92 nearly eclipsed the earlier period for the low flow record (Idaho Department of Water Resources, 1996).

Flows on tributary streams are not regulated. The lowest flows occur in late summer, fall and winter seasons. Flows are usually at their highest during the spring snowmelt. Elevation of the creeks plays an important part in the timing of peak flows. Flows occasionally increase during the summer due to thunderstorms. Storm events may contribute unusually large proportions of the total flow of the South Fork Snake River for short periods of time.

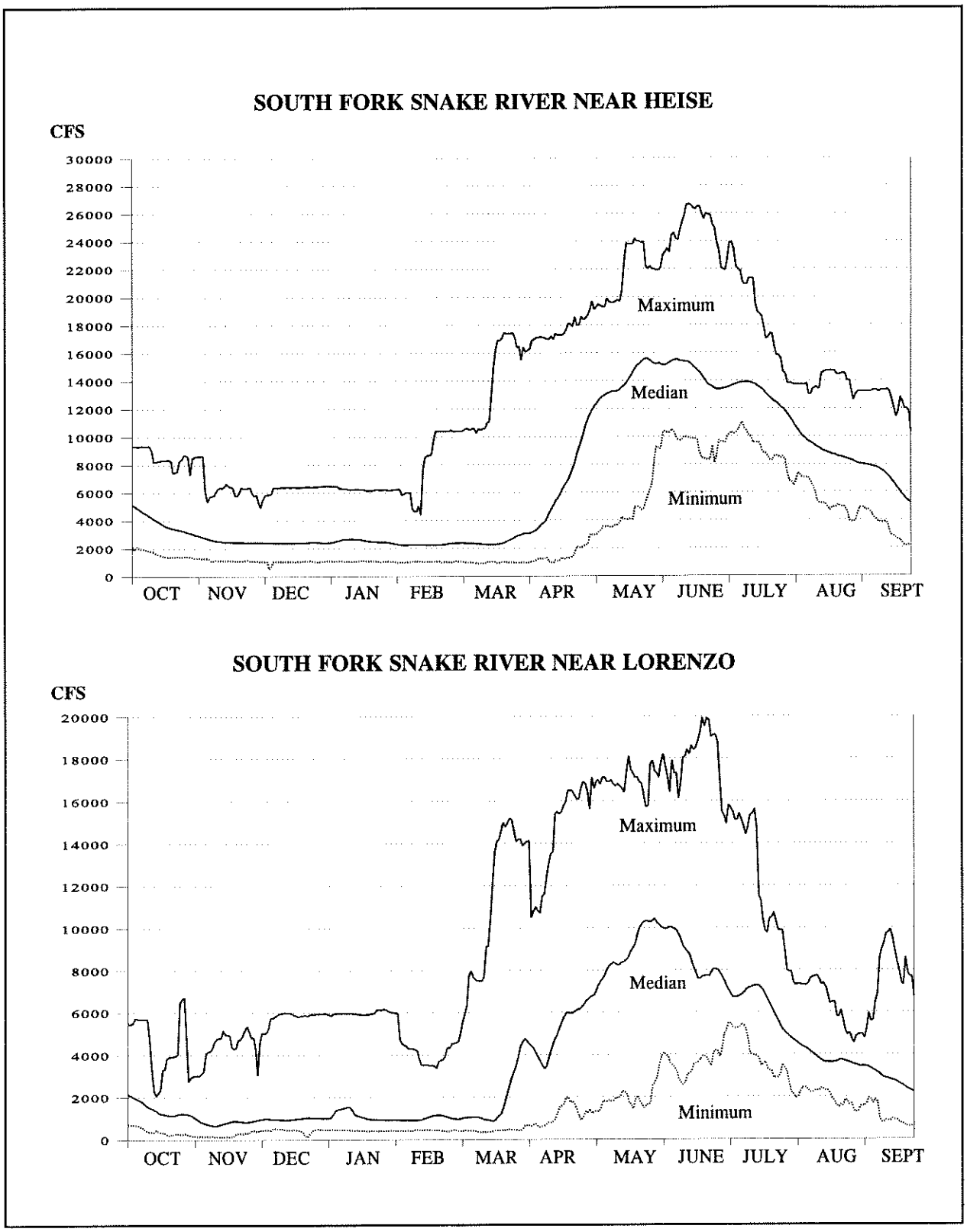


Figure 5. Averaged Daily Flows at Heise 1958-1992 and Lorenzo 1978-1992.

Ground Water

Alluvium along the South Fork Snake River and fractures in the basaltic and granitic rocks of the uplands and mountains provide ground water in the South Fork Snake River Basin. Alluvium in the upper valleys and on the Rigby Fan yield fairly large quantities of water to wells (Figure 6). Depth to ground water in the gravels is generally less than 70 feet with yields estimated at 500 to 2000 gallons per minute (1 to 4 cfs).

Alluvial aquifers are recharged by infiltration from the river and seepage from irrigated tracts. In the reach between Heise to Lorenzo, the South Fork Snake River loses approximately 250,000 AF per annum to ground water. Because of the porous nature of the soils in the basin most of the diverted water in the basin percolates into the alluvial materials of the Rigby Fan and then flows westward. Areas of the fan west of Ririe experience high water table problems as a result of the large amounts of recharge from irrigation. During the summer, ground-water levels rise as much as 30 feet and in some locations approach the land surface (Brockway and de Sonneville, 1973).

The water table occurs in the basaltic and silicic lava beneath the benchlands of the basin. The aquifers beneath the benchlands receive recharge from precipitation and by infiltration from the channels of streams that cross these benchlands. The geological formations in the area have sufficient porosity to accept fairly large volumes of water which reappear as stream flows during the late summer, fall, and winter. Recharge to ground water from precipitation on the northwest facing slopes of the highlands adjacent to the Snake River Plain is estimated to be on the order of 40,000 to 75,000 AF yearly (Mundorff, et al., 1960). With the exception of spring occurrences, depth to groundwater on the benchlands is generally a minimum of 100 feet, and can be tapped at 500 feet on the average with yields generally less than 50 gallons per minute. In the Swan Valley area, wells drawing water from stratum beneath the valley alluvium produce from 30-40 gallons per minute.

WATER ALLOCATION AND USE

The constitution and statutes of the State of Idaho declare all the waters of the state, when flowing in their natural channels, including ground waters, and the waters of all natural springs and lakes within the boundaries of the state, to be public waters. The constitution and statutes also guarantee the right to appropriate the public waters of the State of Idaho, and it is the state's duty to supervise that appropriation and allotment [Idaho Code 42-101]. Water rights are allocated by the state based on date of appropriation for specific quantities, diversion points, places of use, and purposes. Water rights are satisfied in order of priority based on date of appropriation. Changes in water rights such as diversion point or use require an application and approval by the IDWR. If a change exceeds 50 cfs or 5,000 AF, the change must be approved by the Idaho Legislature.

The natural flow of the Snake River above Milner Dam is fully appropriated, except in high water years. Most of the natural flow rights were decreed by the Rexburg Decree in 1910. Water supplies have been augmented by federally financed dams and reservoirs in the Upper Snake. The storage rights in Palisades Reservoir were established through the statutory state permit and licensing process. All of the canals below Heise have contracts for use of stored water from Jackson Lake, Palisades Reservoir, and by exchange, American Falls Reservoir.

The watermaster for Water District 01 administers the water rights above Milner Dam, including the South Fork Snake Basin, under supervision of the IDWR. On a daily basis the watermaster calculates the amount of natural flow available, total diversions, and the amount of stored water used by each space holder. Water accounting is accomplished using data from an automated system operated by USBR (known as the HYDROMET) which monitors important river gages and the majority of canal diversions. Data not available through the automated system is obtained through telephone. Each year over seven million AF of water for irrigation is distributed within Water District 01. The

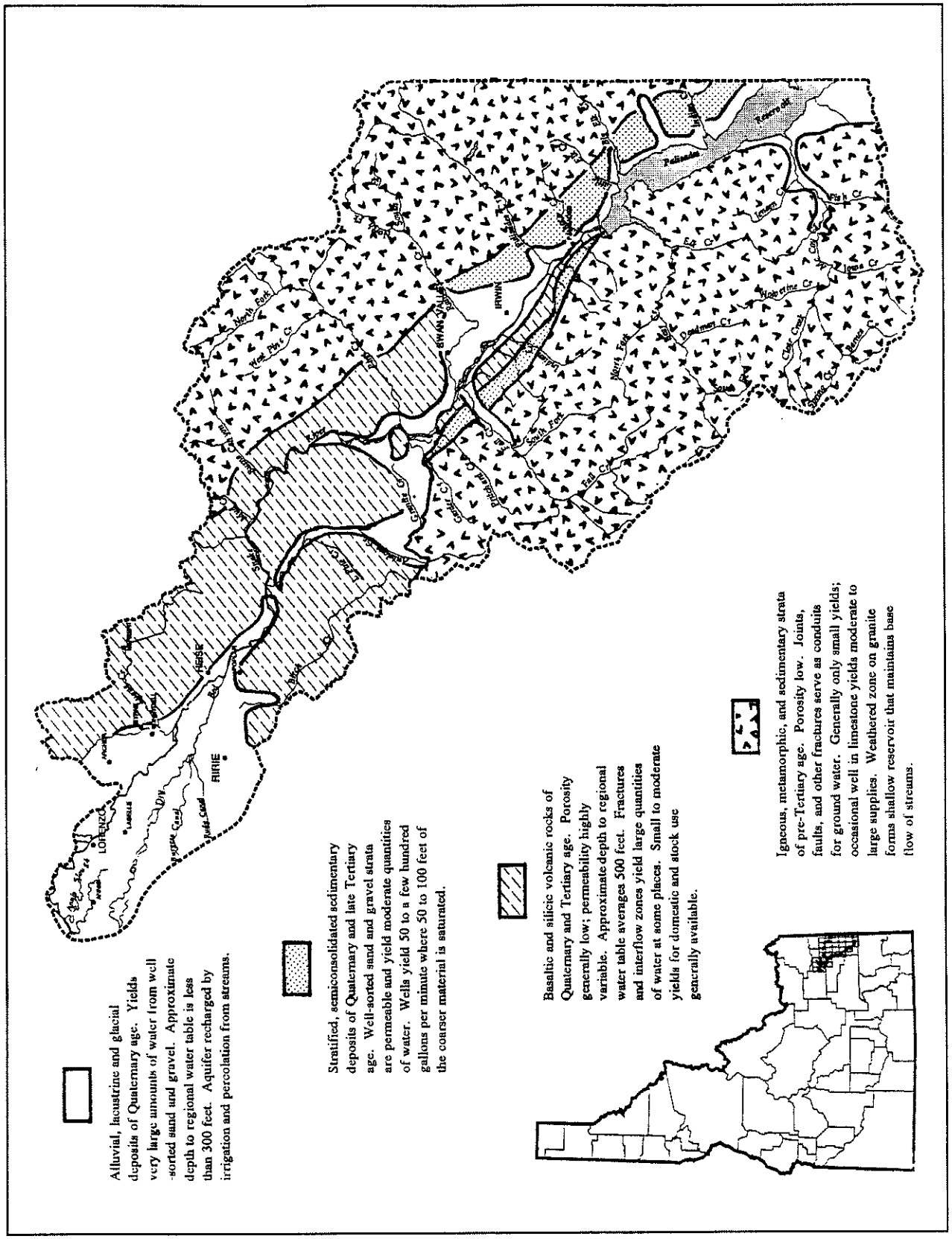


Figure 6. Aquifer Units (Pacific Northwest River Basins Commission, 1970).

watermaster also administers the District 01 Rental Pool (described on page 79) for the Committee of Nine.

The Committee of Nine consists of elected representatives of canal companies and irrigation districts in Water District 01. The Committee functions as a forum for discussion, consultation and advice on operation and administration of the Upper Snake Reservoir System. The Water District 01 watermaster and USBR Snake River Area Manager act as advisors to the Committee. The Committee proposes rules and rates for operation of the District 01 Water Rental Pool subject to Idaho Water Resource Board approval.

Figure 7 summarizes water use for the South Fork Snake Basin. Water appropriations in the basin total approximately two million AF annually (IDWR, 1996a). Water resources of the South Fork Snake Basin have been developed extensively for irrigation. However, other offstream and instream uses are significant and important to the area's economy. Hydroelectric power generation, fish, wildlife and the recreation/tourism industry are dependent on river flows. Power generation at Palisades Dam annually utilizes about 2 million AF of water that is released for irrigation and flood control purposes. Though small relative to other uses, domestic, commercial, industrial, and stock water use are essential to residents of the basin.

The Snake River is the source for the largest number and greatest volume of appropriations. Surface water supplies in the basin are primarily natural flow water rights and are the principal water source for irrigation. Storage provides, on average, only 15 percent of the water diverted above Lorenzo. Ground water comprises only three percent of the area's appropriated water, but it is relied on almost exclusively for domestic supplies. Thermal waters in the basin are scant. Heise Hot Springs is the only development using thermal water in the basin. Table 12 lists water use by stream reach.

Surface water appropriations in the basin are approximately 40 percent of the average annual discharge of the South Fork Snake River at Heise. From 1980 through 1990, irrigation diversions between Heise and Lorenzo ranged from 30 to 70 percent of the average South Fork Snake River flow at Heise during the irrigation season. Figure 8 shows the average monthly flow, recorded minimum monthly flow, and maximum diversion rate between Heise and Lorenzo. Minimum flows and maximum diversion rates are paired to illustrate potential water supply and river flow problems.

The high percolation losses through the canal systems may result in total diversion rates on the Rigby Fan of 10 AFA (acre feet per acre). About 70 percent of the water diverted for

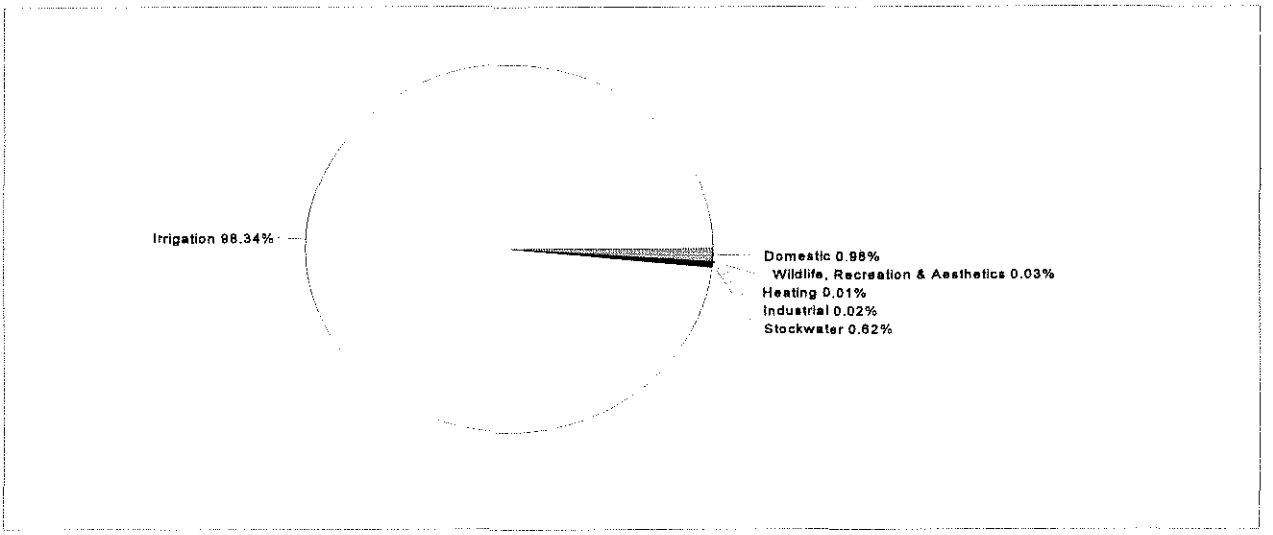


Figure 7. Water Use in the South Fork Snake Basin Based on Water Appropriations and Claims (IDWR, 1995).

Table 12. Water Use by Source for the South Fork Snake Basin.

Water Source	Number of Developments, Filings, or Claims	Total CFS of Diversions or Claims
Groundwater	2,120	450.00
Snake River	365	18,531.62
Springs	396	31.37
Antelope Creek	11	70.61
Big Elk Creek	3	5.04
Granite Creek	1	6.00
Indian Creek	9	13.14
Palisades Creek	37	252.19
Pritchard	5	8.19
Rainey Creek	44	80.96
Warm Springs	1	25.12
All Other Creeks: development < 5 cfs	289	102.72

Source: IDWR water right and adjudication database, 1995

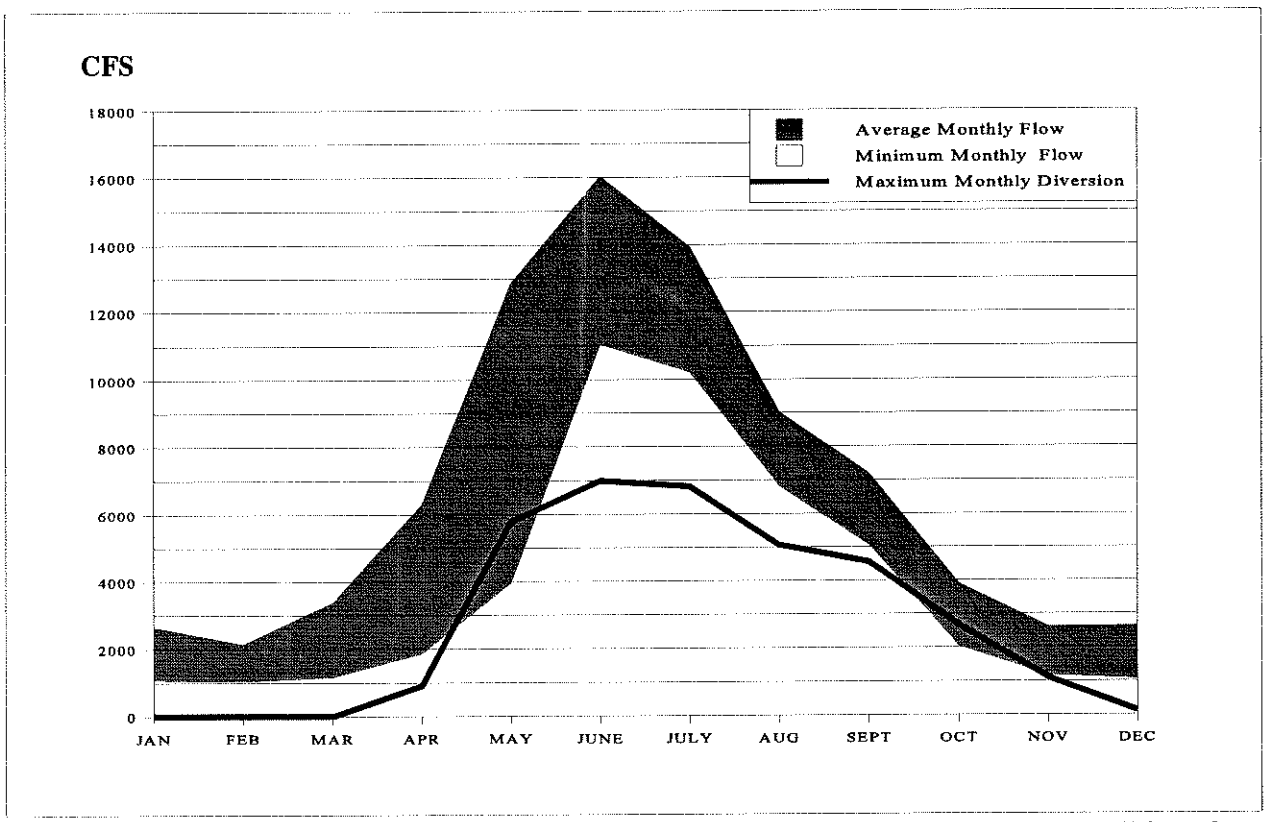


Figure 8. **South Fork Snake River Monthly Average Flows at Heise Gage and Diversions Between Heise and Lorenzo for 1980-1993.**

irrigation in the basin is not consumptively used. This was calculated assuming alfalfa planting (the highest water consumption rate at 3.5 AFA) for the 151,260 acres served by diversions between Heise and Lorenzo. Based on these assumptions, the calculated consumptive need for irrigation water in the basin approximates 529,410 AF (151,260 acres x 3.5 AFA). Canal distribution losses claim an estimated twenty-five percent of diverted irrigation water (SCS, 1977). On-farm distribution and irrigation application/seepage losses account for the remaining 45 percent.

Despite high application rates, total surface water diversions between Heise and Lorenzo have declined since the late 1970's. Currently, irrigators are diverting about 400,000 AF less from the basin than they did in 1974 (Figure 9). By comparison, the total annual diversions in Water District 01 have declined by over 800,000 AF since 1977. The change in diversion volume reflects improved water application efficiencies and administrative procedures implemented by Water District 01. Diversions from the South Fork between Heise and Lorenzo have decreased an average of 21,000 acre-feet per year over the last 19 years.

Agricultural Water Uses

Agriculture utilizes approximately 430,000 acres within the South Fork Snake River Basin. Upstream of Heise, about 55,000 acres of non-irrigated cropland covers the basin's uplands and benches, and livestock grazing is prevalent on forest and range lands. Beef and dairy cattle are dominant in the agriculture of the Swan Valley area. The bulk of irrigated land lies downstream of Heise on the Rigby Fan, where the river leaves the canyon and enters the Snake River Plain (Figure 10).

Thirty-four canals and 44 pumps annually divert and deliver about 1.7 million AF of water from the South Fork Snake River to irrigate farmsteads in the region (IDWR, 1995). Canals

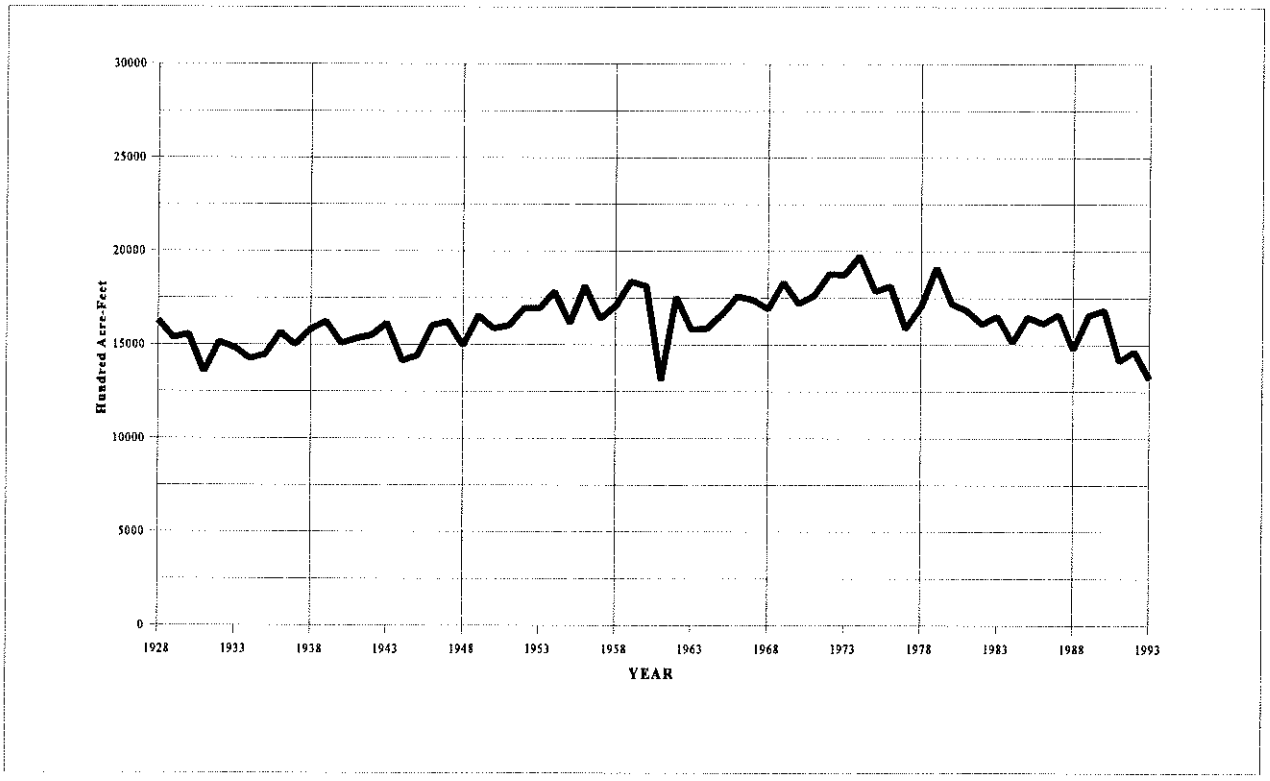
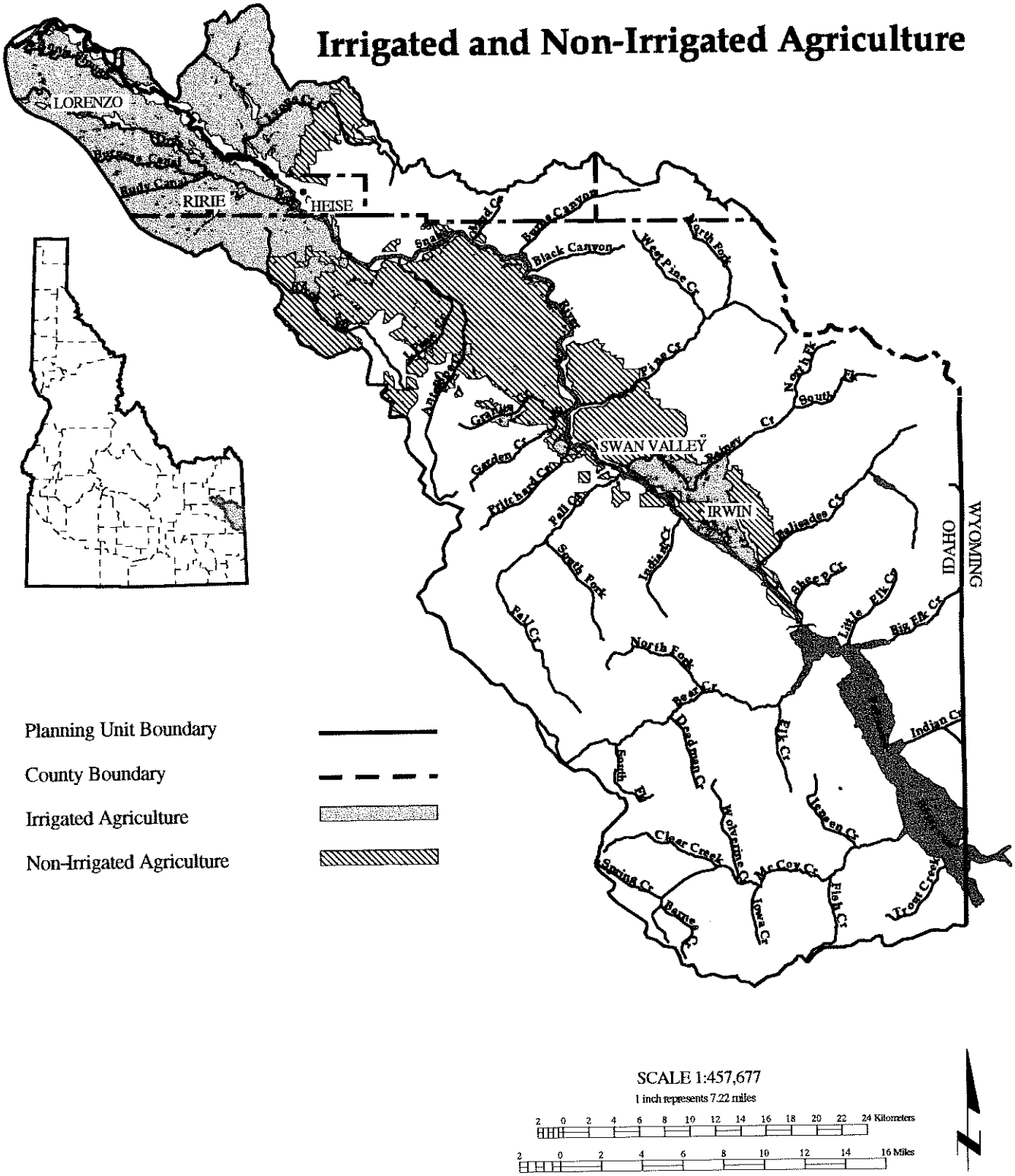


Figure 9. Sum of South Fork Snake River Irrigation Diversions Between Heise and Lorenzo 1928 to 1993.

Figure 10

Irrigated and Non-Irrigated Agriculture



divert an average of 1.5 million AF annually to irrigate the Rigby Fan; roughly 80 percent of this total is diverted via the Dry Bed. Right-bank gravity diversions average 230,000 AF. Pumping stations between Heise and Lorenzo divert approximately 3,500 AF annually. Several pumping stations of 500 horsepower or more lift water about 700 feet to uplands north of the river (Goodell, 1988). Watermaster reports show that water from storage comprises only 10-15 percent of total annual diversions between Heise and Lorenzo. About 75,000 AF of water are diverted for irrigation in the upper basin above Heise.

Sprinkler irrigation has steadily grown in the region with ground water development and drought precipitating water conservation measures. Today, approximately 40 percent of irrigated acreage in the South Fork Snake River Basin is watered by sprinklers compared with 17 percent in 1977. Figure 11 shows the distribution of sprinkler application in 1992.

The climate limits the crops that can be grown in the basin. The combination of soils and climate are suitable for potatoes, small grains, hay, pasture, feed corn and dry peas. In the high irrigated valleys, forage crops predominate and irrigated lands provide a winter feed base for livestock. Dryland crops constitute wheat and other small grains. Exotic grasses and wildflowers are grown on the Pine Bench.

Approximately two-thirds of the acreage irrigated by water diverted in the South Fork Snake Basin between Heise and Lorenzo is used to irrigate lands outside the basin in the Idaho Falls-Rexburg region. About 50,000 acres are irrigated within the basin with South Fork Snake diversions. Farmers irrigate an estimated 25,000 acres in the basin with ground water. Roughly 9,000 acres in the Antelope Flat and Swan Valley areas are irrigated from South Fork Snake River tributaries. Irrigation companies in the basin are listed in Table 13.

Irrigation with ground water began in the basin around the mid-1950's. Approximately 90,000 acre-feet of ground water is pumped annually for irrigation in the basin. Ground water is accessible with pumping lifts generally less than 70 feet. Most ground-water development has been conducted privately by individual farm operations, primarily in those areas not included in the initial surface water irrigation tracts because of their excessive elevation. Sprinkler irrigation is the most common irrigation method used with ground-water pumping. Within areas served by surface water diversion, individual farm operations have developed ground water as a supplemental water source and to increase the flexibility of on-farm irrigation methods and scheduling.

Beef cattle graze on public and private rangeland as well as irrigated pasture. Irrigated lands support much of the area's livestock industry. Animals grazed on nonirrigated public and private rangelands are wintered and fattened for market on feed grown on irrigated land. Most of the basin's sagebrush and forest range is public land administered by the BLM and the U.S. Forest Service. Active cattle and sheep grazing of these allotments account for an estimated 40,000 animal-unit months (AUMs) annually (Watson, 1993; Forest Service, 1993).

Livestock water use includes water for both stock watering and other on-farm needs. The quantity of water used by livestock in the South Fork Snake River Basin is estimated at 100 AF based on livestock numbers in the basin and average water use per head. On the range and in the mountains, livestock usually water freely at streams or springs unless a pump and watering station have been developed.

Domestic, Commercial, Municipal, and Industrial (DCMI) Water Uses

Domestic, commercial, municipal and industrial (DCMI) water use is small in the South Fork Snake River Basin, but essential to human life and economic development. Ground water supplies the domestic, commercial, municipal, and industrial needs in the basin.

Domestic and commercial water uses include drinking, food preparation, washing, and lawn

Figure 11

Irrigation Method (as of 1992)

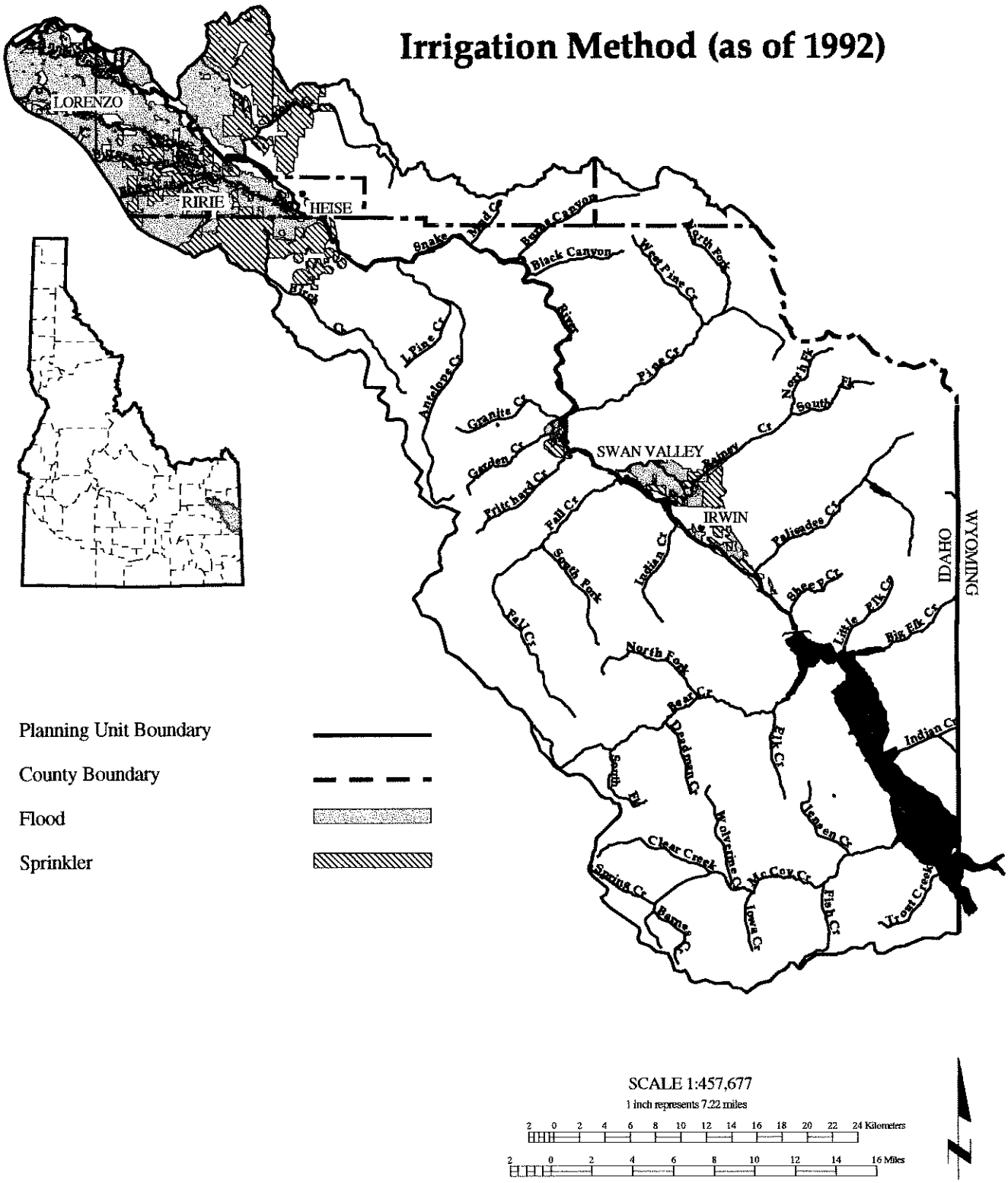


Table 13. Irrigated Cropland Acreages.

	Acres in Basin
Source	
Ground-water	25,500
Surface Water	
South Fork Snake River	43,590
South Fork Snake River Tributaries	8,465
Combined South Fork Snake River and Tributaries	300
Combined Ground Water and Surface Water Diversions	3,030
TOTAL	**80,885**
Irrigation Company or District	**Acres in Basin**
Bannock Feeder Canal Company	30
Burgess Canal and Irrigation Company	1,945
Butler Island Canal Company	1,830
Clark and Edwards Canal Company	2,260
Dilts Irrigation Company	670
Enterprise Canal Company	2,830
Farmers Friend Irrigation Company	2,000
Harrison Canal and Irrigation Company	70
Hill-Petinger Ditch	215
Island Irrigation Company	3,840
La Belle Irrigation Company	2,225
Combined West La Belle and Long Island Canal Company	6,550
Lenroot Canal Company	1,900
Liberty Park Irrigation Canal Company	100
Lowder Slough Canal Company	1,800
Nelson-Corey Ditch	450
North Rigby Irrigation and Canal Company	1,415
Parks & Lewisville Irrigation Company	700
Poplar Irrigation District	970
Progressive Irrigation District	520
The Reid Canal	180
Rigby Canal and Irrigation Company	1,000
Rudy Irrigation and Canal Company	3,100
Sunnydell Irrigation District	3,390
Private Birch Creek	815
Palisades Creek Water Users	2,615
Lower Rainey Creek	1,245
Upper Rainey Creek	2,190
Combined Organized Surface and Ground Water	1,930
Private Developments	
Ground Water	25,500
South Fork Snake River Diversions	3,600
South Fork Snake River Tributary Diversions	1,600
Combined South Fork Snake River and Tributary Diversions	300
Combined South Fork Snake River and Ground Water	1,100
TOTAL	**80,885**

Source: IDWR, 1978.

and garden watering. Residents of Irwin, Swan Valley, and Lorenzo obtain their domestic water from privately owned, relatively shallow, wells. In Irwin, water stands at about 32 feet below the ground surface, and the wells in general are in the neighborhood of 50 feet deep. Subsurface water in the Swan Valley area is about 8 feet below ground surface. Wells at varying depths tap this shallow subsurface water; some are drilled to greater depths for protection against contamination. Increased urbanization in this area represents a significant threat to ground water quality.

Community and municipal water systems provide approximately 30 percent of the water used for domestic and commercial purposes within the South Fork Snake River Basin. Community water systems service six subdivisions or developments in the Palisades area, and are managed by homeowner groups, the developer, or another private entity (DEQ, 1994). The only municipal water system in the basin is in the town of Ririe. The municipality supplies water to homes, commercial establishments, schools, the fire department, and a municipal park. The Ririe water system consists of three wells at depths of 120, 180, and 300 feet, and two elevated storage tanks that can hold over 120,000 gallons. The supply and distribution system for Ririe is considered adequate for current needs (Hall, 1996).

Industrial water use incorporates manufacturing processes, cooling, and employee sanitation. Food processing is the sole industrial use of water in the basin. The industry withdraws water for potato preparation and preservation. Water withdrawals for potato processing are highest from September through March. The largest water right for industrial use in the basin is 1.2 cfs from ground water.

At present, the total domestic, commercial, municipal, and industrial water use in the basin is an estimated 350 AF per year. Domestic use is calculated from population in the basin and average water use per day (Solley, 1993). Commercial, municipal, and industrial water demand is estimated from the water rights.

WATER DEVELOPMENT

Irrigation

The irrigated lands in the lower part of the basin are served by an extensive canal system that includes the Farmer's Friend, Burgess, Rudy, Harrison, Anderson, and Sunnydell canals. This system diverts water out of the South Fork Snake River through an extensive system of headworks and diversion dams. The Dry Bed, referred to as the "Great Feeder", was the main river channel before the South Fork Snake River moved to its present course in 1902. The Dry Bed is now operated as a feeder canal, utilizing head works to control the flow. In the Swan Valley-Irwin area, the Palisades Creek Canal diverts water out of Palisades Creek to irrigate lands near Irwin, while diversions are made out of Rainey Creek to irrigate lands along Rainey Creek and to the east of Swan Valley.

Enough reservoir storage space is available to augment natural flows and to supply the full requirements of lands diverting from the South Fork Snake River under most runoff conditions. A recurrence of extremely dry conditions such as occurred in 1987-92 would cause shortages throughout the basin. The reliability of water supplies on the smaller tributary streams contrast sharply with the reliability of supply on the South Fork Snake River because of lack of storage. For example, by late summer in years of below normal runoff the flow of Rainey Creek drops to less than one-half of the decreed amount. Lands receiving either all or part of their water supply from ground water are generally adequately supplied.

A preliminary investigation was conducted by the Natural Resource Conservation Service (formerly the Soil Conservation Service) at the request of the East Side Soil and Water Conservation District to determine if water efficiency could be improved on Rainey and Palisades creeks (SCS, 1994). Currently water is diverted from Rainey Creek by irrigators using individual delivery ditches. Losses in the present delivery system and water application methods limits the availability of full-season irrigation.

Some reaches of Rainey Creek are often de-watered during critical periods for fish passage. Most years the flow in Rainey Creek is not sufficient by late June to honor all irrigation water rights (SCS, 1994). The study also examined ways to improve delivery and on-farm application of irrigation water on land served by Palisades Creek.

The evaluated alternative entails constructing a gravity-pressurized pipeline to deliver 24.4 cfs from Rainey Creek for sprinkler irrigation. The proposal would result in essentially no delivery losses and could deliver enough water to consistently irrigate the 2000 acres with water rights instead of the 1600 acres that are now consistently irrigated. Increased efficiency would also provide water in the stream for fish migration. The preliminary cost for this project was estimated at $1,025,000 or $513 per irrigated acre (SCS, 1994). The preliminary study recommended further planning for this alternative, because the on-site and off-site benefits were significant.

The study also looked at improving the efficiency of Palisades Canal. Improvements to the Palisades Creek irrigation system, or a combination of improvements to Rainey and Palisades systems, were not considered feasible. The lack of adequate elevation within a reasonable distance made a gravity-pressurized irrigation system economically infeasible (SCS, 1994).

Practically all lands to which surface water can be applied have been developed for many years. Potentially irrigable land remains undeveloped because potential financial returns are not great enough to attract necessary capital, land is in federal ownership, and/or water available for new irrigation is limited. There are several thousand acres of good quality lands, currently dry farmed, on the benches above the South Fork Snake River between Heise and Swan Valley; 1,500 acres of potentially irrigable lands in the Swan Valley area are on the high uplands bordering the present irrigation development on the valley floor, and Antelope Flat has 12,700 acres. Most of this land lies at relatively high elevations, the growing season is comparatively short, and pump lifts to obtain water are high. For these reasons, only scattered areas of relatively small acreage are expected to be developed in the future.

Past studies have identified potential irrigation storage sites. Lynn Crandall/Burns Creek reservoir site has been studied in the past by the USBR as a storage reservoir. The site was reserved as a potential storage reservoir in the Idaho Water Resource Board's 1992 State Water Plan. The proposed location is near the mouth of Burns Creek at river mile 872.5 (Figure 12). Two configurations of the project have been examined. A 1961 proposal by the USBR would have a total capacity of 234,000 AF of water impounded by a 176-foot high dam. Approximately 9.5 miles of the river valley would have been inundated, providing 100,000 AF of supplemental irrigation water (USBR and Army Corp of Engineers [CoE], 1961).

A second development proposal in 1967 would provide irrigation storage replacement for Jackson Lake with a total capacity of 1.46 million AF. A 290-foot high dam would create a reservoir backing water near the existing Palisades Dam (USBR, 1967). In each proposal the reservoir served as a re-regulating reservoir for hydropower discharges at Palisades Dam, allowing an increase in the amount of power produced at the Palisades Powerplant.

Many other dam and reservoir sites in the basin have been studied by the USBR, CoE, USGS, and IDWR. A number of off-stream reservoir sites have been identified, although never seriously considered for development. Dam and reservoir sites studied are listed in Table 14.

Hydropower

Two hydropower generating facilities operate in the basin -- the Palisades Powerplant and Big Elk Creek (Figure 12). The Palisades Powerplant is a USBR facility located at the Palisades Dam.

Figure 12

Water Development

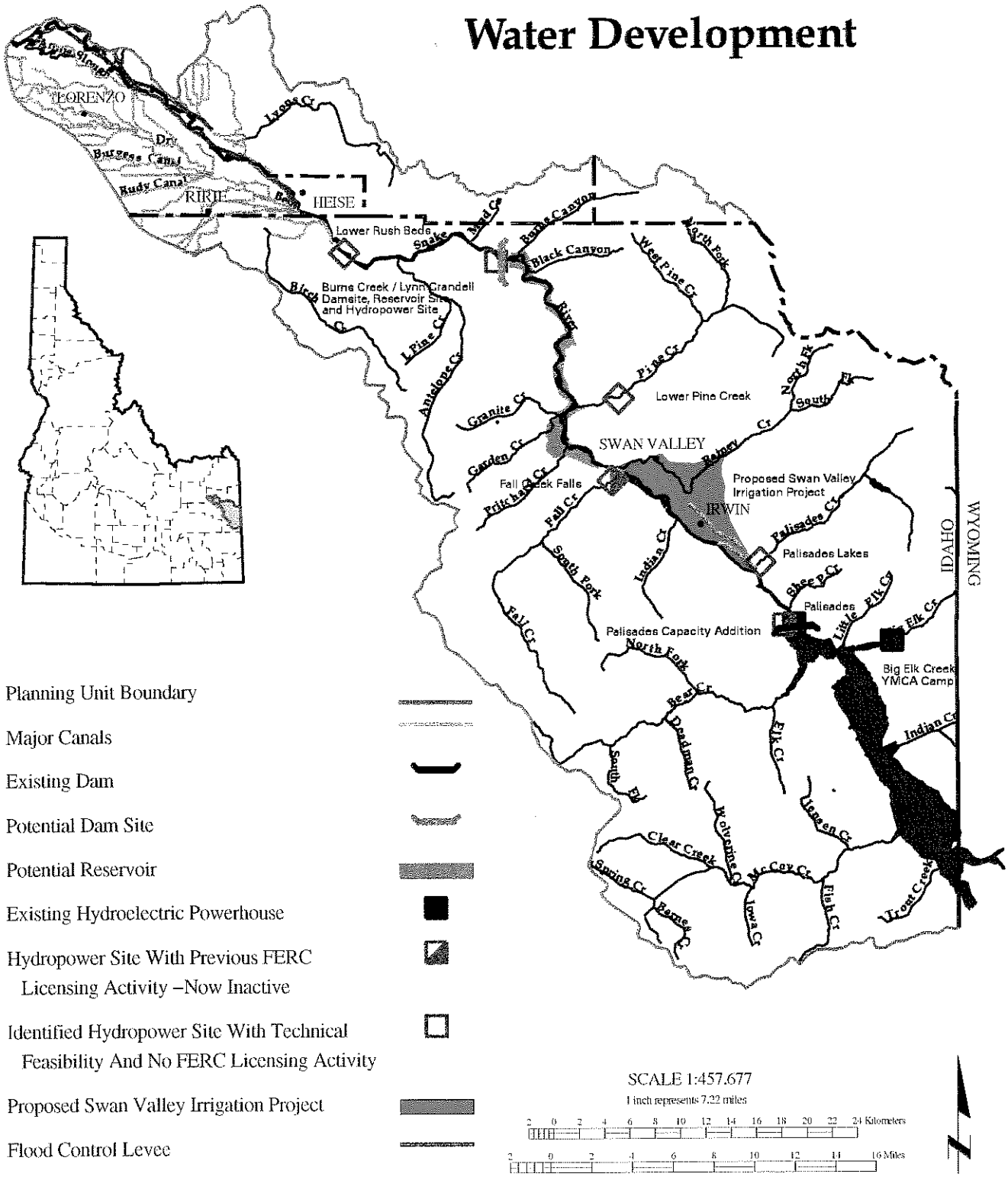


Table 14. Dam and Reservoir Sites Investigated in the South Fork Snake Basin.

Site	Location	Storage	Comment
Lynn Crandall/Burns Creek	South Fork Snake T3N, R42E, Sec. 14	234,000 AF 1,460,000 AF	Two alternatives studied
Rainey Creek Dam & Reservoir	Rainey Creek T1N, R44E, Sec. 33	8,000 A-F	High cost per irrigated acre
Swan Valley Dam & Reservoir	South Fork Snake T1N, R44E, Sec. 33	500,000 A-F	Dam site would be inundated by Lynn Crandall. Geology questionable.
Conant Valley Dam & Reservoir	South Fork Snake T2N, R43E, Sec. 20	750,000 A-F	Dam site would be inundated by Lynn Crandall. Geology questionable.
Dry Creek Dam & Reservoir	South Fork Snake T3N, R43E, Sec. 30	950,000 A-F	Dam site would be inundated by Lynn Crandall. Geology questionable.
Black Canyon Dam & Reservoir	South Fork Snake T3N, R42E, Sec. 13	1,200,000 A-F	Dam site would be inundated by Lynn Crandall. Geology questionable.
Wolverine Creek Dam & Reservoir	South Fork Snake T3N, R42E, Sec. 5	1,500,000 A-F	Lynn Crandall preferred.
Table Rock Dam & Reservoir	South Fork Snake T3N, R41E, Sec. 12	1,500,000 A-F	Lynn Crandall preferred.
Clark Ranch	South Fork Snake T3N, R41E, Sec. 15	1,500,000 A-F	Lynn Crandall preferred.
Birch Creek Dam & Reservoir	Birch Creek T3N, R40E, Sec. 23	6,000 A-F	High cost per irrigated acre.
Offstream Sites			
Gibson Creek-Fall Creek	T1N, R42E, Sec. 34	262,000 A-F	
Swan Valley-Indian Creek	T1N, R44E, Sec. 30	32,000 A-F	
Indian Creek #2	T1N, R43E, Sec. 29	35,000 A-F	
Fall Creek	T1N, R43E, Sec. 8	58,000 A-F	
Fall Creek #2	T1N, R43E, Sec. 8	68,000 A-F	
Fall Creek Falls	T1N, R43E, Sec. 3	94,000 A-F	
Birch Creek	T3N, R43E, Sec. 33	45,000 A-F	
Rainey Creek	T2N, R44E, Sec. 33	250,000 A-F	
Palisades Creek	T1N, R44E, Sec. 35	41,000 A-F	

Sources: USBR and CoE, 1961; USGS, 1965; Idaho Water Resource Board, 1968; CoE, 1995; and Idaho Water Resource Research Institute, 1979.

This facility began power production in 1957. The four original generators each had a nameplate capacity of 28.5 megawatts (MW), for a total installed capacity of 114 MW. During the period of 1992 to 1994, the powerplant capacity was upgraded as part of the USBR's ongoing program of increasing the capacity at existing powerplants. The powerplant now consists of four generators, each with a nameplate capacity of 44.1 MW, for a total installed capacity of 176.6 MW.

The Big Elk Creek Powerplant was licensed as Federal Energy Regulatory Commission (FERC) license #6636. The facility, located on Big Elk Creek, has an installed capacity of 7.5 kw. The power produced by this facility is not marketed commercially, but is used at the Idaho Falls Family YMCA Camp located at Big Elk Creek. This facility was granted a FERC exemption in 1982, and has been operational since 1987 (IDWR, 1995b).

Several hydropower development opportunities have been identified in the basin by past studies. These are summarized in Table 15 and shown in Figure 12. None of the sites appear to be economically feasible under current electric rate schedules. The FERC oversees the licensing of privately operated projects. Three hydroprojects pursued FERC licensing in the past, but are currently inactive.

Flood Management

Flood control is one of the authorized benefits of the Palisades Project, and the USBR is required to follow the established flood control curves for the project. Jackson Lake and Palisade Reservoir provide major flood control in the South Fork Snake Basin. Jackson Lake provides incidental reduction of flood peaks averaging 5,500 cfs, reducing flows by 0 to 8,500 cfs (Wirkus, 1996). Palisades Reservoir provides reduction of flood peaks averaging about 16,800 cfs, reducing flows from 0 to 30,000 cfs. The estimated discharge on the South Fork Snake River at Heise for a 100-year flood event without considering existing flood control dams is 58,300 cfs (Federal Emergency Management Agency, 1981). The estimated flow with the existing flood control dams is 30,000 cfs.

Reservoir releases for flood management are dependent on the amount of storage that must be evacuated with respect to runoff forecasts. Under a plan formulated by the USBR, CoE, and other interested groups, all but the larger floods are regulated to about 20,000 cfs or less near Heise. The extreme flood will be reduced to the maximum practical extent (CoE, 1988). Since the completion of Palisades Dam in 1957, flood peaks in excess of 25,000 cfs at the Heise gage have occurred on four occasions, with a maximum flow of 27,000 cfs on June 18, 1986. Regulation of the South Fork Snake River with the dams in place is illustrated in Table 16.

Below Palisades Dam the safe channel capacity of the South Fork Snake River varies from 15,000 cfs to 35,000 cfs (CoE, 1988). At river flows between 15,000 and 20,000 cfs, small areas along the river, usually covered with pasture grass and annually subject to main river

Table 15. Hydropower Sites Identified in South Fork Snake River Basin.

Site	Potential Capacity	Location
Burns Creek / Lynn Crandall	320,628 kw	South Fork Snake River at Burns Canyon
Palisades Dam	90,000 kw	South Fork Snake River at existing Palisades Dam
Palisades Capacity Addition	90,000 kw	South Fork Snake River at existing Palisades Dam
Fall Creek Falls	468 kw	Fall Creek above the Falls
Palisade Lakes	6948 kw	Palisades Creek
Lower Pine Creek	2730 kw	Pine Creek
Lower Rush Beds	39,000 kw	South Fork Snake River above the Riley Ditch

Sources: USBR and CoE, 1961; USBR, 1967; IWRB, 1968; CoE, 1981; and CoE, 1995.

Table 16. Flood Control Regulation on the South Fork Snake River.

Date	Natural Discharge *(if uncontrolled by upstream projects)*	Regulated Discharge
June 7, 1963	28,000 cfs	25,400 cfs
June 30, 1970	33,800 cfs	25,500 cfs
June 26, 1974	48,100 cfs	26,200 cfs
June 18, 1986	56,900 cfs	27,000 cfs
July 14, 1995	34,300 cfs	22,400 cfs
June 18, 1996	48,300 cfs	24,100 cfs

Source: USBR HYDROMET database.

overflow, are inundated. Bank cutting may be appreciable in some locations at these flows. Channel capacity of the South Fork Snake River at Swan Valley is about 25,000 cfs.

Downstream from Heise, stream bed materials, low banks and gradient induce river meanders. The normal river channel capacity in the Heise to Henrys Fork reach is approximately 20,000 cfs. Between the Great Feeder intake near Heise and the Henrys Fork, an offset levee system was constructed in the early 1960's by the CoE to pass floods up to a magnitude of 30,000 cfs, enough to accommodate the regulated 100-year flood. However, major channel shifts could unpredictably impinge the levees in this reach. Sustained high velocity flows may erode levees and increase flooding risks.

A flood control district, established pursuant to Idaho Code, was organized on the South Fork Snake River in Jefferson and Madison counties in 1946. Flood Control District No.1 maintains the levee system between Heise and Roberts, Idaho. District No. 1 goals are (1) to discourage development in the floodplain, (2) seek to protect and maintain present flood works, and (3) contain flood flows within the present river channel. To this end the District's objectives include identifying and publicizing flood prone areas, assisting in the adoption of a Flood Plain Management Plan, and supporting additional upstream storage projects. The District retains a person for weekly inspection of flood works during spring flows, and has also acquired quarry sites to provide riprap material for flood dike maintenance (Kremer, 1993).

Bonneville, Jefferson, and Madison counties, and the communities of Swan Valley and Irwin participate in the National Flood Insurance Program (NFIP). The program was established in 1968 by the National Flood Insurance Act making flood insurance, previously unavailable from private insurers, available through a federally subsidized program. To participate, communities or counties must adopt a floodplain ordinance specifying land use measures in flood prone areas to avoid or reduce future flood damage. The Federal Emergency Management Agency (FEMA) that administers the NFIP program has established minimum standards for participating agencies.

Floodplain ordinance requirements include elevating the lowest floor of a structure constructed in the 100-year floodplain at or above the base elevation of the 100-year flood. (The 100-year floodplain includes lands subject to a 1 percent or greater chance of flooding in any given year.) Sanitary systems and water supply systems located in the 100-year floodplain must be designed to minimize or eliminate infiltration of flood waters. Development must not encroach into the floodway and must not increase flood levels. (The floodway is an area immediately adjacent to a river or stream channel which becomes the enlarged stream or river channel during flooding.) The participating county or community is responsible for enforcing flood plain ordinance requirements, and determining that other required federal, state and local permits have been obtained before issuing a development permit.

Participation in the NFIP makes flood insurance available to property owners. Any mortgage, loan, grant, or other funding provided, insured or regulated by a Federal agency for a structure located in the floodplain must purchase flood insurance by law. Many lenders may also require flood insurance for conventional loans.

FEMA conducts studies and prepares maps depicting flood hazard information. These maps identify boundaries of the 100-year floodplain and the floodways. Floodplain mapping was completed in 1981 for Bonneville County, 1988 for Jefferson County, 1991 for Madison County, and 1980 for Swan Valley.

WATER QUALITY

The South Fork Snake River from the Wyoming state line to Heise (segment USB-10) and from Heise to Roberts (below the confluence with Henrys Fork; segment USB-20) are designated by the Division of Environmental Quality (DEQ) as Special Resource Waters (Figure 13). Special Resource Waters are specific segments or bodies of water recognized as needing intensive protection to preserve outstanding or unique characteristics, or maintain current beneficial uses. The South Fork Snake River is currently designated by DEQ for the following beneficial uses: domestic water supply, agriculture water supply, coldwater biota, salmonid spawning, and primary and secondary contact recreation (Drewes, 1991). The *Idaho Water Quality Status Report Nonpoint Assessment* rates water quality for the South Fork Snake River as good overall (Idaho Department of Health and Welfare, DEQ, 1992; Drewes, 1991).

In 1994, the Environmental Protection Agency (EPA), under authority of the Federal Clean Water Act, released a 303d list which identified 962 water quality limited waterways in Idaho. A water quality limited segment is a reach which does not fully support all designated beneficial uses. A beneficial use is defined as, "The reasonable and appropriate use of water for a purpose consistent with Idaho state laws and the best interest of the people" (DEQ, 1992). The South Fork Snake River from Palisades Dam to Heise is listed as a water quality limited segment because of flow alteration (EPA, 1996; Figure 13). Listed tributaries in the basin include Antelope and McCoy creeks. Antelope Creek was listed for sediment problems. No specific pollutant is identified for McCoy Creek in the 303d list. All of these reaches are listed as low priority, indicating that designated uses are not fully supported, but risks to human health, aquatic life, recreation, economic, or aesthetics of the water body are minimal.

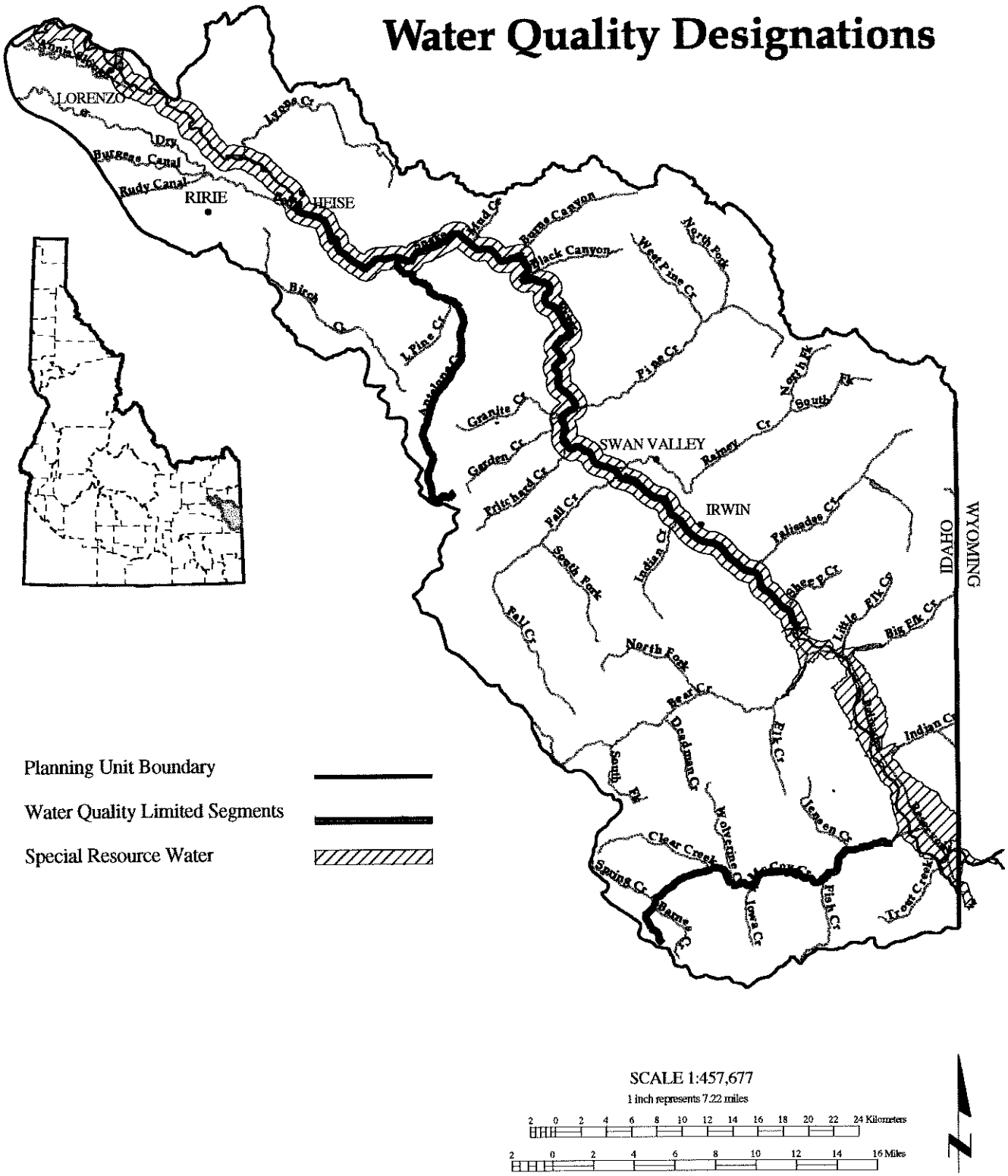
A water quality limited designation by EPA requires development of total maximum daily load (TMDL) standards. A total maximum daily load is the sum of all source and nonsource contributions for a pollutant in a waterway. Pollutant levels established through the TMDL process must be at or below the level established for the waterway to abide by water quality standards. TMDLs were developed as a tool for allocating acceptable contaminant loads from different sources to meet state water quality standards.

The Idaho Legislature passed legislation in 1995 (S.B. 1284) which requires establishment of community-based citizen advisory groups to make recommendations to DEQ and other resource agencies about proper management of impaired waters to comply with state water quality standards. This legislation required DEQ to establish Basin Advisory Groups (BAGs) and Watershed Advisory Groups (WAGs) for each major basin and their watersheds, to make recommendations concerning monitoring, standards revisions, prioritization, and the development of TMDLs and pollution control strategies.

On September 26, 1996, the U. S. District Court for the Western Division of Washington ordered EPA to submit a schedule for completing TMDLs, or their functional equivalent, for all Idaho waters on the 303d list by March 26, 1996. All waters, including those with low priority, are to have TMDLs developed within five years. EPA is legally required to approve Idaho's TMDL plans and to approve a TMDL. EPA requires that a TMDL include reasonable

Figure 13

Water Quality Designations



assurances or monitoring to show that nonpoint source improvements are actually achieved.

The state is required to use the TMDL process to protect beneficial uses of the South Fork Snake River. Flow alteration is listed as a pollutant for the South Fork Snake, because altered flow conditions could threaten or prevent full attainment of beneficial uses such as salmonid spawning and cold water biota (EPA, 1994). End-of-pipe point source pollution (such as treated municipal sewage) is not currently a significant source of pollution for the South Fork Snake River. State water quality standards do not specifically address flow. Since EPA considers flow alteration a form of nonpoint source pollution, the appropriate remedy may be in the form of flow management through the operation of Palisades Dam. However, flow regimes on the South Fork Snake River are controlled by contractual reservoir storage rights and water rights to divert for agricultural and other uses. Flow management must occur in accordance with Idaho law and other constraints.

Water quality data collected by the U.S. Geological Survey (USGS) is available for several stations on the South Fork Snake River. Data availability, time frames and parameters measured vary at each gage. USGS water quality analyses conducted at Heise from 1911 to 1994, and at Lorenzo from 1924 to 1994, for several selected constituents are summarized in Table 17.

Suspended Solids

Suspended solids are good indicators of nonpoint source agricultural pollution (Drewes, 1991). Soil particles are typically entrained in the water column from about three inches above the bottom to the top of the column. Suspended sediment concentrations in the South Fork Snake Basin are influenced by three factors: channel washing, direct input, and dilution (Drewes, 1991). (Channel washing is the flushing of soil and debris that builds up during low flows. Direct input is material washed directly into streams from surrounding lands. Dilution is the result of input of relatively "cleaner" waters into the system.)

The DEQ prepared a State Agricultural Water Quality Plan (SAWQP) for the Antelope-Pine creeks area. The study collected samples for a period from October 1987 to May 1989 from Palisades Dam to Heise, and on several tributaries of the main stem -- Antelope, East Birch, Granite, Pine and Rainey creeks (Drewes, 1991).

The SAWQP determined agricultural impacts on the South Fork Snake River were minimal (Drewes, 1991). Suspended solid measurements below Palisades Dam never exceeded the EPA Water Quality Index guidelines for no impact during the 1987-1989 SAWQP study. At the Heise gage sediment loads exceeded EPA guidelines for a moderately polluted river twice (Drewes, 1991).

Intermittent streams contribute the highest concentrations of suspended sediments into the South Fork Snake River. This is the result of three characteristics: 1) close proximity to farmland; 2) lack of water and exposure of stream bottoms leading to greater washing during spring runoff; and 3) lack of a bedrock stream bottom allowing greater contact with soils and mass wasting (Drewes, 1991). By comparison perennial streams tend to have well-developed riparian areas, stream beds and banks, preventing erosion of upland soils during high flows and filtering pollutants from adjacent farmlands. The greatest contributor of suspended solids (also inorganic nitrogen and phosphorus) to the main stem are East Birch, Antelope, and Granite creeks (Drewes, 1991).

Sources of sediment, in addition to agricultural practices (farming and grazing), include wildlife grazing, recreation, residential development, mining, timber harvest, road and trail construction, and forest and range fires (BLM and Forest Service, 1991). Roads, specifically those within riparian areas, generally contribute 85-90 percent of sediment reaching streams in disturbed forest land (Targhee National Forest, 1996a). Another source of sediment is stream bank erosion due to compaction, stream bank trampling, and channel movement.

Table 17. Water Quality Constituent Statistics for Two Sample Locations on the South Fork Snake River.

		Temp. (deg. C)	Flow * (cfs)	pH (Std)	Dissolved Oxygen (mg/l)	Fecal Coliform (colonies/ 100 ml)	Dissolved Solids (tons/ day)	Nutrients (mg/l)			
								Nitrogen Total (as N)	Nitrogen Nitrite + Nitrate (dissolved as N)	Ortho-phosphate (dissolved as P)	Phosphorus Total (as P)
Station: **Heise** (13037500)	Sample Size or Period of Record	270	1911 - 1994	632	130	94	575	75	151	49	161
	Mean	7.25	6930	7.9	10.4	20.4	4020	.68	.31	.05	.04
	Range	0 -23.0	460 - 51,600	6.5 - 8.8	7.8 - 13.6	1 - 150	868 - 17,700	.05 - 4.70	<0.1 - 6.4	.01 - .98	<.01 - .40
Station: **Lorenzo** (13038500)	Sample Size or Period of Record	112	1924 - 1994	9	9	9			6	9	9
	Mean	8.29	4050	8.5	10.6	15.4			0.1	.01	.03
	Range	0 - 17.5	110 - 19,900	8.1 - 8.7	9 - 12.7	1 - 63			0.1 - 0.2	<.01 - .01	.01 - .05

* Flow (cfs) = mean annual; high and low mean daily values given for range

Source: USGS, 1996; and Milligan et al., 1983.

Agricultural practices resulting in sedimentation in streams are expected to be reduced through cost sharing programs organized under the auspices of the Soil and Water Conservation District. Best management practices (BMPs) are proposed on 47,000 cultivated acres located on tributaries to the South Fork Snake River. The goal is to reduce erosion to 5 tons/acre/year. Projects are occurring on Antelope and Pine Creek drainages (BLM and Forest Service, 1991).

Nutrients

Nutrients typically include compounds of nitrogen and phosphorus. Those monitored in the SAWQP study included total Kjeldahl nitrogen, nitrate, nitrite and ammonia nitrogen, ortho-phosphate phosphorus, and total phosphorus (Drewes, 1991). Organic nitrogen was calculated by subtracting the ammonia value from the Kjeldahl nitrogen value. The recommended inorganic limit for total nitrogen to prevent development of aquatic nuisance vegetation is 0.3 milligram/liter (mg/l) (Mackenthun, 1973). Total nitrogen levels exceeded the recommended levels in 11 of 77 samples taken at Heise in the SAWQP study (Drewes, 1991). Inorganic nitrogen levels exceeded recommended levels on the tributaries to the following extent: East Birch Creek (18 of 18), Antelope (4 of 18), Granite (4 of 18), Pine (1 of 18), and Rainey (0 of 18). Nitrogen sources appeared to be from agricultural practices, particularly in areas where tributaries flowed through pastures (Drewes, 1991).

Phosphorus can be tightly bound with soil particles. Consequently, phosphorus is normally transported with sediment and may increase with suspended solid concentrations. Phosphorus occurs naturally throughout the basin. High enough levels occur in basin soils that it is rarely applied in agricultural practice.

The results from the SAWQP study indicate that total phosphorus levels in the intermittent streams exceeded the 0.1 mg/l recommended limit in 67 percent of the samples (Drewes, 1991). The established, perennial streams exceeded the recommended limit 23 percent of the time. The dissolved ortho-phosphate phosphorus level exceeded the 0.025 mg/l recommended limit in 18 percent of the intermittent stream samples and in 5 percent of the perennial tributary samples. Phosphorus concentrations were not detectable below Palisades Dam. It is assumed that phosphorus upstream settles out with sediments in the reservoir (Drewes, 1991). Farming practices are the principle man-caused source of total phosphorus below Palisades Dam. It was not known whether the majority of ortho-phosphate phosphorus came from agricultural or residential sources or both, but occurrence followed the same pattern as the total phosphorus (Drewes, 1991).

Bacteria

Bacteria standards for the South Fork Snake River are determined by the designated uses established (DEQ, 1992). The main stem is protected for primary contact recreation, which is the most limiting standard. No records for bacteria at Heise exceeded the recommended standard of 500 colonies/100 ml (Drewes, 1991). In 198,1 fecal coliform counts were significantly higher at the Menan gage (outside the basin and below the confluence with the Henrys Fork) than at Heise (USGS STORET data). Rainey and Granite creeks exceeded the recommended bacteria levels at least once (Drewes, 1991). Both Rainey and Granite creeks run through livestock pastures, and fecal coliform-streptococcus ratios indicate that livestock are the main contributor (Drewes, 1991). Samples for Rainey Creek showed human fecal coliform contamination as well.

Other Water Quality Parameters

Additional water quality parameters measured included temperature, dissolved oxygen, and pH. At Heise, the temperature requirements for salmonid spawning (13° C or less) were met during the spawning season. The temperature reached 14-15° C in July and September (Table 17). The minimum standard for dissolved oxygen for salmonid spawning (6 mg/l) has been met at Heise since 1911 (lowest is 7.8 mg/l).

The pH range of 6.5 - 9.5, established for surface water aquatic life, was not exceeded at Heise. The pH level has remained relatively steady within the range established for surface water standards.

A preliminary study done by DEQ in 1994 during an unusually low volume in Palisades Reservoir, indicated that river water temperatures (taken 750 meters below dam) did exceed the overall maximum (13° C) and average daily maximum (9° C) temperatures for salmonid spawning a majority of the sampling days (DEQ, 1995). These temperatures could postpone spawning or force the selection of less desirable redd location. Water temperature was not influenced by the amount of water discharged but rather the ambient air temperatures during low flows.

Information on other tributaries in the basin were acquired from the Targhee National Forest (Table 18). The Draft Forest Plan Revision and Environmental Impact Statement reported water quality in Big and Little Elk creeks was good in the 1970's, as was Rainey and Palisades creeks in a later 1994 study. The Forest Service also found Fall, Pritchard, Bear, Indian, and McCoy creeks had a good to fair rating in channel stability, but that Big Elk, Palisades, Rainey, Burns, and Pine creeks ranged from good to poor channel stability (Targhee National Forest, 1996a; Table 18). Impacts came mainly from recreational use, particularly in areas of dispersed camping, and from cattle grazing and roads. The lowest rated tributaries were Fall, Bear, and Antelope creeks (all of Fall Creek and lower half of Bear Creek). Fall Creek problems were attributed to cattle grazing, power line clearing, riparian roads and heavy recreational use, resulting in a fair rating for channel stability. On Antelope Creek, both the private and Forest Service lands were heavily impacted by roads, recreation, and cattle trampling.

Lakes and Reservoirs

Palisades Reservoir (elevation 5,620 ft.) is located on the Wyoming - Idaho border with most of the impoundment in Idaho. The shorelines are gravel and rock with mud flats in the upper reaches. The near shoreline slopes are primarily forested with meadows at the upper end. Despite summer drawdowns, the littoral zone of the reservoir is very narrow due to steep underwater slopes. This aspect tends to limit productivity and increase the capacity to absorb nutrient loading (Milligan, et al., 1983).

In a 1983 study of 85 lakes and reservoirs, Palisades was classified as mesotrophic with a Trophic Status Index (TSI) value of 16.8, indicating moderately rich in nutrients (Milligan, et al., 1983). (The TSI ranged from oligotrophic Redfish Lake with a TSI value of 7.6 to eutrophic Lake Lowell, near Caldwell, at 34.0; mesotrophic water bodies ranged from 16.5 to 18.1). The TSI took into consideration 11 parameters, including Chlorophyll a, organic content, total suspended solids, color, Secchi disc, turbidity, total phosphorus, total nitrogen, conductivity, alkalinity, and pH. Palisades Reservoir had a maximum depth of 32.3 meters, a Secchi disc depth reading of 3.5 meters, and a euphotic zone depth of 9.5 meters. The one-time sampling yielded a pH value of 8.0, hypolimnion dissolved oxygen level of 5.2 mg/l, fecal coliform count of 20 colonies/100 ml, total nitrogen of 0.19 mg/l, and total phosphorus of 0.04 mg/l. These values are all well within normal range and recommended limits.

Drewes (1991) reported that there is no indication Palisades Reservoir has any trophic or nutrient problems, but during runoff the waters received from the tributaries and released downstream do contain elevated levels of inorganic nitrogen. The reservoir is included in the Special Resource Water designation for the South Fork Snake River. Even though total phosphorus values were high in reservoir tributaries, as they were in the groundwater sampled near the reservoir (see following Ground Water discussion), it settled out or was utilized by reservoir plankton.

The 1985 Western Lakes Survey concluded that Upper Palisades Lake was in very good condition. This is typical for high elevation wilderness lakes which receive little impact other than seasonal recreation (Targhee National Forest, 1996a).

Table 18. Summary of South Fork Snake River Tributary Stream Conditions.

Tributaries	Intermittent or Permanent	Well-developed Riparian Communities (farming/grazing not close to stream)	Channel Stability (condition of stream beds and banks)	General Level of Water Quality *	Comments
McCoy Creek	Permanent		Good		
Bear Creek	Permanent	No	Fair		Half of creek has poor channel stability
Big Elk Creek	Permanent		Poor to Good	Water quality measured in 1970s good at that time	
Palisades Creek	Permanent		Poor to Good	Water quality measured by U.S. Forest Service in 1994 was good	
Indian Creek (river tributary)	Permanent		Good		
Fall Creek	Permanent		Fair		Entire creek has poor channel stability
Rainey Creek	Permanent	Yes	Good	2 (water quality measured by U.S. Forest Service in 1994 was good)	Problems with cattle & wildlife grazing impacts
Pritchard Creek	Permanent		Good		
Granite Creek	Intermittent	No	Poor	3	
Pine Creek	Permanent	Yes	Good	1	
Burns Creek	Permanent		Poor to Good		
East Birch Creek	Intermittent	No	Poor	5	
Antelope Creek	Intermittent	No	Poor	4	Private & U.S. Forest Service land impacted by roads, recreation, cattle trampling
West Birch Creek	Intermittent		Poor	6	

* The six tributaries evaluated in the Antelope - Pine SAWQP study were ranked (1 = least polluted; 6 = most polluted)

Source: Drewes, 1991; Targhee National Forest, 1996a.

Ground Water

Data available to date indicate ground water quality is good. The shallowness of the alluvial aquifer, geology, soils along the South Fork Snake River, and development pressures currently occurring in the basin have resulted in considerable concern about the quality of the ground water. The USGS National Water Quality Assessment Program reported that several wells tested along the main stem, from Palisades to the Henrys Fork confluence, had nitrate levels that were still < 2 mg/l (the federal drinking water standard is 10 mg/l) (Rupert, 1994). Samples taken from wells in the basin between 1992 to 1995 as part of the Idaho Statewide Ground Water Quality Monitoring Program found wells in Swan Valley had the highest nitrate levels of those sampled. However, they averaged 1.5 mg/l, well below the standard (Crockett, 1996).

With current and anticipated population growth in the Swan and Conant valleys, there is serious concern about the potential for pollution of the shallow alluvial aquifer, and ultimately the river, from septic systems installed at new developments (Dunn, 1996). Soil surveys done in Ririe, Conant Valley and Swan Valley identify severe limitations for absorption of pollutants from septic tanks and sewage lagoons (SCS, 1979 and 1981a).

Other Resource Values

TIMBER

Most timber harvest in the basin occurs under the direction of the Forest Service with the majority of forest lands under the jurisdiction of the Targhee National Forest. A small portion of the Caribou National Forest, encompassing the McCoy Creek watershed, is in the southern portion of the basin. About 101,000 acres, or 15 percent of the basin, are considered tentatively suitable for timber harvest. This comprises less than 1 percent of the total suitable timber found on the Targhee National Forest and Caribou National Forest. Suitable timber is determined by identifying lands that produce or are capable of producing crops of industrial wood by reviewing information on land coverage, slope, soil types, and aspect. Other criteria considered include: whether lands are withdrawn from entry by Congress, the Secretary of Agriculture or the Forest Service Chief; if current technology and knowledge indicates harvest can occur without irreversible impacts to soils and the watershed, and the site will revegetate within five years of harvest; and information exists to determine responses to timber management activities (Targhee National Forest, 1996b).

The Forest Plan Revision for the Targhee National Forest proposes timber harvest for some lands in the South Fork Snake Basin. Forest management would occur to improve forest health by reducing risk of insect and disease, and improving big game habitat. Small sales are proposed in the Elk Creek, Moody Creek, Burns-Pat creeks, McCoy-Jensen creeks, Fall Creek, and Brockman Creek watersheds over the next ten years. Less than 1,000 total acres are estimated for harvest with a total volume of 3,000 thousand board-feet in the basin (Targhee National Forest, 1996b). The Land & Resource Management Plan for the Caribou National Forest proposes harvest of 1.19 million board-feet for the time period 2001-2010 (Caribou National Forest, 1985). However, the Land & Resource Management Plan is currently being revised which may result in some changes (Moe, 1996).

MINES AND PROSPECTS

Currently very little mining activity occurs in the basin. Of eight mining claims, one is actively being pursued. The area has experienced periods of intense development and exploration for different minerals in the past. Gold exploration occurred from the 1870's to the late 1920's. In the mid-1980's the eastern half of the basin contained many oil and gas leases. Over the years exploration for other minerals has occurred.

Travertine - Eight mining claims in the basin are for travertine deposits located east of the Fall Creek drainage. One involves an active mine in the process of being patented. Although the

deposit is small (296.5 acres), it is a quality product and marketed internationally (Horsburgh, 1995). Travertine is a marble-like building material used in landscaping and adorning the exterior of buildings.

Phosphate - Deposits of the Meade Peak Phosphatic Shale Member of the Permian Phosphoria Formation occur within the basin. Although Idaho provides a small percentage of the world's phosphate, it is a major mineral commodity in the state, contributing about $80 million dollars annually to the economy. The phosphate industry is one of the top three in eastern Idaho. Phosphate is used to produce fertilizers and phosphoric acid.

Rich deposits are located in the Caribou Range Known Phosphate Leasing Area west of Swan Valley (Figure 14). Four phosphate leases for the area date from 1929 with an estimated 10-20 year supply (Horsburgh, 1995). The last reported activity occurred in the 1960's as part of exploration (Forest Service, 1996a). Economic conditions have not resulted in mining of these deposits, and will likely not occur until deposits in the Soda Springs area are exhausted approximately 50-70 years from now (Horsburgh, 1995). Other phosphate deposits have been identified throughout the basin and are depicted in Figure 14 (Idaho Bureau of Mining and Geology, 1981).

Oil and Gas - An inventory of oil and gas potential completed in 1992 indicates the possibility of discovering oil or gas is high within portions of the basin (Horsburgh, 1992). The basin lies in what is known as the overthrust belt, a thick sequence of sedimentary rocks which were folded and faulted. The thrust sheets have overridden each other in a west to east direction.

The area north of the South Fork Snake River from Pine Creek east has a high potential. The geologic setting of this area is similar to producing fields found in adjacent Utah and Wyoming characterized by asymmetric folds in the leading edges of major thrust plates. The area north of the South Fork Snake River and west of Pine Creek has a moderate potential. The remainder of the basin has little or no potential (Horsburgh, 1992). See Figure 14.

Exploratory wells were drilled in Mike Spencer Canyon, Swan Valley, Bald Mountain and Black Mountain in the mid-1980's, but were not successful. Commercial market conditions have resulted in no recent oil and gas exploration. Oil industry representatives have indicated that exploration in Idaho will likely not occur until the value of oil remains above $30 a barrel (Horsburgh, 1992).

Gold - Historically, commercial gold mining occurred on Caribou Mountain in the McCoy Creek drainage from the 1870's to 1920's (Jones, 1996). The area is covered by lode and placer claims for gold. Today recreational gold dredging, sluicing and panning occur.

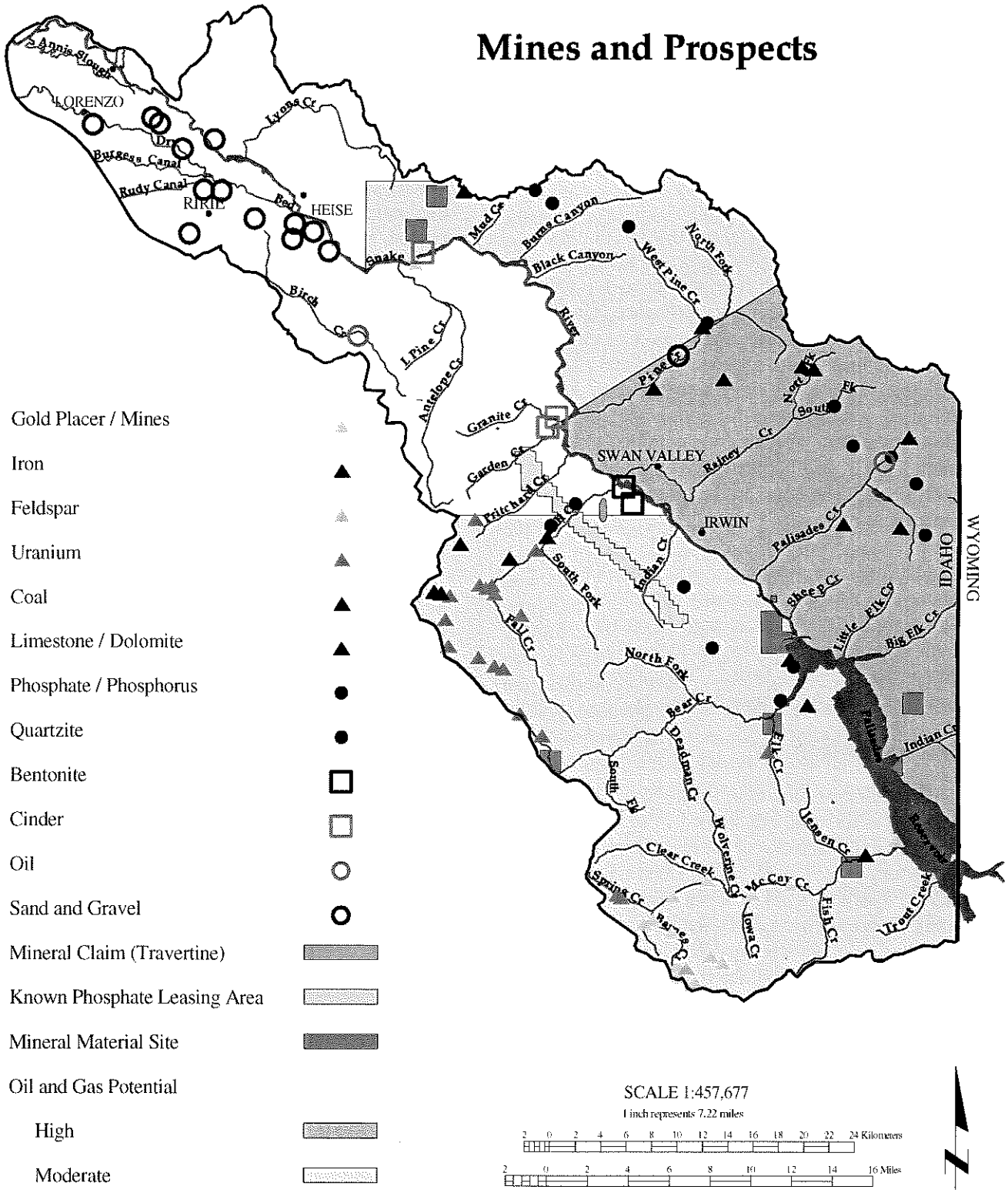
Impacts from recreational dredging were significant enough to require closing McCoy Creek to use under a simple one stop permit system. Individuals must now apply for a stream channel alteration permit from the Idaho Department of Water Resources and a special use permit from the Forest Service (Verner, 1995). Activity is limited to five individuals a year and is closed to all activity from May 1 to September 1 to protect spawning cutthroat (Jones, 1996).

Mineral Material Sites - Ten mineral material sites are located in the basin. These are sites with mineral deposits of economic value that may be used for agriculture, building material, cleaning and abrasive materials, construction, decorative arts, and landscaping. The materials may be removed by securing a permit from the Forest Service or BLM. Sites within the basin contain sand, gravel and cinders. Materials from these sites are mainly used by local government entities for road maintenance and construction (Horsburgh, 1995).

Exploration in the basin has identified several other mineral prospects including uranium and

Figure 14

Mines and Prospects



iron in the headwaters of the Fall Creek drainage, and limestone and dolomite deposits throughout the basin (Idaho Bureau of Mining and Geology, 1981). Low grade coal deposits occur throughout the basin, but are not economically viable (Gillerman, 1995) Feldspar, quartzite and bentonite have also been identified. Figure 14 depicts the general locations of these deposits.

NAVIGATION

There is no commercial navigation. defined as moving commodities by water, on the South Fork Snake River reach from the Idaho-Wyoming state line to the Henrys Fork confluence. Under the Idaho Admissions Act and Idaho Constitution, the State claims title to all bodies of water that are navigable. Under this claim a stream must have been used as a "highway for commerce" on the date that the State of Idaho was admitted to the Union (July 3, 1890). State title applies to the South Fork Snake River in the basin (Idaho Department of Lands, 1986).

Outfitters use the South Fork Snake River for commercial floating and fishing expeditions. To date, eight outfitters are licensed to operate on the South Fork Snake River by the Idaho Outfitters and Guides Licensing Board. This activity is discussed in the *Recreation* section.

FISH AND WILDLIFE

In 1980, the South Fork Snake River was identified as the most important fish and wildlife habitat in Idaho and one of the most significant in the western United States (U.S. Department of Interior, Fish and Wildlife Service [USFWS], 1986). There are several key features that make the river so biologically important and unique. Throughout the length of the free-flowing section, the river flows though the most extensive and highest quality cottonwood forest in Idaho (Riggin and Hansen, 1992). Secondly, fish productivity in the South Fork Snake River is high, and supports one of the few remaining native cutthroat trout fisheries (Thurow, et al., 1988). These features, plus the resident bald eagle population and breeding bird diversity, set the river and its basin apart from many others in western North America.

Ecosystems

The biodiversity in the basin is high, in large part because of the uniqueness of the South Fork Snake River narrowleaf cottonwood community (Saab, 1991). (Biodiversity defines biological species diversity measured by determining the total number of species in a community and the relative abundance of the species.) The South Fork Snake River narrowleaf cottonwood forest is the most productive habitat type in the basin for species diversity (BLM and Forest Service, 1991). The construction of Palisades Reservoir resulted in the loss of significant riverine and riparian habitat for aquatic mammals (mink, otter), elk, mule deer, breeding waterfowl, ruffed grouse, bald eagle, and nongame birds. The osprey is the only terrestrial vertebrate known to have benefitted from the reservoir (Meuleman, Martin and Hansen, 1992).

Riparian communities are the most important habitats in North America for solitary nesting birds, and critical for migrating birds (Schroeder and Allen, 1992). Data collected by the Targhee National Forest found three of the twelve communities on the forest had the majority of species occurring in or adjacent to the riparian community (Targhee National Forest, 1993). This included 62 of 85 mammals, 262 of 301 birds, and 13 of 17 amphibians and reptiles. Another study found sixty-seven percent of the 126 total riparian species utilizing the river riparian corridor were neotropical bird migrants (Meuleman, et. al., 1986).

The tributaries to the South Fork Snake River provide important foraging and nesting habitat, and refugia for wildlife in the basin. While the tributary riparian communities do not possess the extensive mature narrowleaf cottonwood gallery forest, and therefore, within-community heterogeneity that the main stem does, they often present mosaics of greater between-community heterogeneity. Tributary habitat will become more critical as human use and activity on the main stem increases.

The South Fork Snake River below Palisades Dam represents the largest continuous stand of narrowleaf cottonwood *(Populus angustifolia)* forest in the state and entire intermountain region (Saab, 1991; Riggin and Hansen, 1992). However, forest age composition of the South Fork Snake River corridor indicates insufficient numbers of young cottonwood to replace mature cottonwood (BLM and Forest Service, 1991). Inventories conducted in 1982 and 1988 determined 84 percent of the cottonwood population was mature or older trees (41 years or older), and the remaining 14 percent were young trees (Aslett, 1982; BLM and Forest Service, 1991). The establishment of immature trees on gravel bars and disturbed areas is not sufficient because flow releases have reduced the amount of sediment scouring, channel shifting and deposition. Total recruitment on gravel bars and sucker growth in mature stands will probably decline in area and vigor over the years (Merigliano, 1996).

Merigliano studied cottonwood stands from Palisades Dam to Heise to examine changes to the forest structure and composition from the 1950's to the present (Merigliano, 1994). His study found that as the stream channel became entrenched, it confined the cottonwoods to a denser, but narrower band. Merigliano concluded the pre-settlement/pre-dam cottonwood ecosystem is similar today in composition and structure, but stands are significantly smaller. The last major episode of cottonwood recruitment occurred in the mid-1940's before Palisades Dam was constructed. Cottonwood regeneration is dependent on occasional flooding, possibly of the magnitude and frequency of 36,000 cfs every 10-15 years (Merigliano, 1996). Planting is considered the least desirable option because of expense, access, rocky soils, irrigation, and beaver depredation.

In addition to the narrowleaf cottonwood dominance, the South Fork Snake River streamside riparian community also includes water birch, red-osier dogwood, silverberry, sandbar willow, yellow willow, and bentgrass (Merigliano, 1994). Narrowleaf cottonwood dominates the canopy, but the red-stemmed dogwood has the highest understory density (Saab, 1992). Other species included in the riparian community of the South Fork Snake River and its tributaries are Douglas fir, lodgepole pine, wild rose, and western serviceberry.

The east side tributaries (Indian, Big Elk, Palisades, Rainey, Pine, and Burns creeks) tend to be lusher and less xeric than the west side tributaries (McCoy, Bear, Indian, Fall, Pritchard, and Antelope creeks), in part because of the geology and topography of the canyons (tight and narrow on the east side, wider and more open on the west side). The Bear Creek riparian community, typifying the west side tributaries, is dominated by sandbar willow, alder, dogwood, and Douglas fir, with more open sagebrush-aspen complexes along the stream at higher elevations.

Burns Creek canyon, an east side riparian community in excellent, near pristine condition, has certain vegetation types which are uncommon for this part of Idaho (Layser, 1994). The community types exhibit exceptional diversity of species and structure. The upper Burns Creek canyon consists of shrub and tree dominated communities of white alder, water birch, red-osier dogwood, alder, and sandbar willow with Rocky Mountain maple, ninebark, and bigtooth maple common in places. Also found are Hudson Bay currant, black hawthorn, chokecherry, Douglas fir, subalpine fir, horsetail, Engelmann spruce, and narrowleaf cottonwood scattered throughout. The lower reach is dominated by stands of large narrowleaf cottonwood with a multi-layered, structurally diverse, deciduous tree and shrub understory of western birch, red-osier dogwood, and bluegrass. It is unusual for species such as water birch, bigtooth maple, ninebark, and hawthorn to extend as far up a tributary as they do in Burns Canyon, providing a connection between the South Fork Snake River and its uplands. The 490-acre Burns Canyon Research Natural Area was recently designated by the Intermountain Regional Forester indicating the significance of this community.

Cress Creek is unique among the tributaries, because it is a spring-fed riparian system

(Kotansky, 1996). Originating on the northern bench of the lower South Fork Snake River downstream from Heise, the stream has excellent water clarity and quality for all parameters, except fecal coliform bacteria (Kotansky, 1996). The high water quality supports a healthy, highly-structured riparian ecosystem with a number of different hydrophytic marsh species such as narrowleaf cottonwood, water birch, water cress, cattail, and monkeyflower within a few feet of semi-arid upland species of predominantly juniper, bluebunch wheatgrass, big sagebrush, slender wheatgrass, arrowleaf balsamroot, and antelope bitterbrush.

A plant listed as threatened under the Endangered Species Act occurs in the basin. A species of orchid, Ute ladies' tresses (*Spiranthes diluvialis* - which means "of the floods") was found in the fall of 1996 in four active riparian zones, or flood channels, of the South Fork Snake River (Moseley, 1996). The four populations were found between Fall Creek Campground and Kelly Island Campground, a distance of about 40 river miles. The orchid is also distributed in Colorado, Montana, Wyoming, Utah and Nebraska on the fringes of flood channels, but well within the riparian community.

The uplands above the riparian community are dominated by Douglas fir, quaking aspen, juniper, and sagebrush. Douglas fir and quaking aspen dominate the north-facing slopes; juniper and sagebrush dominate the south-facing slopes (BLM and Forest Service, 1991).

Numerous invasive plant species occur in the basin, including several knapweeds (*Centaurea* spp.), common tansy (*Tanacetum vulgare*), Canada thistle (*Cirsium vulgare*), purple loosestrife (*Lythrum salicaria*), leafy spurge (*Euphorbia esula*), and musk thistle (*Carduus nutans*) (U. S. Department of Energy, Bonneville Power Administration [BPA], 1995). Riparian ecosystems in the west are seriously threatened by these exotic invasions, caused by soil and habitat disturbances and non-native introductions. Agencies and counties are working cooperatively in the basin to prevent further invasion and spread, using integrated pest management techniques.

Fisheries

Eleven species representing four families occur in the main stem (Thurow, Corsi, and Moore, 1988). The native fish species include the cutthroat trout, mountain whitefish, mountain sucker, bluehead sucker, Utah sucker, Utah chub, redside shiner, longnose dace, speckled dace, mountain sculpin and Paiute sculpin. The most abundant game fish in the South Fork Snake River are mountain whitefish (*Prosopium williamsoni*) which are an important food source for bald eagles. Species introduced to the basin include rainbow, brook, brown, and lake trout, kokanee and coho salmon.

The South Fork Snake River is an important cutthroat trout (*Oncorhynchus clarki*) and brown trout (*Salmo trutta*) fishery (Schrader and Griswold, 1994). Its importance is associated with high growth rate and natural reproduction (Martin, 1996). Special IDFG fishing regulations, high densities and low mortality rates also contribute to the outstanding fishery condition. In a comparative study with eight other Idaho cutthroat streams, the South Fork Snake River ranked second only to the main Snake River in measured length at 4 years of age (Schill, 1991).

Although unresolved, some biologists believe two subspecies of cutthroat trout exist in the basin -- Yellowstone cutthroat and Snake River fine-spotted cutthroat (Behnke, 1992). The Yellowstone cutthroat exists in the basin as both migratory and non-migratory populations. The nonmigrants spend their entire life in the tributaries. The migrants move into the tributaries from the main stem to spawn and then return to the main stem (Thurow, Corsi, and Moore, 1988). The Yellowstone cutthroat trout has evolved with little interspecific competition, and has consequently developed a relatively broad niche in terms of feeding habits and habitat utilization (Targhee National Forest, 1993). Both subspecies are found throughout much of the basin, but the Yellowstone cutthroat is the

dominant subspecies in the South Fork Snake River and tributaries, while the fine-spotted cutthroat dominates above Palisades Dam in the reservoir and tributaries (Thurow, 1996; Figure 15). Palisades Dam, completed in 1957, created a flatwater lacustrine environment that effectively eliminated migration of cutthroat from the South Fork Snake River below the dam to tributaries to the reservoir (Thurow, Corsi, and Moore, 1988). Some fish still move downstream from the reservoir.

The Yellowstone cutthroat and fine-spotted cutthroat trout are listed as Species of Special Concern by the IDFG. Species of Special Concern are native species which are either low in numbers, limited in distribution, or have suffered significant habitat losses (IDFG, Conservation Data Center [CDC], 1994). Historically, the Yellowstone cutthroat occupied 3,797 miles of riverine habitat within Idaho (Duff, 1996). Current assessment indicates that approximately 1,622 stream miles are presently inhabited by Yellowstone cutthroat, or 43 percent of their original historic range. However, only a small percentage of this population has been genetically verified. There is concern that the genetic purity of many of these populations may be contaminated by rainbow trout hybridization. Of the twenty-one sub-basins with Yellowstone cutthroat trout in Idaho, nineteen (including the South Fork Snake River Basin) contain exotic trout species such as rainbow which threaten the genetic purity of the Yellowstone cutthroat species.

Thirteen tributaries to the main stem are considered biologically significant, because they are perennial with known cutthroat spawning. McCoy, Bear, Indian, and Big Elk creeks flow into Palisades Reservoir and are considered important spawning tributaries (Moore, Aslett, and Corsi, 1981). Palisades, Rainey, Pritchard, Pine, and Burns creeks are important spawning tributaries to the main stem. Dean (1996a) reported that healthy, stable reproducing populations of cutthroat exist in McCoy, Bear, Palisades, Pine, and Burns creeks.

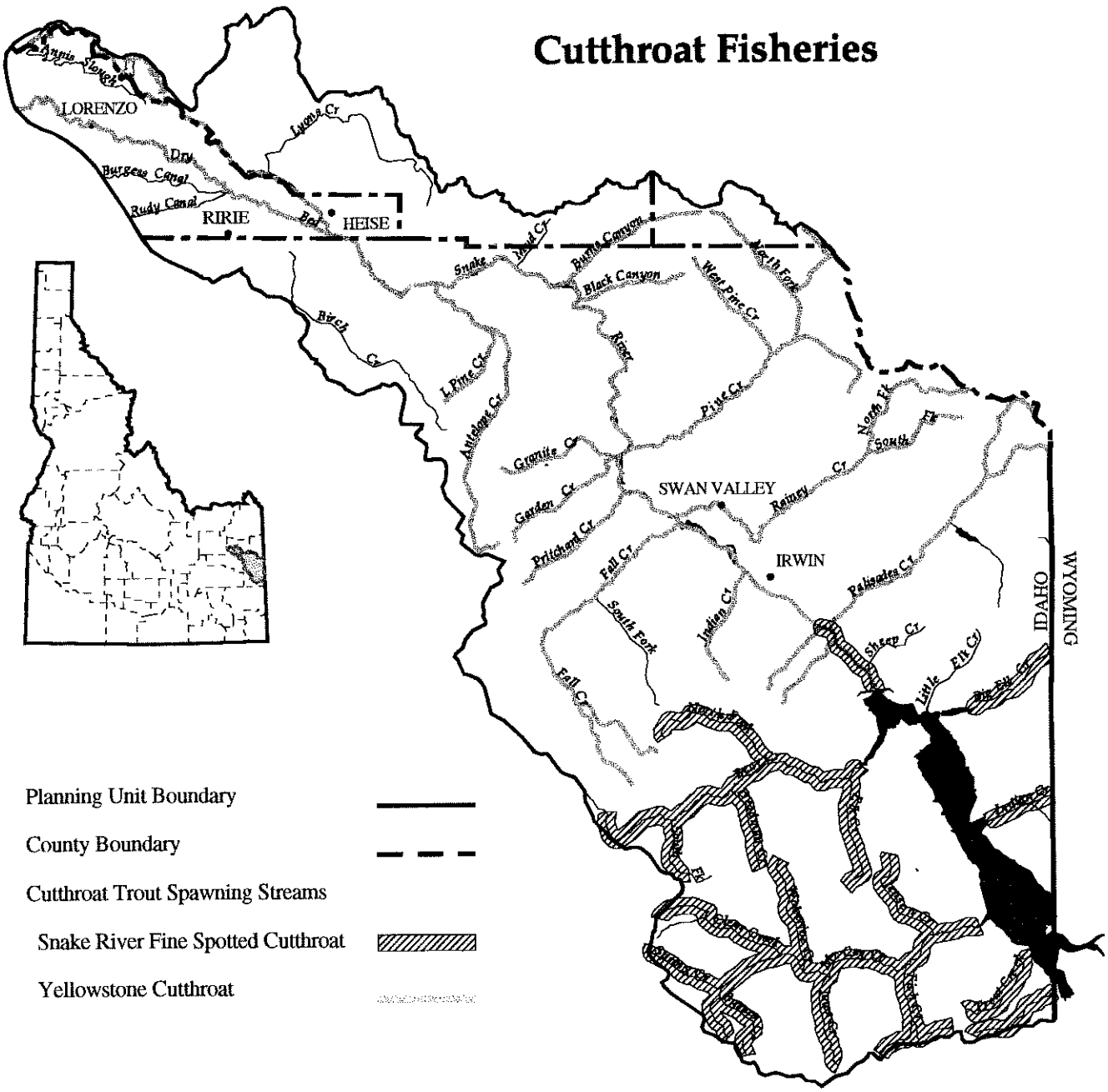
Threats to many of the spawning tributaries limit recruitment to the main stem fishery. Palisades Creek, the uppermost tributary to the South Fork Snake River, has excellent spawning and rearing potential, but 95 percent of the water is diverted one kilometer above the mouth during irrigation season (Moore, 1980). Currently, a bypass system is operated to increase migratory success. Indian Creek is severely degraded by cattle (Moore, 1980). The Fall Creek Yellowstone cutthroat population has been isolated for almost two million years because of a ten meter waterfall at the mouth (Dean, 1996b). Consequently, the thriving population of cutthroat trout may well be a unique subspecies. Rainey Creek is dewatered at times because of a porous alluvium in the upper section and five diversions in the lower section. Degradation occurs in lower Rainey Creek from dewatering and siltation. Springs recharge it before entering the South Fork Snake River. Pine Creek, including its three forks, is the largest tributary to the main stem used by spawning trout. The low gradient, upper reach flows through a flat valley and has a good riffle-pool structure. Some impacts occur from grazing. Antelope Creek drains an area with intense agriculture which has impacted the water quality and habitat in the lower section. The headwaters provide adequate habitat for spawning and rearing, supporting a self-sustaining population of resident trout. Burns Creek is considered to be the most important spawning tributary below Palisades Dam.

Despite the threats identified, all of these tributaries are considered by the IDFG to be important cutthroat trout spawning tributaries (Martin, 1996). An additional threat to the basin cutthroat fishery is the hybridization with rainbow trout, jeopardizing the viability of the native cutthroat population and fishery (Martin, 1996). The IDFG currently is radio-tagging rainbow trout to determine their current distribution in the basin.

Brown trout were introduced into Idaho in 1892. The species were not planted by IDFG into the South Fork Snake River Basin until 1968,

Figure 15

Cutthroat Fisheries



SCALE 1:457,677

1 inch represents 7.22 miles

2 0 2 4 6 8 10 12 14 16 18 20 22 24 Kilometers

2 0 2 4 6 8 10 12 14 16 Miles

although the species were already present in 1955, comprising 5 percent of all trout samples. In 1979, brown trout represented 9 percent of the angler catch. From an economic perspective, they are of major importance in the South Fork Snake River drainage, providing anglers with an opportunity to catch "trophy-sized" fish. The official state record of 26.4 pounds was taken below Palisades Dam in 1981 (Martin, 1996). A study of juvenile Yellowstone cutthroat, brown trout, and mountain whitefish in the main stem found the winter density of cutthroat trout was the highest of the three species, brown trout was the lowest (Schrader and Griswold, 1994).

During the winter, the sub-yearling cutthroat and brown trout are most abundant in the side channels of the South Fork Snake River where cover and habitat occur. Available winter habitat is associated with river discharge (Schrader and Griswold, 1994). Recent research indicates a minimum flow of about 1500 cfs from October 1 to March 30 is needed to reduce juvenile mortality (Schrader and Griswold, 1994). The greatest loss of juvenile cutthroat and brown trout occurs at flows between 1540 to 1240 cfs, because the greatest number of habitats become unavailable as they dry up or freeze (Schrader and Griswold, 1994).

Wildlife

Wildlife habitats mapped for the basin include areas where selected wildlife are dependent to maintain their populations during critical times of the year (Figure 16). This includes crucial wintering ranges for elk and/or mule deer, white-tailed deer, mountain goat; nesting territories for heron rookeries; and bald eagle principal management parcels (Martin, 1996; Naderman, 1996; Whitfield, 1993; Hayden, 1989; CDC, 1996; BLM and Forest Service, 1991).

Mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) use all South Fork Snake River Basin habitats in the spring, summer, and fall, and the sagebrush-wheatgrass and forested habitats of the foothills and river corridor in the winter (BPA, 1995; Gardetto, 1996). Both species prefer higher elevations, but snow depths force them to lower elevations in the winter, mainly south facing slopes with lower snow depths. Mountain goats tend to concentrate on the more precipitous east side of the river, while mule deer and elk on the more open west side. Whitetail deer reside mainly in the floodplain of the main stem. Moose occur throughout the basin.

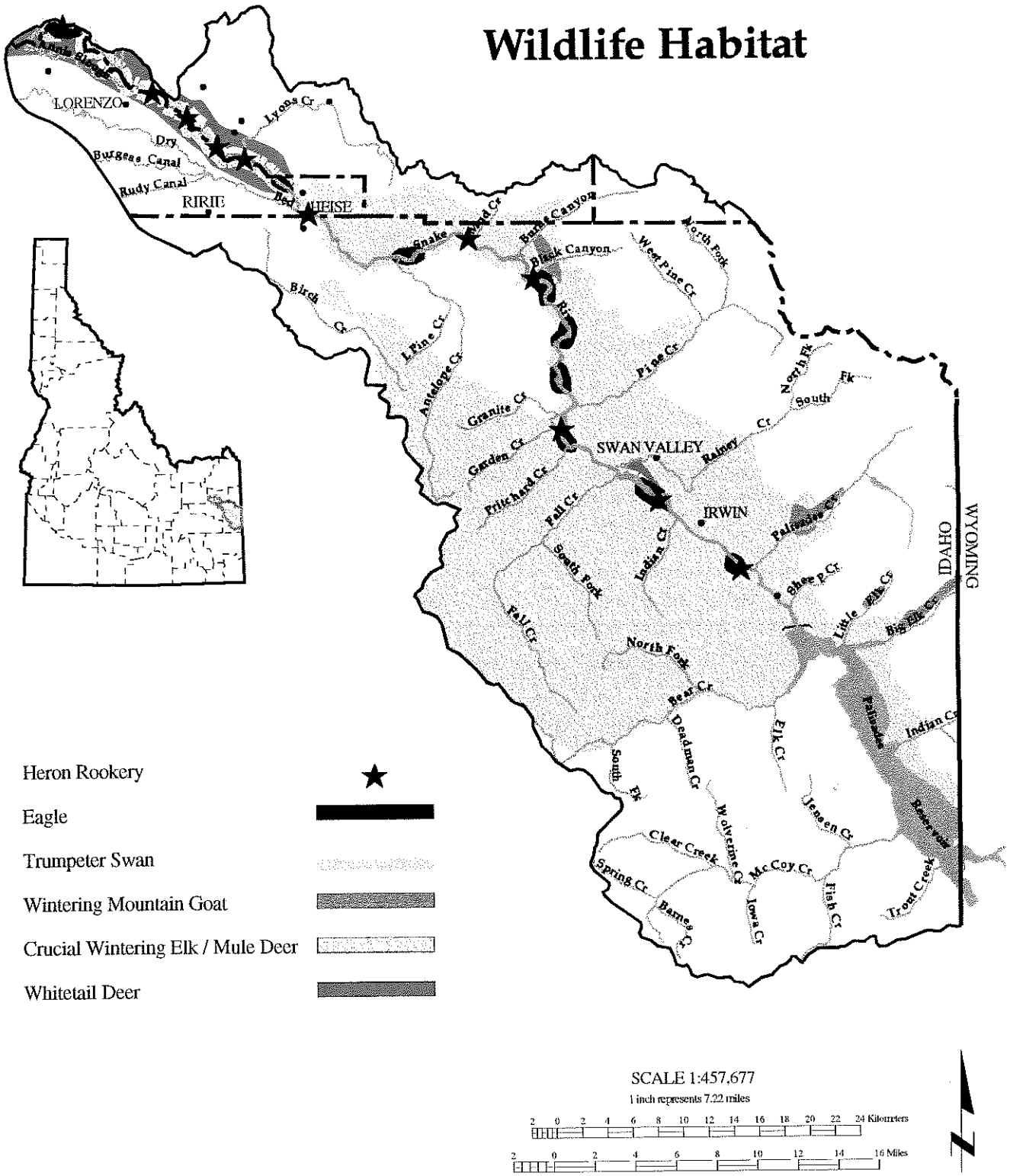
Canada geese (*Branta canadensis*) use the South Fork Snake River corridor for wintering, nesting and brood rearing (BPA, 1995). The river corridor has been identified as one of the most important nesting areas in the region (Krohn and Bizeau, 1980, cited in BPA, 1995). Canada geese primarily nest on the approximately 260 islands occurring on the South Fork Snake River between Palisades Dam and the Henrys Fork confluence. Between 1972 to 1979, the IDFG studied nesting success and found it depended on the magnitude and timing of spring releases (IDFG, 1979; Riggin and Hansen, 1992). Flows between 8000-16,000 cfs from March to May increase goose nesting success (Cochnauer and White, 1975). Flows below 8000 cfs allow nests to suffer from predation (Parker, 1973). Flows greater than 16,000 cfs inundate the nests. However, the IDFG believe that fish, stream channel, and riparian needs outweigh goose nesting needs when water is in short supply (Martin, 1996).

The South Fork Snake River is also used as a migratory wintering area by the trumpeter swan (*Cygnus buccinator*) (IDFG, 1994; Figure 16). Winter habitat requires ice-free waters, usually occurring where springs feed into the river, supporting abundant aquatic plant forage species such as pondweed, waterweed, duckweed, and water milfoil (BPA, 1995).

The northern goshawk (*Accipter gentilis*) nests in at least two locations in the basin. Goshawks typically locate their nests on gentle to moderate slopes with northern aspects adjacent to springs or streams (Reynolds, 1983, cited in BPA, 1995). Goshawks usually remain as residents once they have established nests.

Figure 16

Wildlife Habitat



Recently, the USFWS modified the process to list threatened and endangered species (*Federal Register*, February 28, 1996). Currently, there are only two species of animals listed as threatened or endangered in the South Fork Snake River Basin -- the peregrine falcon (*Falco peregrinus anatum*) is listed as endangered and the bald eagle (*Haliaeetus leucocephalus*) as threatened (IDFG, Conservation Data Center 1996). The peregrine falcon has historically nested on the South Fork Snake River cliffs (BLM and Forest Service, 1991). For nesting the birds need a combination of steep vertical surfaces to prevent predation, and ledges and cracks for scrapes and roost sites (Kilpatrick, 1987, cited in BPA, 1995). Typical nesting habitat is cliffs between 100 to 300 feet high, but rarely above 8500 feet (2590 meters) in elevation. The USFWS has attempted to restock peregrines in the South Fork Snake River corridor using birds from the Peregrine Fund in Boise. Presently, two active natural eyries are found in the corridor (Gardetto, 1996).

The entire upper Snake is regionally important as a critical bald eagle nesting and winter area (Riggin and Hansen, 1992). In 1967, no eagles were known to nest along the river. By 1982, there were ten breeding pairs. In 1986, 35 percent of all eagles nesting in Idaho nested in the South Fork Snake River Basin. (Greater Yellowstone Ecosystem Working Team, 1983; Swenson, et al., 1986; Meuleman, et al., 1986). In 1992, eleven nesting pairs and sixty wintering birds were identified in the basin (Martin and Hansen, 1992). Currently there are twelve nests in the basin; eleven occur on public land (Gardetto, 1996). The South Fork Snake River Basin currently contributes 50 percent of the total bald eagle production in Idaho and accounts for more than 30 percent for the Greater Yellowstone Ecosystem (BLM and Forest Service, 1991).

Bald eagles nest in large, prominent trees in multi-layered forest stands, usually in large conifers and cottonwood trees (DeGraff, et al., 1991, cited in BPA, 1995). Nesting territories are occupied annually, as long as an adequate breeding population exists. A pair of eagles may return to the same nest for many years if the location is near an adequate food source, such as fish, waterfowl, and rabbits (Paige, et al., 1990, cited in BPA, 1995). In the Greater Yellowstone Ecosystem, 45 percent of bald eagle nests occur in narrowleaf cottonwood with the remainder in blue spruce, Douglas fir, lodgepole pine or Engelmann spruce (Swenson, et al., 1986). Ten of eleven nests in the basin are found in cottonwoods, mostly large, old trees.

For foraging purposes, most eagle nests are placed near important spawning tributaries for cutthroat trout and Utah suckers, because the main stem may be silt-laden with spring runoff (Swenson, et al., 1986). Bald eagles forage in the tributaries, especially when the South Fork Snake River is frozen, but they rely predominately on the main stem when accessible. On the South Fork Snake River, both cutthroat trout and whitefish provide abundant food for bald eagles (Sather-Blair and Preston, 1985, cited in BPA, 1995). Low winter flows that cause extensive and prolonged icing negatively affect fish populations and impact the eagles as well.

In 1983, it was estimated that 72 percent of the existing nesting population of eagles could be impacted unless adequate management practices were applied (Greater Yellowstone Ecosystem Working Team, 1983). There are four nests that are seriously threatened by current and potential development in the vicinity of Palisades Creek, Swan Valley, Conant Valley, and Antelope Creek (Whitfield, 1996). Habitat for bald eagles was prioritized for protection from Palisades Dam to the confluence. Reaches closest to the dam were given the highest priority for protection, because of the imminent threat from development (Martin and Hansen, 1992).

Vertical vegetation stratification, plant species richness, and special habitat features such as snags are frequently related to bird species abundance in the riparian habitat. A study conducted from 1991 to 1994 studied the patterns of habitat use by breeding birds in cottonwood riparian forests along the South Fork Snake River from Palisades Dam to the Henrys Fork confluence (Saab, 1994). Bird distribution and abundance and vegetation data were collected for

57 cottonwood forest patches. Habitat conditions studied ranged from relatively undisturbed areas to areas used for livestock grazing and/or recreational activities.

Ninety-seven species were recorded in the study with 78 percent of them migratory (Saab, 1994). Preliminary results indicate species richness was slightly higher in undisturbed areas (82 species) than in grazed (79 species) or recreational sites (60 species). Bird abundance and species richness were greater in relatively undisturbed cottonwood patches with a greater diversity and density of shrubs and ground cover than that found in disturbed patches. Large cottonwood patches surrounded by natural landscapes had higher species richness than small cottonwood patches surrounded by agricultural landscapes.

Species composition was equally similar between grazed and recreation use sites (81 percent) and between undisturbed and grazed sites (81 percent), while undisturbed and recreational sites were the least similar (75 percent). Cottonwood forests in the reaches of the river that possessed the higher bird diversities, such as the canyon portion (Conant Valley to Black Canyon), tended to be more connected, large stands and have a greater mosaic of vegetative communities in the surrounding landscape.

Saab's (1996) study of breeding birds recommended that land acquisitions focus on large cottonwood patches surrounded by natural landscapes to maintain species richness of native birds. Maintaining large cottonwood patches is also critical for the long-term persistence of habitat interior species. Whereas, small fragments of riparian habitat are important for attracting the habitat edge specialists. Avian nest predators such as crows, magpies and starlings, and avian brood parasites persist with urban and rural development, and are potential threats to breeding bird productivity as land use development occurs.

In a recent publication, Frest (1994) reported several locations where springsnail mollusks, a Species of Special Concern, are found in the South Fork Snake River Basin. The sites and genera include Cress Creek Spring (*Physella, Oxyloma*), Kelly Canyon springs (*Lyogyrus, Physella*), Hawley Gulch springs and runs (*Lyogyrus*), Mud Creek (*Physella, Oxyloma, Deroceras*), Warm Springs complex (*Pyrgulopsis, Physella*), Wolverine Creek (*Lyogyrus*), Spring Creek (*Physella*), and McCoy Creek and tributaries (*Stagnicola, Physella, Lyogyrus*). Frest (1995) recommended that several of these species warrant listing under the Endangered Species Act, including *Lyogyrus spp.* and *Pyrgulopsis spp.*

RECREATION

The *Recreation* section is a summary of inventory information obtained while preparing the South Fork Snake River Basin Plan. More information is provided in the Recreation Technical Report located in IDWR files. Several federal, state, county and local entities manage lands and facilities providing recreation opportunities in the basin. Primary recreation providers are the Targhee National Forest, Caribou National Forest, and Idaho Falls District BLM. The USBR has facilities below Palisades Reservoir. Additional opportunities are available at sites managed by IDFG, Bonneville, Madison and Jefferson counties, and private entities.

Recreation use in the basin by activity is summarized in Table 19 by regional participation and agency. This table does not provide a complete quantification of recreation use, because much of the use occurs as dispersed use or through private entities which is difficult to assess. (Dispersed use is activity that occurs outside developed facilities.) The information does provide a general description of the composition of recreational activities that occur in the basin compared to regional participation. Because a recreation visit is estimated for each activity that an individual participates, the use estimates do not represent total numbers of individuals recreating in the basin.

Table 19. Estimated Recreation Activity Participation for Region 6 and the South Fork Snake River Basin.

Activity	REGION 6[1] PARTICIPATION Resident Travelers	Non-res. Travelers	Bureau of Land Management 1994 RVs[2] (% of total)	Bureau of Reclamation 1994 Rvs	U. S. Forest Service 1994 RVS (% of total)
Fishing	10.7%	8.0%			
Reservoirs					200 (0.01%)
Rivers			81,020 (28.2%)		196,300 (7.0%)
Ice					10,800 (0.4%)
Boating	5.3%[4]	2.6%[4]			
Canoe					9,400 (0.3%)
Sailboat					2,200 (0.1%)
Other non-motorized			74,950 (26.1%)		21,400 (0.8%)
Motorized boating			65,250 (22.7%)		43,000 (1.5%)
Tour/Ferry					1,000 (0.04%)
Other Water-based					
Swimming	2.3%				17,700 (0.6%)
Water skiing/Diving	1.0%				19,800 (0.7%)
Camping	5.3%	9.1%	19,400 (6.7%)		450,800(16.0%)
Organization Camps					105,400 (3.7%)
Hunting	3.0%				155,300 (5.5%)
Big Game			3,790 (1.3%)		
Waterfowl			1,250 (0.4%)		
ORV Travel	1.5%	0.6%	2,750 (1.0%)		64,300 (2.3%)
Other Motorized					445,100(15.8%)
Non-motorized					
Hiking	45.8%		5,700 (2.0%)		48,800 (1.7%)
Biking	6.9%		1,250 (0.4%)		14,700 (0.5%)
Horseback			1,250 (0.4%)		34,000 (1.2%)
Other Land-based					
Picnicking	5.3%		15,050 (5.2%)		78,600 (2.8%)
Nature study			13,250 (4.6%)		84,900 (3.0%)
Sightseeing	6.9%	17.5%			311,200(11.1%)
Tours					54,200 (1.9%)
Sports					36,800 (1.3%)
Recreation cabins					34,400 (1.2%)
Gather forest products					77,700 (2.8%)
Winter Sports			1,250 (0.4%)		307,500(10.9%)
Skiing	4.6%				
Snowmobile	2.3%				
Snowplay	1.5%				
Other			1,250 (0.4%)		188,400 (6.7%)
TOTAL RVs			**287,410**	**11,049[3]**	**2,708,900**

[1] Region 6 includes Bonneville, Clark, Fremont, Jefferson, Madison and Teton counties.
[2] RV - Recreation visit equals one person for one visit regardless of length of visit. Each activity a person participates is counted as one recreation visit. Therefore, total recreation visits do not estimate total numbers of people recreating.
[3] Indicates visitation at the Bureau of Reclamation site below Palisades Dam only. Visitation at facilities located on Palisades Reservoir are included in the U. S. Forest Service estimates.
[4] Water skiing is included under boating.

Sources: Parrish et al., 1996; Hunt et al., 1994; Targhee National Forest, 1995; Bureau of Land Management, 1995; Brown, 1995; Daniels, 1995.

The basin supports a wide diversity of recreation settings and experiences ranging from natural, undeveloped settings to areas with facilities. Most developed facilities are located within the South Fork Snake River corridor and include campgrounds, boat access and picnic facilities. Figure 17 depicts developed facilities and important recreation areas in the South Fork Snake River Basin.

The South Fork Snake River corridor is the focus of much concentrated recreation use. The Idaho Falls District BLM estimates 225,000 recreation visits in the South Fork Snake River corridor from Palisades Dam to the Henrys Fork confluence in 1995 (Brown, 1996). The composition of recreation activities in the river corridor is illustrated in Figure 18, page 58. Estimated hours fished during the summer has more than tripled since 1982 from 53,676 hours to 169,142 hours in 1996 (Moore and Schill, 1984; Schrader, 1996).

Public land occurs along most of the length of the river, theoretically providing extensive access (with the exception of private land in the Swan Valley area.) However, access is limited in some areas, because of the steep-walled canyon, dense vegetation, lack of roads, or private lands obstructing access to adjacent public lands.

Despite these limitations, several developed access points are located along the river. These include eleven boat access facilities, Kelly Island campground operated by the BLM, and Twin Bridges campground operated by Madison County (Figure 17). Seven boat access facilities are improved with concrete ramps. The remainder are unimproved bank launches. Additional access is possible by roads paralleling the river. Sections of Forest Service Road 058 parallel the river between Irwin and Fall Creek Falls. The Snake River Road (Forest Service Road 206) parallels the north side of the river from Black Canyon to below Wolf Flat. Estimated visits for access sites along the river managed by BLM are presented in Table 20.

To protect bald eagle nesting areas, heron rookeries, and improve vegetation and other wildlife resources, camping in the South Fork Snake River canyon (Conant to Black Canyon) is now restricted to designated camping areas (BLM and Forest Service, 1991). These designated areas are located in the vicinity of Pine Creek, Dry Canyon and Gormer Canyon, and are depicted in Figure 17.

Observation of recreation patterns over the past three years have identified some changes and trends in recreation use in the corridor. Recreation visits have increased significantly on the river in the reach below Heise. Personal water crafts (jet skies) are appearing in greater numbers. Guided fishing trips have increased. Anglers are not the only people floating the river -- more people are floating to enjoy the scenery. More people are camping in the canyon reach (Conant Valley to Black Canyon). In 1995 an estimated 713 people camped in the canyon (Brown, 1996).

The South Fork Snake River has a reputation for its native cutthroat fishery, and is nationally recognized as one of the top 100 trout fishing streams in America (Pero and Yuskavitch, 1989). The value of fishing and associated recreation activity to the local economy is estimated at almost $5.7 million annually (BLM and Forest Service, 1991). In a 1987 survey asking anglers to identify their most frequently fished waters, 13.4 percent of Region 6 residents named the Snake River, 4.9 percent the South Fork Snake, and 7.5 percent Palisades Reservoir (Reid, 1989). A random survey of resident and non-resident anglers purchasing a 1994 fishing license, identified the South Fork Snake River as one of the top ten waters fished, as well as one of the most preferred (IDFG, 1995a; IDFG, 1996).

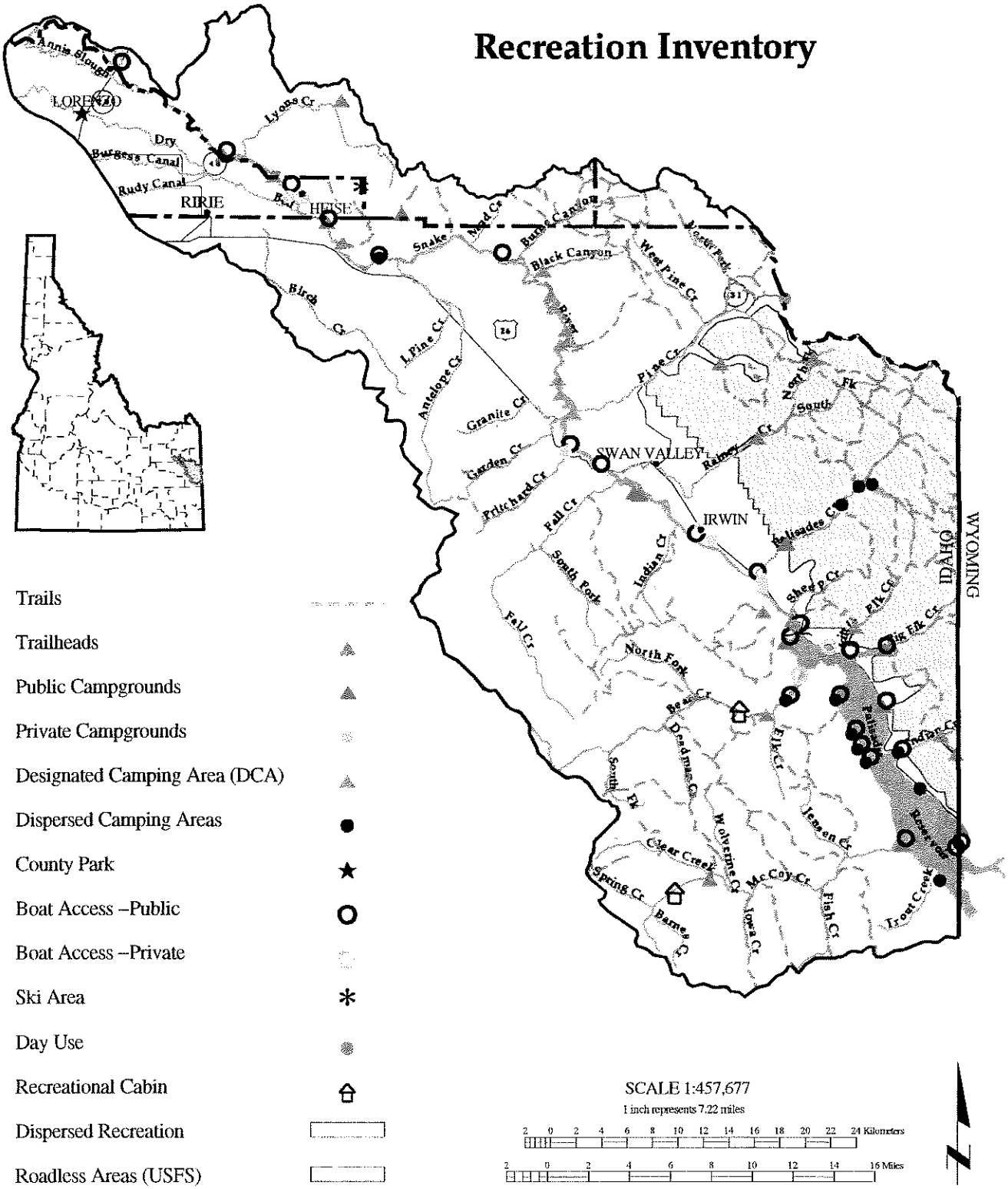
Table 20. 1995 Estimated Site Visits for BLM Managed Access Sites Along the South Fork Snake River Corridor.

Site	Visits
Conant Boat Access	36,267
Byington Boat Access	43,852
Lorenzo Boat Access(Undeveloped)	21,402
Kelly Island Campground	4,504

Source: Brown, 1996.

Figure 17

Recreation Inventory



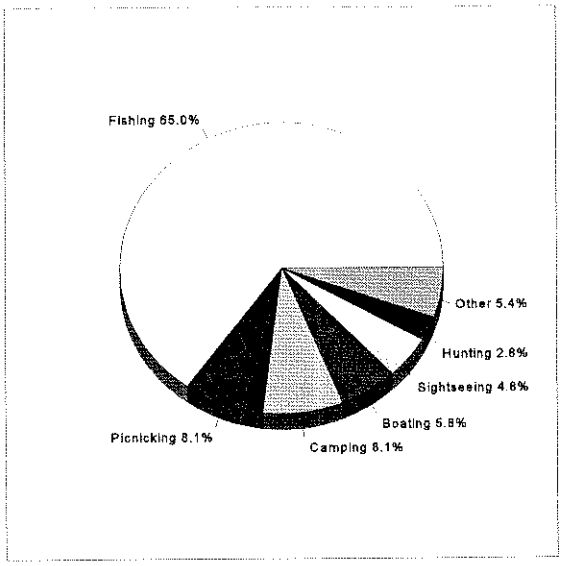


Figure 18. Composition of Recreation Activities in South Fork Snake River Corridor (Brown, 1996).

Angling use has increased significantly on the river. The IDFG estimated 89,000 angler hours on the river from March 1979 through February 1980. Based on the number of launches from the Conant boat ramp, an estimated 181,335 angler hours occurred below Conant in 1995 (Brown, 1996). Schrader (1996) estimated 169,142 angler hours during the 1996 summer season. The salmon fly hatch occurring in late June to early July results in significant angling activity for about a month.

Current IDFG management on the South Fork Snake River emphasizes a quality cutthroat trout fishery. Burns, Pine, Rainey, Pritchard, Palisades, and McCoy creeks and all other tributaries are also managed as a quality cutthroat trout fishery. Management objectives include restrictions on size and harvest of fish to achieve greater catch rates and larger "quality" size fish. These include a 2-fish limit with an 8 to 16 inch protective slot (IDFG, 1996). Harvest restrictions were initially implemented on the South Fork Snake River from Irwin to Heise gage in 1984, and extended to Palisades Dam in 1988 (IDFG, 1996). These management strategies resulted in increased size and numbers of cutthroat, and a 300 percent increase in fishing effort in 1989. The cutthroat harvest rules were implemented for the South Fork Snake River below Heise and all tributaries in 1990, and extended to all trout species on the South Fork Snake River in 1992 (IDFG, 1996).

The South Fork Snake River fishing season from Palisades Dam to the Heise stream gaging cable is open the Saturday of Memorial Day weekend through November 30. The reach below Heise is open all year. Additional restrictions apply to some important spawning tributaries. Pine Creek is closed to anglers until July 1. Burns Creek is closed until September 1.

The South Fork Snake River is also managed as a wild brown trout fishery, relying on natural production. The state record brown trout (26.4 pounds) was taken below Palisades Dam in 1981 (Martin, 1996). General management objectives are in place for whitefish with no special regulations for that species.

Many float the South Fork Snake River to view scenery and wildlife as well as to fish. Drift boats and rafts are common crafts seen on the river, as well as canoes. Personal water craft (jet skies) are also appearing on the river resulting in some conflicts among various recreation users. Motorized boating activity varies from year to year, but is estimated to range from 20-40 percent of the boating use (Brown, 1996; Taul, 1996).

Palisades Reservoir is a large reservoir with 16,100 surface acres at full pool. The reservoir is operated by the USBR, and the Targhee National Forest operates the recreation facilities. Bonneville County maintains the boat docks and has enforcement authority on the Idaho portion of the reservoir. Recreation activity consists of fishing, water skiing and camping on the shores. Several dispersed camping areas predominately accessible by boat are popular camping spots. Because the reservoir has such a large surface area, congested areas on the reservoir have not been a concern in the past, although some boat ramps receive heavy use.

Eight outfitters provide fishing trips on the South Fork Snake, operating from Palisades Dam to the confluence with the Henrys Fork. The

river is segmented into four sections consisting of Palisades Dam to Swan Valley Bridge, Swan Valley Bridge to Black Canyon, Black Canyon to Poplar, and Poplar to the Henrys Fork confluence. Each outfitter can operate up to four boats per day on a section, with no more than twelve boats total in a day (IOGLB rules). This would allow a maximum of 96 outfitter boats along the length of the South Fork Snake River during a day, or a maximum of 32 boats on any section.

Guided fishing trips on the South Fork Snake River have consistently been the largest component of the outfitting industry comprising 79 percent of the guide business in 1994, an increase of 24 percent from 1993 (Idaho Outfitters and Guides Licensing Board [IOGLB], 1995). In 1995, 5,877 individuals used the services of an outfitter to fish on the South Fork Snake.

Flows on the South Fork Snake River affect the ability to conduct outfitted trips. An informal survey of outfitters indicated flows of 8-10,000 cfs are ideal for guided fishing trips. The outfitters identified 15,000 cfs as a maximum flow and a minimum flow of 3,000 cfs. High and low flows limit angling success and the commercial marketability of guided trips. When flows are considered too high for successful fishing efforts, pressures increase on neighboring rivers such as the Henrys Fork as anglers look for other places to fish.

Big game hunting activity is recorded by unit number. The South Fork Snake River Basin is located mainly within Units 66, 67 and 69. Portions of Units 63A and 64 are located at the western end of the basin. These offer some of the few general bull elk hunting opportunities in southeastern Idaho, and receive heavy use (Martin, 1996). Table 21 depicts hunter days (the number of days hunters spent hunting for a given species) for big game -- deer, elk, moose and mountain goat.

Table 21. Estimated Hunter Days for Deer, Elk, Moose and Mountain Goat.

Year	Unit 63A	Unit 64	Unit 66	Unit 67	Unit 69	TOTAL
			DEER			
1990	423	4,065	6,946	5,773	11,303	**28,510**
1991	961	4,793	8,705	3,867	14,044	**32,370**
1992	135	2,844	9,386	2,476	10,157	**24,998**
1993	333	4,331	10,061	4,974	11,224	**30,923**
1994	670	585	720	778	1,840	**4,593**
			ELK			
1990	453	1,542	6,632	2,669	6,783	**18,079**
1991	845	2,386	10,651	4,681	6,863	**25,426**
1992	307	2,444	13,593	4,822	4,404	**25,570**
1993	414	2,442	14,415	5,843	5,318	**28,432**
1994	-	1,596	9,986	4,539	4,827	**20,948**
			MOOSE			
1990	38	64	46	82	110	**340**
1991	46	26	78	15	174	**339**
1992	41	32	73	18	81	**245**
1993	199	70	174	37	265	**745**
1994	104	85	106	145	121	**561**
			MOUNTAIN GOAT			
1990	-	-	-	72	-	**72**
1991	-	-	-	35	-	**35**
1992	-	-	-	48	-	**48**
1993	-	-	-	41	-	**41**
1994	-	-	-	40	-	**40**

Source: Nelson, 1990 and 1991; Kuck, 1992-1994.

SCENIC VALUES AND NATURAL FEATURES

The South Fork Snake River Basin is located in the Middle Rocky Mountain physiographic province characterized by complexly folded and faulted mountain ranges. The Snake River Range and Caribou Range dominate the eastern portion of the basin separated by a wide flat valley. The western portion of the basin occurs on the perimeter of the Snake River Plain province. The Geology and Soils section describes these geologic features in more detail.

An overview of outstanding natural areas in Idaho conducted by several state agencies identified the South Fork Snake River and its riparian forest as one of the most extensive cottonwood forests in the West (State of Idaho, 1975). In an evaluation of sites in Idaho, the South Fork Snake River received the highest rating for wildlife populations (Poccard, 1980). It has been proposed as a National Natural Landmark, because of its ecological characteristics (Johnson and Pfister, 1982). Other areas in the basin noted for distinctive scenic values include Menan Buttes, a National Natural Landmark described in the geology section of the plan, and Swan and Conant valleys.

A evaluation of the scenic values of waterways in the basin was conducted as part of the South Fork Snake River Basin Plan. The evaluation and results are presented in the *Resource Evaluation* section.

CULTURAL RESOURCES

Federal law and management policy requires assessment, survey and mitigation for potential cultural resource sites prior to implementation of federal project proposals, or actions on federal land. Although approximately 67 percent of the basin is under the jurisdiction of federal agencies, much has not been formally surveyed. Most Forest Service surveys occur in association with timber sales, but little timber harvest has occurred within this basin (Targhee National Forest, 1996a). Survey efforts have occurred as the result of USBR activities, road realignment, and range projects which have examined small areas of the South Fork Snake River drainage.

Completed surveys have identified more than 100 sites within the basin (Idaho State Historical Society, 1996). Prehistoric sites include Native American hunting camps, lithic workshops, and volcanic glass quarry sites. Many sites are historic, affiliated with mining and ranching activities, and the administration of Forest Service lands (BLM and Forest Service, 1991).

No sites are listed on the National Register of Historic Places, although many sites are eligible. The National Register is an official list maintained by the National Park Service of archaeological, historic, and architectural properties of national, state and local significance worthy of preservation. Compilation of the list was established in 1966. Known eligible sites located in the basin include: an aboriginal base camp near the Table Rock campground; a pictograph site near Warm Springs; the Heise, Brockman, Bald Mountain and Currant Creek guard stations; the Swan Valley Ranger Station; and the limekiln quarries on the Targhee National Forest (Targhee National Forest, 1996a; Willingham, 1996).

Resource Evaluation

As defined by the Idaho Code, a recreational or natural river "means a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values" [Idaho Code 42-1732 (7) and (9)]. A natural river is free of substantial impoundments, dams or other structures and the riparian area is largely undeveloped. A recreational river may include some manmade development in the waterway or the riparian area. The resource evaluation is an exercise to identify rivers or streams that may be eligible for this designation. A designation is made only if the Board determines the value of preserving the waterway is in the public interest and outweighs developing the river for other beneficial uses. This determination is largely based on information received from the public

and at advisory group meetings. State designation does not change or infringe upon existing water rights or other vested property rights.

Criteria used to identify outstanding resource values for fish and wildlife, recreation, and scenic values are briefly described in the following sections. The resource evaluation criteria and results were reviewed by the advisory group, agencies and public during advisory group meetings. At that time, additional information were provided and tributaries were evaluated or reevaluated based on the new information. Table 22 summarizes the river and stream reaches identified with outstanding resource values. Figure 19 depicts the locations of these reaches.

FISH AND WILDLIFE (BIOLOGICAL)

The biological evaluation for the South Fork Snake River Basin considered the entire watershed of a stream reach. This procedure represents a combination of several different stream assessment methodologies, including the EPA Rapid Bioassessment Protocols (RBP) and Streamwalk, the DEQ's Beneficial Use Reconnaissance Procedure (BURP), and IDFG's Idaho Rivers Information System (IRIS) among others. There were twenty-six streams or reaches evaluated in the basin. All these streams had some biological information about them available, but it may not be sufficient to evaluate the resource value. The evaluation consisted of a two step procedure: 1) *River Biological Screening Process*---an initial screening to determine eligibility, and 2) *Crucial Species and Habitats*---a final evaluation of the basin's unique species and their habitats.

Criteria

River Biological Screening Process

Biological data were collected from various sources, including IDFG, Targhee National Forest, Idaho Falls District BLM, IDWR field surveys, and specific research studies. The data were compiled for twenty biological attributes on each stream (Table 23, page 64). These twenty attributes were categorized into four components to help collect and organize the data:

1. ***Habitat: Aquatic***- physical conditions and water quality associated with the water in the stream channel;
2. ***Habitat: Riparian***- physical conditions and vegetation community characteristics in the floodplain;
3. ***Species: Aquatic*** - plant and animal species associated with the water in the stream channel;
4. ***Species: Riparian*** - plant and animal species in the floodplain.

Based on available data, each stream was evaluated for the number of attributes that were positive. An attribute was considered positive if the data indicated the characteristic contributed positively to the quality of the habitat.

Crucial Species and Habitats

Based on the available information for several identified key species, species complexes, and habitats in the South Fork Snake River Basin, reaches were also assessed for presence and current status of crucial species and habitats. These "key" species or habitats were selected on the basis of ecological importance as noted by biologists. These species and habitats include the following:

- Unique riparian ecosystem (cottonwood *Populus angustifolia* gallery forest; or spring-fed system)
- Yellowstone cutthroat trout (*Oncorhynchus clarki Bavaria*)
- Fine-spotted cutthroat trout (*Oncorhynchus clarki* ssp.)
- Bald eagle (*Haliaeetus leucocephalus*)
- Breeding birds (predominately land birds, few water birds)

Results

Both components of the evaluation were considered to determine if a reach possessed outstanding biological values. Reaches with outstanding biological values fulfilled the following criteria:

Table 22. Summary of Outstanding Resource Evaluation for the South Fork Snake River Basin.

STREAM REACH	FISH & WILDLIFE	SCENIC	RECREATION
Bear Creek	✘+		✘
Big Elk Creek			
State line to T1S, R46E, NW ½ Sec. 17	✘	✘	✘
T1S, R46E, NW ½ Sec. 17 to high water of reservoir	✘		✘
Black Canyon	✘		✘
Burns Creek (tributary to Palisades Reservoir)	✘		✘
Burns Creek (tributary to main stem)	✘+	✘	✘
Cress Creek	✘	✘	✘
Elk Creek (tributary to Bear Creek)	✘		✘
Fall Creek			
Headwaters to Forest Road 058	✘+		✘
Forest Road 058 to mouth	✘+	✘	✘
Indian Creek (tributary to Palisades Reservoir)	✘		
Indian Creek (tributary to main stem)	✘		✘
Iowa Creek (tributary to McCoy Creek)	✘		✘
Jensen Creek (tributary to McCoy Creek)	✘		✘
Little Elk Creek			✘
Little Kelly			
Headwaters to T4N, R41E, NW ½ Sec. 29		✘	
McCoy Creek	✘+		✘
Mike Spencer Canyon			✘
Palisades Creek			
Headwaters to Palisades Campground	✘+	✘	✘
Palisades Campground to mouth	✘		
Pine Creek			
Headwaters to No Cut Timber Canyon	✘+		
No Cut Timber Canyon to Mouth	✘+	✘	
Pine Creek, North Fork	✘+		✘
Pine Creek, West Fork	✘+		✘
Pritchard Creek			
Headwaters to BLM Boundary	✘		✘
BLM Boundary to mouth	✘		
Rainey Creek			
Headwaters to Forest boundary	✘+		✘
Forest boundary to mouth	✘+		
Sheep Creek			✘
South Fork Snake River			
State line to confluence of Salt and South Fork Snake rivers	✘		✘
Confluence of Salt and South Fork Snake rivers to Palisades Dam	✘	✘	✘
Palisades Dam to Irwin footbridge	✘		✘
Irwin footbridge to Henrys Fork confluence	✘	✘	✘
Tie Creek (tributary to Pine Creek)	✘		
Trout Creek	✘+		✘
Warm Springs	✘		
Waterfall Canyon	✘	✘	✘
Wolverine Creek	✘		✘

✘ = Stream reach evaluated as having outstanding resource values for the resource indicated.
✘+ = Includes perennial tributaries.

Figure 19

Waterways with Outstanding Resource Values

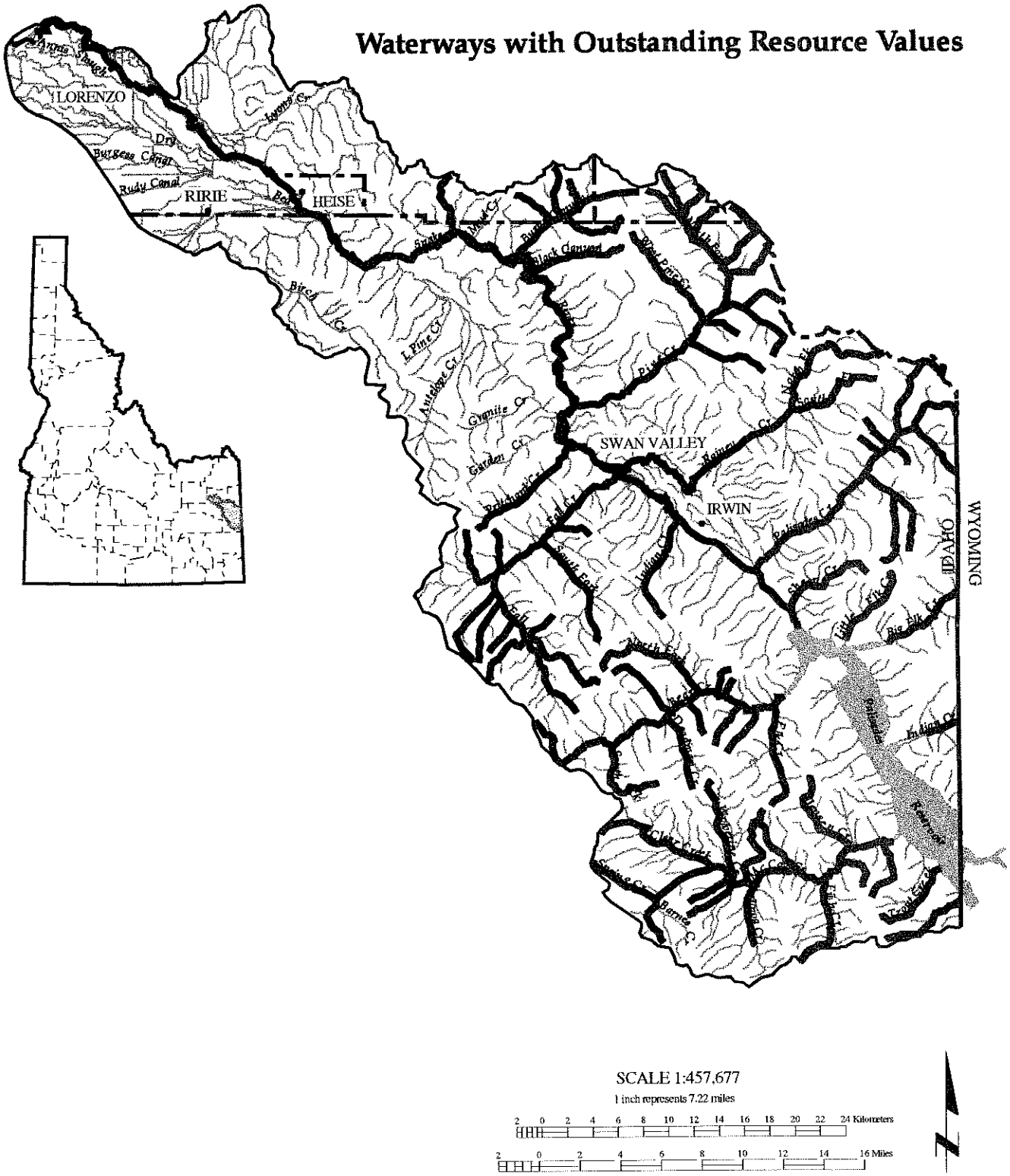


Table 23. *River Biological Screening Process Criteria*

HABITAT--Aquatic

1. Bottom substrate type (observe in channel-forming pool tail-outs [at least 1/3 of stream width] and low gradient riffles): cobble and boulders dominant; fine sediment not dominant
2. Instream cover: large woody debris and/or undercut bank
3. Instream habitat: complexity of stream channel habitats present (riffles [or bends], runs, pools)
4. Water quality: at least one of the following DEQ classifications apply to study reach :
   - Meets all beneficial uses
   - Water quality criteria/standards satisfied
   - Outstanding Resource Water
   - Special Resource Water
5. Crucial spawning habitat

HABITAT--Riparian

6. Bank stability: vegetation canopy and roots cover majority of bank and no slumping or eroding occurs
7. Riparian vegetation cover: dominated by shrubs and/or trees
8. Special management areas:
   - Area of Critical Environmental Concern
   - Pioneer Area
   - Priority Wetlands
   - Research Natural Area
   - Recovery Area
   - Special Interest Botanical Area
   - Wild & Scenic River or eligible
   - Wildlife Refuge
   - Wildlife Management Area
   - Wilderness Area or proposed

Crucial wildlife habitat:

9. wintering
10. migratory/roosting

SPECIES--Aquatic

11. IDFG fishery management classification; at least one of the following IDFG fishery classifications applies to study reach:
   - Trophy
   - Preservation
   - Quality
   - Wild Trout
   - Anadromous
12. Fish species richness: diversity (no. species with balanced abundances) relatively high
13. Fish species composition: predominantly native or game species
14. Aquatic insect composition: predominantly species of low pollution/sediment tolerance (e.g., mayflies, stoneflies, caddisflies, etc.)

Rare aquatic biota:

15. Federal listed species
16. Conservation Data Center listed species

SPECIES--Riparian

17. Riparian species richness: diversity (total no. species with balanced abundances) relatively high
18. Riparian species composition: predominantly native species

Rare riparian biota:

19. Federal listed species
20. Conservation Data Center listed species

- at least 50 percent of the available data was positive (all reaches evaluated met this criteria); and

- the presence of at least one of the following crucial habitats or sensitive species: unique riparian ecosystem, active cutthroat spawning or rearing, active eagle nesting, or unusually high breeding bird diversity.

Reaches identified with biologically outstanding values using these criteria are summarized in Table 24.

RECREATION EVALUATION

The recreation evaluation focused on recreational opportunities occurring within specific river or stream reaches. The evaluation entailed identification of recreation units; analysis

Table 24. Summary of Outstanding Biological Resources for Stream Reaches in the South Fork Snake River Basin.

REACH	River Biological Screening Process[1]	Crucial Species and Habitats[2]	Outstanding Biological Values
Burns cr. (res trib)	18/20	√	Spawning tributary with good population of cutthroat trout; bald eagle foraging habitat
Trout Cr.	16/20	√	Spawning tributary with good population of cutthroat trout
McCoy Cr. (incl. Fish Cr.. & other perennial trib.)	10/16	√	Important spawning tributary with strong population of cutthroat trout; bald eagle foraging habitat
Bear Cr. (incl. Elk Cr. and other perennial tributaries)	12/18	√	Important spawning tributary with strong population of cutthroat trout; bald eagle foraging habitat
Indian Cr. (res tributary)	16/20	√	Spawning tributary with good population of cutthroat trout
Big Elk Cr.	17/20	√	Spawning tributary with good population of cutthroat trout; bald eagle foraging habitat, kokanee spawning
Little Elk Cr.	10/10		
Palisades Cr. (incl. headwaters trib., perennial trib..)	12/16	√	Important spawning tributary with strong population of cutthroat trout; bald eagle foraging habitat
Indian Cr. (river trib)	9/11	√	Spawning tributary with good population of cutthroat trout
Fall Cr. (incl. perennial trib.)	`9/14	√	Disjunct population of cutthroat
Rainey Cr. (inc. perennial trib..)	7/11	√	Important potential spawning tributary with good population of cutthroat trout; bald eagle foraging
Pritchard Cr.	7/11	√	Spawning tributary with good population of cutthroat trout
Pine Cr. (incl. West & North Pine Cr, Tie Cr., and other perennial trib.)	10/15	√	Important spawning tributary with strong population of cutthroat trout; bald eagle foraging habitat
Black Canyon	17/20	√	Spawning tributary with good population of cutthroat trout
Warm Springs Cr.	16/20	√	Spawning tributary with good population of cutthroat trout; unique spring-fed aquatic community and riparian cottonwood gallery forest with good structural diversity; bald eagle foraging habitat
Burns Cr. (incl. perennial trib.)	15/20	√	Important spawning tributary with strong population of cutthroat trout; mature, healthy riparian community with good structural and species diversity; bald eagle foraging
Wolverine Cr.	16/20	√	Spawning tributary with good population of cutthroat trout; bald eagle foraging habitat
Antelope Cr.	6/11		
Cress Cr.	10/14	√	Unique spring-fed riparian community with good structural diversity
Palisades Reservoir	11/11	√	Bald eagle nesting
S Fk Snake R: Palisades Dam to Irwin	14/18	√	Bald eagle nesting; important cutthroat trout rearing habitat
South Fork Snake R: Irwin to Conant Valley (Granite Cr.)	15/17	√	Bald eagle nesting; above average breeding bird diversity; important cutthroat trout rearing habitat, mature, healthy riparian community with good structural and species diversity
South Fork Snake R: Conant Valley to Black Canyon	15/17	√	Bald eagle nesting; above average breeding bird diversity; important cutthroat trout rearing habitat, mature, healthy riparian community with good structural and species diversity
South Fork Snake R: Black Canyon to Heise gaging station	13/17	√	Bald eagle nesting; mature, healthy cottonwood gallery forest; above average breeding bird diversity; important cutthroat trout rearing habitat
South Fork Snake R: Heise gage station to Heise Br	10/16	√	Bald eagles perching;;mature, healthy cottonwood gallery forest; important cutthroat trout rearing habitat
South Fork Snake R: Heise Br to Henry's Fork confluence	16/18	√	Bald eagle nesting; mature, healthy cottonwood gallery forest; important cutthroat trout rearing habitat

[1] = Total no. of positive attributes / Data available of maximum 20 attributes [2] = ✓indicates presence of crucial species or habitat

of the recreational diversity and importance of each recreation unit; and categorization of a final evaluation value for each unit (outstanding, high, or moderate to low).

The river reaches within the South Fork Snake River Basin were grouped into segments or discrete recreation units delineated on the basis of land use patterns, access and/or recreational use patterns. Each recreation unit was individually evaluated for recreational diversity and the importance of recreational opportunities. Specific recreational features of these units are summarized in evaluation forms located in IDWR files.

Recreational diversity is a measure of the variety of recreational opportunities available in the recreation unit. Three criteria were assessed to arrive at a diversity value: 1) identification of land-based and water-based recreation opportunities, 2) natural features, and 3) level of access.

Land-based and water-based recreation activities occurring within the river corridor were identified through review of agency documents and maps describing recreation facilities, and communications with various agencies and user groups. Land-based activities include camping, hiking, or hunting. Water-based recreation includes fishing, swimming and boating.

Natural features were identified which enhance recreation opportunities or experiences. These include description of water characteristics influencing the type of boating activity possible; summary of the aesthetic values of the unit; and identification of special fish and wildlife habitat characteristics providing increased opportunity for wildlife observation or other wildlife-related recreation.

Level of access was described to provide information regarding the types of recreational activities possible, potential use volume, and opportunities for primitive or isolated versus a more developed recreation experience.

Recreational importance was determined through review of three criteria: 1) unique or rare features which may enhance the recreation experience such as high quality fisheries or wildlife habitat; 2) public concern for the recreational values of the unit (determined from public and advisory group input, and agency consultation; and 3) special designations and/or agency recreation management objectives.

The final recreation evaluation class for each recreation unit was based on a combined assessment of diversity and importance.

A recreation unit evaluated as outstanding: a) provides significant recreation opportunities encompassing a great diversity of activities; b) provides a unique or rare experience within the region or basin; and/or c) receives the highest use.

A recreation unit evaluated as high is characterized by river segments: a) receiving high use; b) providing a high diversity of recreational opportunities; and/or c) providing an important recreation experience which is unique but typical for the region.

Moderate to low designations define those river segments with: a) recreational opportunities typical in the region; b) receiving moderate to low use; and/or c) having moderate to low recreation diversity.

Table 25 (pages 68 and 69) summarizes the recreation evaluation for river reaches evaluated in the South Fork Snake River Basin. The evaluation focused on the main stem of the South Fork Snake River and thirty major tributaries. Many stream reaches in the basin lacked sufficient data to evaluate recreation opportunities and were not evaluated.

SCENIC VALUES EVALUATION

The objective of the scenic values evaluation was to determine the distinctiveness or scenic quality of landscape settings. The evaluation involved two steps. One was to categorize landscapes along stream reaches into individual visual units. The second was to evaluate the scenic distinction or aesthetic value of these

visual units to identify outstanding scenic landscapes.

Delineating Visual Units

A visual unit defines a landscape area with similar spatial characteristics such as landform, vegetation, water form, or cultural modifications (Tetlow and Sheppard, 1980). Noticeable changes in these characteristics significantly changing the viewing experience defines the boundary between visual units. Visual units provide a frame of reference to later evaluate the scenic value of landscape features.

Visual unit boundaries were determined by considering a river or stream as a linear viewing corridor or series of viewing experiences. The outermost boundary of the unit is defined by the edge of canyon walls, or the extent of the viewshed. Any distinct or conspicuous change in landscape elements significantly changing the viewing experience as one progressed along the corridor marks the boundary between visual units. In the South Fork Snake River Basin, visual unit boundaries generally indicate changes in the stream pattern or water characteristics (i.e., free flowing water versus reservoirs, single channel versus braided, or flowing versus cascading); differences in canyon wall scale and enclosure; presence of unique landforms; changes in density and types of vegetation patterns; and/or changes in the degree or type of land use patterns.

Visual unit boundaries were delineated during site visits conducted from 1993 to 1995. Information was recorded on maps and through photography. Forms were also completed in the field and later photographic documentation reviewed to record landform, vegetation, water character, cultural modifications and other characteristics for each unit. Boundaries were drawn on 7.5 minute U.S. Geological Survey quadrangle maps and checked against orthophotoquads to verify accuracy.

The scenic evaluation focused on the main stem of the South Fork Snake River and major tributaries. Of the sixteen streams evaluated for scenic values, sixty-nine visual units were identified. Not all tributaries were evaluated, especially if access was difficult. The entire tributary was not evaluated if time did not allow access to the entire stream. This was the case for the headwaters of several streams. Streams that extended into Wyoming were only evaluated for scenic values within Idaho.

Scenic Distinction Evaluation

Each visual unit was evaluated for scenic distinction. Scenic distinction is a measure of the aesthetic quality of a landscape from a regional perspective. This evaluation must consider the landscape features within the context of the region or physiographic province that it occurs. Therefore, landscape elements for the South Fork Snake River Basin are evaluated relative to typical landscape features in Eastern Idaho and not Northern Idaho.

The Forest Service and BLM have established procedures for measuring the aesthetic quality of landscapes (BLM, 1986; Forest Service, 1974). Scenic distinction for the South Fork Snake River Basin used the scoring presented in Table 26, page 70. This table was developed by the BLM for use in evaluating scenic quality of public lands, and uses criteria similar to the Forest Service system. The model assesses the degree of variety a landscape possesses. The premise behind this chart is that all landscapes have scenic value, but areas with the most variety or harmonious composition have the greatest value (BLM, 1986; Forest Service, 1974).

The degree of visual variety and harmonious composition of seven factors (landform, vegetation, water, color, adjacent scenery, scarcity and cultural modifications) is evaluated using a numeric rating system. Each component comprising the landscape is evaluated individually, using a value of one to five (with the exception of cultural modifications which are rated -4 to 2) to rate the amount of variety,

Table 25. Recreation Evaluation Criteria and Results for the South Fork Snake River Basin.

Outstanding Significant recreational opportunities available as indicated by a great diversity of activities; unique or rare experience; and/or highest use areas.	**Bear Creek** *(Headwaters to high water of reservoir)* - significant diversity of recreational opportunities; one of the few areas in the state to participate in general bull elk hunting **Big Elk Creek** *(State line to high water of reservoir)* - unique opportunity to observe and fish for kokanee; one of the few areas in the state to participate in general bull elk hunting **Black Canyon** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting **Burns Creek** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting; high motorized use trail **Cress Creek** *(Headwaters to mouth)* - high quality spring-fed stream ecosystem providing unique education opportunities to the area; high use which is increasing yearly **Elk Creek** *(headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting **Fall Creek** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting; highest hunter densities in the basin **Indian Creek** *(Tributary to main stem)* - one of the few areas in the state to participate in general bull elk hunting **Iowa Creek** *(Tributary to McCoy Creek)* - Historic mining town, Caribou City, determined eligible for the National Register, planned for interpretation **Jensen Creek** *(Tributary to McCoy Creek)* - one of the few areas in the state to participate in general bull elk hunting **Little Elk Creek** *(headwaters to mouth)* - one of the few places in Idaho to hunt mountain goat; one of the few areas in the state to participate in general bull elk hunting; **McCoy Creek** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting; highest fishing pressure of all tributaries in the basin **Mike Spencer Canyon** *(Tributary to Pine Creek)* - one of the few areas in the state to participate in general bull elk hunting **Palisades Creek** *(Headwaters to Palisades Creek Campground)* - unique opportunities -- easy access to high mountain lakes; wilderness setting; high use National Recreational Trail; one of the few areas in the state to participate in general bull elk hunting **Pine Creek, North and West Forks** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting **Pritchard Creek** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting in a isolated setting **Rainey Creek** *(Headwaters to Forest boundary)* - one of the few areas in the state to participate in general bull elk hunting **South Fork Snake River (Palisades Reservoir)** *(State line to dam)* - significant diversity of recreational opportunities; highest use destination reservoir in the state **South Fork Snake River** *(Palisades Dam to confluence with Henrys Fork)* - unique quality fishing opportunities which attract people nationally; fishing opportunities in both a roaded and unroaded setting; one of the few areas in the state to participate in general bull elk hunting **Sheep Creek** *(Headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting **Trout Creek** *(Tributary to Palisades Reservoir)* - one of the few areas in the state to participate in general bull elk hunting **Waterfall Canyon** *(Tributary to Palisades Creek)* - Waterfalls, one of the few areas in the state to participate in general bull elk hunting **Wolverine Creek** *(headwaters to mouth)* - one of the few areas in the state to participate in general bull elk hunting

High River segments with a high use volume; high diversity; and/or a recreation opportunity which is unique but typical in the region.	None identified
Moderate and Low River segments with moderate to low use volume; moderate to low diversity of opportunities; and/or providing recreational opportunities typical and abundant within the region.	**Antelope Creek** *(Headwaters to mouth)* - moderate to low diversity of recreational opportunities **Indian Creek** *(tributary to reservoir)* - moderate/low diversity of recreational opportunities **Kelly Creek** *(Headwaters to mouth)* - moderate rating for uniqueness because of ski opportunities; moderate/low diversity of recreational opportunities **Little Kelly Creek** *(Headwaters to mouth)* - moderate diversity of recreational opportunities **Palisades Creek** *(Palisades campground to mouth)* - low diversity of recreational opportunities on private land **Pine Creek** *(Headwaters to Forest boundary* - moderate diversity of recreational opportunities **Pine Creek** *(Forest boundary to mouth)* - moderate/low diversity of recreational opportunities because of difficult access **Rainey Creek** *(Forest Boundary to mouth)* - moderate to low diversity of recreational opportunities **Sheep Creek** *(Headwaters to mouth)* - moderate diversity of recreational opportunities

contrast, harmony, or distinctiveness within the unit -- the higher the rating, the greater the variety or more distinctive the feature. Several factors are considered when evaluating these individual landscape features and are described below.

Landform - This component considers variation in topography. The more variation in topography the more interesting. Land forms perceived as outstanding or distinctive are steep, massive, severely eroded or sculpted, or have interesting rock formations and outcrops.

Vegetation - Evaluating the vegetation component of the landscape requires consideration of variety in patterns, forms and textures of plant material. Landscapes with several plant communities are usually considered more interesting than landscapes characterized by one type. The variety or diversity of plant material in an individual plant community is also considered.

Color - Color is evaluated with respect to harmony, vividness and contrast in the landscape setting. In the South Fork Snake River Canyon, the vivid green of vegetation provides a pleasing contrast against the dark basalt of the cliffs. Landscapes with muted colors or monotonous color schemes are rated lower. It is important to consider seasonal variations such as peak autumn color and wildflower displays.

Water form - Water is an ingredient that adds movement or serenity to a scene. The degree that water dominates the scene is the key in rating its contribution to the scenic value of the landscape. Studies in which observers are asked to rate the quality of the scenery have consistently found that scenes with water are always rated higher than scenes without. This makes it more difficult to differentiate scenic values for a river basin study when water is present in all landscapes. The primary criterion is movement or dominance of water in the landscape. While water within the canyon would tend to dominate the desert landscape, in the context of the South Fork Snake River Canyon slow moving water (typically found in reservoirs) would be considered less interesting than water characterized by more visible movement such as rapids and falls, or with interesting patterns such as braiding or extensive meanders.

Table 26. Scenic Distinction Evaluation Criteria

LANDFORM	High vertical relief; severe surface variation; detail features dominant 5	Steep canyons; variety in shape and pattern of landforms; detail features not dominant 3	Low rolling hills; flat valley bottoms; few or no interesting land features 1
VEGETATION	Variety of vegetation types in interesting forms, textures, and patterns 5	Some variety in vegetation, but only one or two major types 3	Little or no variety in vegetation 1
WATER	Clear and clean; cascading whitewater; dominant feature in landscape 5	Flowing or still, but not dominant in landscape 3	Absent, or present but slack water or slow moving 0
COLOR	Rich color combination; vivid color; pleasing color contrasts 5	Some intensity or variety in color and contrast, but not dominant element 3	Subtle color variations or contrasts; generally mute tones 1
ADJACENT SCENERY	Adjacent scenery greatly enhances visual quality 5	Adjacent scenery moderately enhances overall visual quality 3	Adjacent scenery has little or no influence on overall visual quality 0
SCARCITY	Very rare in region; consistent chance for exceptional wildlife, wildflower viewing, etc. 5	Distinctive, although somewhat similar to others in the region 3	Interesting within its setting, but fairly common within the region 1
CULTURAL MODIFICATIONS	Modifications add favorable to visual variety while promoting visual harmony 2	Modifications add little or no visual variety and introduce no discordant elements 0	Modifications add variety but are very discordant and promote strong disharmony -4

SOURCE: BLM, 1986.

Adjacent scenery - The influence of adjacent scenery can be an important consideration for landscape settings which by themselves are not considered to have high scenic value, but provide a frame for some spectacular adjacent scenery.

Scarcity - Landscape scarcity considers situations where a number of not so spectacular elements in an unusual or unique combination may produce a memorable scene, or gives added value to unique features that are rare such as plant communities or geological features.

Cultural modifications - Alterations to the landscape may detract from the scenery, but also may enhance. For example, studies in Arizona showed that agricultural landscapes were rated higher for scenic value than the natural creosote flatlands. The key is whether the development is harmonious using materials that blend with the landscape or contrast in a positive way. A cultural modification that would be considered to be positive would use materials that mimiccolors, textures, form and line found in the surrounding landscape setting. Agricultural settings tend to enhance the scenic value of some landscapes.

Using these concepts, a scenic distinction evaluation was completed for each visual unit identified in the South Fork Snake River Basin. A narrative description of each element was prepared and each element given a numerical rating. A final rating is derived by totaling the scores for all seven landscape features. This score determines the scenic distinction category:

class A = outstanding - scores of 32 to 19
class B = high - scores of 18 to 12
class C = moderate/low - scores of 11 or less

Table 27 describes the scenic distinction evaluation results for the South Fork Snake River Basin. Evaluation forms (available in IDWR files) describe the landscape features and document the scoring for each visual unit.

Table 27. Results of the Scenic Evaluation for the South Fork Snake River Basin.

SCENIC DISTINCTION CATEGORY	STREAM REACH
Class A = Outstanding Landscapes with significant variety in landscape features; and/or possessing distinctive or unique, rare features (received a score of 32 to 19).	South Fork Snake River (Confluence of Salt and South Fork Snake rivers to Palisades Dam; one-mile west of Idaho-Wyoming state line) South Fork Snake River (Irwin footbridge to Henrys Fork confluence) Big Elk Creek (State line to T 1 S, R 46 E, NW ½ of Sec. 17) Burns Creek (T 4 N, R 43 E, SE 1/4 of Sec. 28 to Beartrap Canyon Cress Creek Fall Creek (Forest Road 058 to mouth) Little Kelly Creek (Headwaters to T 4 N, R 41 E, NW ½ of Sec. 29) Palisades Creek (Headwaters to Palisades Creek campground) Pine Creek (No Cut Timber Canyon to mouth) Waterfall Canyon
Class B = High Landscapes with moderate variety in landscape features (received a score of 18 to 12).	South Fork Snake River (Palisades Dam to Irwin footbridge) Antelope Creek Bear Creek Big Elk Creek (T 1 S, R 46 E, NW ½ of Sec. 17 to mouth) Fall Creek Indian Creek (reservoir tributary) Kelly Creek (Kelly Ski Area to Little Kelly Creek confluence) Little Kelly Creek (T 4 N, R 41 E, NW ½ of Sec. 29 to mouth) Lyons Creek (Headwaters to T 4 N, R 41 E, SE 1/4 of Sec. 5) Lyons Creek (Herbert to T 4 N, R 40 E, SE 1/4 of Sec. 10) McCoy Creek Palisades Creek (Palisades Creek campground to Highway 26) Pine Creek (North Fork Pine Creek confluence to No Cut Timber Canyon) Rainey Creek Sheep Creek
Class C = Moderate to Low Landscapes where characteristic features possess little variety (received a score of 11 or less).	South Fork Snake River (State line to Salt and South Fork Snake rivers confluence) Kelly Creek (Headwaters to Kelly Ski Area) Kelly Creek (Little Kelly Creek confluence to mouth) Lyons Creek (T 4 N, R 41 E, SE 1/4 of Sec. 5 to Herbert) Lyons Creek (T 4 N, R 40 E, SE 1/4 of Sec. 10 to Bench) Pine Creek (Headwaters to North Fork Pine Creek confluence)

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ISSUES, CONSIDERATIONS, AND PLAN OBJECTIVES

Local Issues

In February and March 1995, public meetings were conducted in Irwin, Victor, Ririe and Idaho Falls to inform the public about preparation of a South Fork Snake River Comprehensive State Water Plan. The public was asked to identify issues, values and solutions. Comments were recorded for meeting participants' response to the following discussion topics:

- Identify values you would like to see protected, sustained or improved in the future. (Values may be lifestyle opportunities or experiences, or features found in the basin.)
- Identify specific concerns, problems or changes relative to water policy and management that need to be addressed in the South Fork Snake River Comprehensive State Water Plan.
- Suggest specific development, improvement, conservation and/or preservation actions to maintain values you have identified, or to address concerns and issues you noted.

The South Fork Snake Advisory Group reviewed the comments received and provided some additional suggestions. Over 200 comments were received. These comments were reviewed, consolidated and summarized under eleven categories. A summary of public comment received is contained in Appendix B.

To help focus the scope of the plan and set priorities for future public meetings, the advisory group reviewed the issues listed under the eleven categories, and ranked each on a scale of 1 to 5. Issues were ranked for how important they were, and how much effort the advisory group should devote in addressing the issue. The remainder of the planning effort for the basin focused on the top ranked issues for each category. These are summarized by category below.

WATER QUALITY

Water quality concerns focus mainly on potential threats from residential development in the corridor and basin. There is serious concern about the potential pollution of the shallow alluvial aquifer and river from increased densities of septic systems with new development. Soil surveys for Swan Valley, Conant Valley and Ririe identify high water tables and associated soils as a severe limitation for construction of sanitation facilities in some areas (SCS, 1979 and 1981a).

Development pressures have also resulted in removal of riparian vegetation along the river which can act as a filtering buffer. Concerns are that increased removal of vegetation and replacement with turf may lead to contamination to the river from fertilizers and herbicides used on the more manicured landscapes. Increased activities along the shoreline are feared to lead to increased sedimentation in waterways.

Other water quality issues include questions about current monitoring of water quality and communication with the public about the results. The public wants to ensure that water quality is regularly monitored to identify problems as they occur, and that they are kept apprised of the status of water quality in the basin. Concerns about sanitation management of recreation use in the canyon were also expressed.

FISHERIES

The South Fork Snake River has a significant cutthroat fishery as described in the *Fish and Wildlife* section. The river is considered one of the top 100 trout fisheries in the nation, and attracts anglers from around the world.

Commercial outfitters depend on the fisheries and have seen a 68 percent increase in business between 1990 and 1994 (IOGLB, 1995). Angling use by private individuals has also increased, resulting in concerns about the effects of increased pressures and over harvest.

The public expressed a desire to maintain the quality of the fishery and the fishing experience. Maintenance of the river fishery depends on spawning access to tributaries, recruitment of juveniles back to the river, and survival of juveniles through the fall and winter period (Wright, 1996). Threats to the future of the South Fork Snake River fishery include reductions in habitat quantity and quality.

One important issue is maintenance of winter habitat which is dependent on flows. Research conducted by Schrader and Griswold (1994) determined a flow of 1,500 cfs from October 1 to March 30 to be the biological minimum flow for sustaining the cutthroat fishery population in the South Fork Snake River Basin. In dry years, these flows have not occurred as water is stored in Palisades Reservoir to ensure the reservoir fills to provide irrigation water in the coming season.

RIPARIAN MANAGEMENT

The cottonwood riparian forest and other riparian vegetation along the South Fork Snake River and tributaries contributes to the wildlife and scenic values of the basin. The riparian forest along the South Fork Snake River is the largest stand of narrowleaf cottonwood in the Intermountain Region (Riggin and Hansen, 1992). Maintenance of this habitat is critical to the survival of the bald eagle, breeding bird diversity, and other wildlife values (Swenson, et al., 1986; Saab, 1991; and BLM and Forest Service, 1991).

Concerns focused on the decline in vigor and size of cottonwood stands. Cottonwood regeneration is dependent on flood events large enough to move sediment (Merigliano, 1996). Construction of Palisades Dam has changed river flows and reduced the volume of flood events. The need to explore options for improving cottonwood regeneration was expressed.

Development occurring along the river corridor poses additional threats to the viability of riparian habitat because of native vegetation removal. Bonneville County and Jefferson County require 80-foot and 75-foot setbacks from the highwater mark, respectively (Bonneville County Commissioners, 1995; Jefferson County Planning Commission, 1988). The setback applies to structures and does not prevent alteration to vegetation. Some are concerned that development along the river corridor would inhibit the possibility of providing flows to benefit riparian habitat.

WILDLIFE

Wildlife concerns involve maintaining the vitality of the bald eagle population and Canada geese nesting success. Potential threats to the bald eagle population include: loss of cottonwoods important for nesting habitat, increase in residential development and associated removal of cottonwood habitat, disturbance from increased recreational use, and winter flows and icing which hinder access to food.

The nesting success of Canada geese is dependent on the timing and magnitude of spring releases (Riggin and Hansen, 1992). Canada geese nest on islands on the main stem. Low flows result in predation of nests; high flows flood nests.

RECREATION

The South Fork Snake River offers a variety of quality outdoor recreation opportunities, including fishing, hunting, scenic boating, hiking, skiing, biking and camping. Recreation activity in the basin is increasing as the area population expands and the South Fork Snake River is discovered by people from outside the area. Increased use results in conflicts between different user types, including motorized and non-motorized users, commercial outfitters and the public, and resident and non-resident recreationists.

River flows are regulated by releases from Palisades Reservoir predominantly governed by irrigation and flood control objectives. Recreation opportunities and the quality of the recreation experience are dependent on the quantity and timing of these releases. The public has expressed concerns about changes to the quality of the outdoor recreation experience from increased recreational use and timing of river flows. Others believe construction of Palisades Reservoir and controlled releases have improved recreation opportunities and the experience.

Additional issues mentioned include boater safety near the Great Feeder. Several boaters have been swept through the head gates and injured. An irrigation storage project has been proposed in the past at Burns Canyon (also known as the Lynn Crandall Project) which would inundate the unroaded canyon reach of the South Fork Snake. This project was listed in the Board's 1992 *Idaho State Water Plan* as a potential storage reservoir site. Many citizens expressed concern about the effects to recreation opportunities and the fishery if Lynn Crandall dam were constructed.

GROWTH AND DEVELOPMENT

Land development in the basin raises many concerns. More than 50 platted subdivisions have been inventoried in the South Fork Snake River Basin at the end of 1995. Most of these are concentrated in Swan Valley, Irwin and the north perimeter of Palisades Reservoir. A few are above the canyon east of Ririe and a few are located along the Dry Bed. Local communities are concerned about the rising property taxes and the burden to provide fire and other services with increased populations.

Relative to water management, the public has significant concerns about water quality impacts. With increased housing densities and septic systems, there are concerns that ground water and eventually the river will become contaminated. Many expressed a desire to see a community sewage system built to minimize impacts to water quality. However, the costs associated with constructing a system are a limiting factor.

Most concerns involving land development focus on the river corridor, particularly private land development in the canyon. The effects to natural resource values described earlier in this plan are a concern. Many comments expressed a desire to restrict development to maintain riparian vegetation, wildlife and fishery habitat, recreation opportunities, and scenic values. Coupled with concern for controls on development adjacent to the river are concerns about restrictions to private property rights.

Some comments concerned additional water development options in the basin. Several sites have been investigated for potential hydro development or storage projects in the past. These include the Lynn Crandall site located on the South Fork Snake River at the Burns Creek confluence. Comments were expressed supporting and opposing construction of the Lynn Crandall Project.

AGENCY MANAGEMENT

Public comment focused on the numerous entities managing resources in the basin, frustration at the lack of coordination, and the desire for management decisions to be based on good science and information. The Board also received public comment supporting and opposing state protection designation for rivers and streams in the basin. Some comments mentioned support or opposition to wild and scenic designation for the South Fork Snake River.

WATER ALLOCATION

Water allocation concerns the distribution and use of water in the basin. Some members of the public are concerned about the possibility of zero flows below Palisades Dam and the resulting adverse effects. A desire was expressed to find more flexibility in management of the river and allocation of water to achieve a balance in meeting the needs of all water users. Suggestions were provided for ways to coordinate water management to ensure sufficient flows to protect all users. The need to protect existing water rights and diversions, and acknowledge other

legal constraints, is also an important consideration.

OPERATION OF PALISADES

Most comments addressed the desire to see some flexibility in the operation of the system to meet multiple demands. Some members of the public wanted to see adjustment to timing and flows to meet multiple needs, including irrigation, flood management, protecting private property, fisheries, wildlife, cottonwood regeneration and recreation.

IRRIGATION

Some individuals expressed the desire to see improved irrigation efficiency with the objective of making conserved water available for other uses and needs such as instream flows. Others noted that water conserved from irrigation may result in undesirable consequences such as reduction in recharge to the aquifer. Concerns were also expressed that actions and recommendations pertaining to irrigation issues must not impact existing water rights and access to maintain diversion structures.

FLOOD MANAGEMENT

Flood protection in the South Fork Snake River Basin is provided by two upstream reservoirs (Palisades and Jackson Lake) and flood control levees downstream of Heise. With the increased development occurring along the river corridor, the public expressed concern about development in floodplains. Development along the river encroaching into the flood area may reduce the volume of flood stage flows and affect the USBR's ability to manage floods without property damage. Damage from flooding might result in increased costs to taxpayers.

The levees constructed below Heise were designed to accommodate regulated flows of 30,000 cfs. However, deposition in the river channel raises the height of the river bed and reduces the capacity of these levees to accommodate floods. There is a concern that the current levee system will need to be raised or expanded to provide continued protection in this reach of the South Fork Snake River. This has become an expensive practice in the Jackson, Wyoming area where levees are expanded to protect residences. Many felt the current levee system should not be expanded to protect additional lands.

Institutional Constraints And Opportunities

Other state, federal, and local entities have major roles in the regulation and management of water and land use. Comprehensive plan consistency with other plans is one factor among several considered by the Board in its policy decisions. Several city, county, state, and federal planning documents produced in recent years concern the South Fork Snake River Basin. These have been taken into consideration in the development of the South Fork Snake River Basin Comprehensive State Water Plan. Some provide a framework for which actions and recommendations contained in the Board's plan must be compatible. Many present opportunities to implement actions and recommendations proposed by the Board for the South Fork Snake River Basin.

SNAKE RIVER REGULATION

Operation and Management of the Upper Snake System and Palisades Reservoir

Palisades Reservoir is one component of the Upper Snake Reservoir System operated by the USBR. The system includes five storage reservoirs in Idaho and two in Wyoming (Figure 20; Table 28). These seven reservoirs have a total storage capacity of 4.37 million acre feet, and supply 1.31 million acres of agricultural land with either a full or partial irrigation water supply (USBR, 1996). Operation of Henrys Lake, owned by the North Fork Reservoir Company, is coordinated with the USBR reservoirs. The Upper Snake Reservoir System is operated primarily for irrigation and flood control with power generation, recreation, fish and wildlife being secondary. Operation of Palisades

Figure 20

Upper Snake Reservoir System

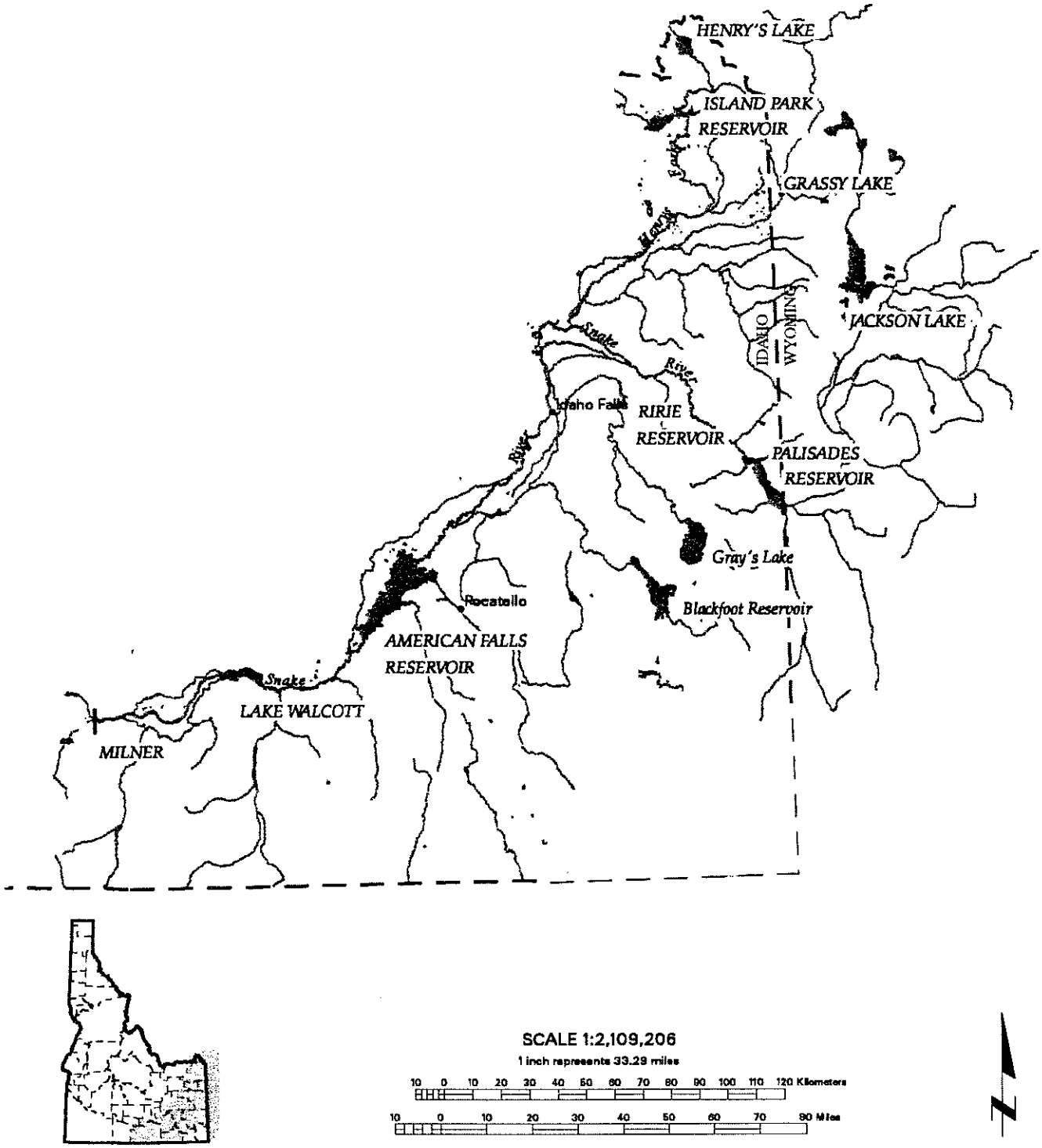

Table 28. Upper Snake System Federal Reservoirs

Reservoir	Total Storage (AF)	Active Storage(AF)	Storage Rights Priority Dates
Jackson Lake	847,000	847,000	1906, 1910, 1913
Palisades Reservoir	1,401,000	1,200,000	1921*, 1939
Ririe Reservoir	90,500	80,500	1969
Grassy Lake	15,470	15,200	1936
Island Park	135,586	135,205	1921, 1935, 1940
American Falls	1,672,590	1,672,590	1921*, 1921
Lake Walcott	210,200	95,200	1909

* Winter Water Savings Contracts, see page 79.
Source: USBR, 1996.

and the other Upper Snake reservoirs is controlled by several factors: 1) appropriation, use and distribution of water must comply with state water law; 2) contractual obligations to space holders must be fulfilled; and 3) projects must be operated in a manner consistent with congressional authorization for the project.

The Upper Snake Reservoir System is operated as a unified storage system, storing and releasing water to maximize the capability of the reservoirs. Two major system operation principals are followed: 1) water is stored as far upstream as possible, and 2) water is released first from the reservoirs that are easiest to refill (USBR, 1996). Palisades Reservoir is the second-highest storage reservoir on the main stem of the Snake River and is operated for a variety of purposes, including irrigation water storage, flood control, and power production.

Irrigation water is stored as far upstream as possible. Releases are made as needed through the summer and fall to meet irrigation demands, and to move water downstream to American Falls Reservoir. Water demand is determined by weather, crop consumptive use requirements, and cropping patterns. Irrigation releases are determined by the water rights available to meet the needs of approximately 50 canals (USBR, 1996).

The reservoirs act to hold flood waters upstream and release the water gradually over time. The required space needed for flood control storage is determined by rule curves which indicate how much space must be available in a reservoir based on date and runoff forecast. Forecasts are determined by observed precipitation and runoff, snowpack moisture, and historical conditions. During the fall, reservoirs are lowered and maintained to provide adequate storage for possible rain-on-snow events. After January, space is maintained according to the quantity of anticipated inflow from spring runoff.

Refilling the reservoir for irrigation is balanced with flood control objectives. Providing too much flood control space jeopardizes reservoir refill, and placing too much emphasis on reservoir refill jeopardizes flood control operations. Jackson Lake, Palisades Reservoir and Ririe Reservoir provide major flood control for the Upper Snake watershed above Milner Dam. Palisades Reservoir is managed in conjunction with Jackson Lake to limit flood flows to 20,000 cfs at the Heise stream gage (USBR, 1996). Jackson Lake provides 25 percent of the flood control space and Palisades Reservoir provides 75 percent of the needed flood control space (CoE, 1988). Ririe Reservoir, located to the south of the South Fork Snake Basin, is operated to limit Willow Creek flows to 1,200 cfs, providing additional flood protection to Idaho Falls, Ammon, Iona and Ucon (USBR, 1996; Federal Emergency Management Agency, 1981). Other reservoirs above Milner incidentally provide flood control space.

Power production at Palisades Reservoir is secondary to irrigation storage and flood control operations. Whenever possible, water releases for irrigation or flood control are diverted through the powerhouse, but water is not released

specifically for power production (USBR 1996). During the period of 1992 to 1994, the power plant was upgraded from the original 119.9 MW capacity to a 176.6 MW capacity, an increase of 49 percent. During the Federal Fiscal Year 1995, the Palisades Power plant produced 176,000 MW-hours of electricity (USBR, 1995).

Winter releases from Palisades Reservoir are established early in November based on carryover storage and fall inflow. The usual minimum winter outflow is 1,100 - 1,200 cfs, however, during drought years the winter flow has been as low as 550 cfs (USBR, 1996). If carryover storage is large, higher releases may be made around the end of the calendar year to create or maintain storage space for flood control operations. Average winter releases are 2,260 cfs (USBR, 1996).

The amount of water available in the entire Upper Snake System and the amount of carry-over from the previous year impact the timing and volume of flood control and irrigation releases. The management of the system and Palisades Reservoir is modified according to the amount of available water. If the spring runoff forecast is low, the amount of water drawn down for flood control will be less than normal, increasing the chance of refilling the reservoir. If the spring runoff forecast is higher than normal, the amount of flood control storage space must be increased to allow for flood control operations.

A water rights accounting system is maintained by the Water District 01 watermaster to ensure that the storage and use of water is properly accounted to the appropriate space holders, regardless of where the water is physically stored or actually released. This allows the system to be operated more efficiently than if water were physically stored according to the storage right priorities. A space holder contract is the purchase of a certain amount of reservoir storage space, not a contract to deliver a specific amount of water. Under this system, space holders can retain unused stored water from one year to the next, however, the total amount of water cannot exceed the volume of the contracted space. There are 52 entities with storage space contracts in Palisades Reservoir (USBR, 1996).

Some storage water rights in Palisades Reservoir are "winter water savings" rights. Water users ceased diverting water in the winter in exchange for an earlier storage priority date in the reservoir (USBR, 1996). Those entities with winter water savings rights must not divert water during the winter or they will lose their early priority date.

Water District 01 Water Rental Pool

The Idaho Legislature provided the Idaho Water Resource Board with the authority to operate a water bank in 1979. Water bank rules and regulations were adopted in 1980 and revised in 1991 and 1992. A water rental pool has been in existence in the Upper Snake River Basin since 1919. Prior to 1979 it operated on an informal basis. The Board designated the Committee of Nine as the local entity to operate the rental pool for Water District 01. The Committee of Nine is an advisory committee representing major irrigation entities in the district.

The Upper Snake pool is the largest and most active water bank in Idaho. Since 1979, an average of 388,000 AF of space has been placed in the rental pool, and an average of 135,000 AF of yield has not been leased (Sutter, 1995). Of the total 2,252,921 AF of yield placed in the rental pool from 1987-1994, 28 percent has not been leased. However, in 1992, the sixth year of a continuous drought, only 4,652 AF of yield was placed in the Upper Snake Rental Pool, while requests for irrigation water far outstripped supply.

The primary purpose of the Upper Snake Rental Pool is to meet the needs of irrigation water users within Water District 01. First priority is given to irrigators with storage rights in USBR reservoirs. Secondary priority for irrigators using water in the USBR project area. Other beneficial uses are given a lower priority. The largest purchaser of District 01 rental pool water prior to 1991 was Idaho Power. Since then the USBR has been the largest purchaser, using

the water to meet salmon flow augmentation objectives. This is discussed in the next section.

The water bank provides flexibility in the system by allowing entities that are in short supply to lease water. Leasing water from the rental pool has been suggested as an opportunity to provide instream flows for fishery and other resources benefitting from instream flows. However, water rental for these purposes would be a low priority.

Endangered Species Act and Salmon Flow Augmentation

The USBR is directed by the biological opinion issued by the National Marine Fisheries Service on March 2, 1995 to provide water from storage to augment river flow during periods of downstream salmon migration. The Idaho Legislature passed a resolution in 1996 that opposes flow augmentation as a long-term solution for salmon recovery. However, the resolution set conditions under which the USBR may release up to 427,000 AF each year from its projects on the Snake River for flow augmentation through 1999.

The Governor has created an "Idaho Policy" that requires an annual assessment of whether water is available for flow augmentation. The policy seeks to balance the amount of water released from Idaho reservoirs with downstream actions that influence fish passage at Snake and Columbia River dams.

USBR operations at Jackson and Palisades dams impact the South Fork Snake River Basin. The USBR controls approximately 4,000 AF of uncontracted space in Jackson Reservoir and 10,500 AF of uncontracted space in Palisades Reservoir. In dry years the USBR has released water normally held to increase head for power generation. Palisades contains 200,000 AF of space reserved for this purpose. It is questionable whether salmon flow augmentation is a legal use of powerhead water. The USBR purchases water from the District 01 Water Rental Pool and uses powerhead to meet salmon flows objectives.

Water Rights

Water rights are administered by the Idaho Department of Water Resources. They are issued by date of appropriation, for specific quantities, diversion points, places of use, and purposes. Idaho follows the Prior Appropriation Doctrine, best described as "first in time - first in right." Changes in water rights such as diversion points must be approved by IDWR. River regulation and appropriation of water must comply with Idaho water law.

Water stored in USBR reservoirs have two separate rights - the right to store and release water, and the right to divert water. Storage rights are associated with the storage facility and are usually held by the facility owner. Diversion rights for irrigation are appurtenant to the land and are often held by an entity such as a canal company. Both types of rights have specifications for purpose, amounts, site, and date of priority. The USBR holds the storage rights for Palisades Reservoir. Reservoir storage rights are satisfied in order of priority. A reservoir may have several priority dates, indicating that storage at the reservoir has increased, or natural flow rights were exchanged for storage rights.

Instream Flows

Except for salmon flow augmentation water, the USBR does not release storable water over Milner Dam that can be controlled above the dam (USBR, 1996). A minimum flow of zero is allowed for the Snake River at Milner Dam in the *Idaho State Water Plan*. This is recognition that flows have sometimes been reduced to zero at the dam. In licensing the Milner hydropower project, the FERC has specific "target flows" for the Snake River at Milner Dam of 200 cfs. The target flow must be satisfied only when water in excess of irrigation needs is available (FERC, 1990). Target flow may be acquired from Idaho Power Company storage in American Falls Reservoir, or may be leased from the Upper Snake Rental Pool.

In 1905, a 10-mile reach of the Snake River at Blackfoot had no streamflow for several days,

indicating that water demands were exceeding natural flow (Kjelstrom, 1992). The Minidoka Project was initiated to store excess winter and spring flows to alleviate water shortages (USBR, 1996). Releases for irrigation from Jackson Lake (constructed in 1907 and reconstructed in 1910), and later Palisades Reservoir, now enhance summer flows in the river at Blackfoot.

Snake River Compact

Allocation of Snake River water to the states of Idaho and Wyoming is contained in the Snake River Compact signed in 1949, and approved by Congress in 1950. The compact allocates 96 percent of the natural flow to Idaho and the remaining 4 percent to Wyoming for storage or direct diversion. Wyoming's portion is estimated at 200,000 AF based on run-off at the Idaho-Wyoming line.

The Wyoming portion of Snake River water may be diverted or stored by the state with no restrictions for 100,000 AF. Use of the remaining 100,000 AF by Wyoming requires replacement storage to benefit existing Idaho water users. Wyoming has contracted 33,000 AF of storage in Palisades Reservoir from the USBR as replacement storage to meet its obligations under the Compact. Wyoming may use this space by exchange to maintain higher lake levels in Jackson Lake or supplement low fall and winter flows below the lake.

Fort Hall Indian Water Rights Agreement

The Idaho Water Resource Board entered into negotiations with the Shoshone-Bannock Tribes of the Fort Hall Indian Reservation in 1985 concerning the extent of water rights of the Tribe. The negotiations led to ratification by Congress of the Fort Hall Indian Water Rights Act of 1990, adopted by the Idaho Legislature in 1991. The agreement quantifies the Tribes' water right claims above Hells Canyon Dam. Tribal water rights were quantified at 581,030 AF annually for present and future irrigation, DCMI, hydropower and stock water uses.

The agreement authorizes the Shoshone-Bannocks to operate a tribal water bank pursuant to state law. The Bank will be operated by a Tribal Rental Pool Committee. Only water accruing to the Tribes' 83,900 AF of space in Palisades Reservoir and 46,931 AF in American Falls Reservoir may be placed in the water bank. Rental of this storage space is subject to the terms of the Michaud Contract. Water users in the Fort Hall Indian Irrigation Project have a right of first refusal for any storage water available from the rental pool. Water that accrues to the Tribal storage space in Palisades may not be released for use past Milner. The Tribal water stored in American Falls Reservoir may be used below Milner Dam without refill penalties being incurred by the Tribe. The right to contract storage rights is the only Tribal water right located within the South Fork Snake River Basin.

Additionally, 100,000 AF of rental water from Palisades and Ririe reservoirs was allocated as mitigation water to non-Indian water users to compensate for impacts to existing water rights from the agreement. These water users have incorporated as Mitigation Inc. to manage this water. Water not leased by the water users is added to the water bank.

Snake River Resource Review

The USBR is currently conducting a comprehensive review of its operations and the resources in the Snake River Basin above Brownlee Dam. The main objective is to develop a decision support system to analyze operation of the system. The decision support system can help to explore how the system might respond to different management scenarios to meet traditional uses while responding to additional demands for water. The review is scheduled for completion in the year 2000. The resource review provides an opportunity to coordinate the information and recommendations developed during the Board's state water planning activities in the South Fork Snake River Basin with other agencies.

BUREAU OF LAND MANAGEMENT AND FOREST SERVICE MANAGEMENT

Snake River Activity/Operations Plan

The Snake River Activity/Operations Plan is a plan prepared jointly by the Idaho Falls District BLM and Targhee National Forest to ensure maintenance of the natural resources on federal lands along the South Fork Snake River (BLM and Forest Service, 1991). The plan was developed with the help of a fifteen-member Task Force to identify issues and problems, and provide ideas and suggestions. Management actions contained in the document are proposed to prevent degradation of resources, perpetuate the cottonwood ecosystem, and maintain current land uses. The objectives and goals contained in the Snake River Activity/Operations Plan and the South Fork Snake River Comprehensive State Water Plan support each other in maintaining the outstanding fish, wildlife, recreation and scenic values identified in the basin.

Targhee National Forest Plan Revision

The Targhee National Forest manages almost 65 percent of the lands in the South Fork Snake River Basin. The first Forest Plan for the Targhee National Forest was completed in 1985. A draft Environmental Impact Statement and Forest Plan Revision were released for public comment in early 1996. A final plan is expected in 1997. The Forest Plan Revision will guide all natural resource management activities, and establishes management standards, guidelines and prescriptions for the Forest over the next ten to fifteen years.

The draft plan proposes management goals and objectives that can lead to implementation of recommendations in the Board's South Fork Snake River Water Plan. Some of the goals and objectives proposed within the South Fork Snake River Basin include:

- continued implementation of the Snake River Activity/Operations Plan
- continued cooperation with other agencies to ensure cottonwood regeneration along the South Fork Snake River;
- silvicultural management to improve wildlife habitat;
- providing a variety of recreational activities ranging from motorized to primitive;
- maintaining scenic values in the South Fork Snake River Canyon;
- maintaining recreation values from Palisades Dam to Conant Valley;
- maintaining or enhancing bald eagle habitat, big game habitat, and improve goose nesting opportunities on the South Fork Snake River (Targhee National Forest, 1996b).

Wild and Scenic River Studies

The Targhee National Forest and Idaho Falls District BLM have conducted wild and scenic river studies for reaches in the South Fork Snake River Basin. The wild and scenic river study process involves two steps: 1) an eligibility analysis to determine if a river reach possesses the minimum criteria for further study as a potential wild and scenic river; and 2) a suitability study to evaluate if a river should be recommended for inclusion into the National Wild and Scenic River System. Three designations are possible, indicating the degree of development along the reach -- wild, scenic or recreational.

The Draft Forest Plan Revision prepared by the Targhee National Forest contains the results of a tentative eligibility determination. This analysis identified free-flowing river or stream reaches with "outstandingly remarkable" geologic, scenic, recreational, fish, wildlife, historic and/or cultural values. Additionally, the Medicine Lodge Resource Management Plan, completed by the BLM in 1985, conducted an eligibility study for the main stem from Palisades Dam to the Henrys Fork confluence (BLM, 1985). The results of the eligibility findings are summarized in Table 29.

The reaches found eligible will be managed to preserve those values contributing to eligibility. The agencies need to complete a suitability study prior to recommending

Table 29. Eligible Wild and Scenic Reaches in the South Fork Snake River Basin.

Reach	Location	Potential Classification	"Outstandingly Remarkable" Values
Forest Plan Revision*			
South Fork Snake River	Palisades Dam to Conant Valley power line	recreational	recreation, fish and wildlife
South Fork Snake River	Conant Valley power line to Lufkin Flat	scenic	recreation, scenic values, fish and wildlife
South Fork Snake River	Lufkin Flat to Riley Diversion	recreational	recreation, fish and wildlife
Big Elk Creek	Main stem and lower 2 miles of the 3 forks	wild	wildness, scenic values
McCoy Creek	Lower 3.5 miles	recreational	fisheries
Bear Creek	Main stem and North Fork and Deadman Creeks	recreational	fisheries
Palisades Creek	Confluence with North Fork Palisades Creek and Corral Canyon to Palisades Campground	wild	wildness, scenic values
Waterfall Canyon	Source to Upper Palisades Lake	wild	wildness, scenic values
Pine Creek	Tie Canyon to Forest boundary	recreational	fisheries
Burns Canyon	Crystal Lake to confluence with S Fk Snake River	recreational	fisheries
Medicine Lodge RMP			
South Fork Snake River	Palisade Dam to Conant Valley power line	recreational	
South Fork Snake River	Conant Valley power line to Riley Diversion	scenic	
South Fork Snake River	Riley Diversion to Henrys Fork confluence	recreational	

* Results of a tentative eligibility determination.

designation of eligible reaches as wild and scenic. Congressional approval is also needed for a river to become a part of the National Wild and Scenic River System. The Board encourages the Forest Service and BLM to work within the state planning process rather than pursuing federal protection of waters within the South Fork Snake Basin.

PALISADES WILDLIFE MITIGATION PLAN

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 requires the Bonneville Power Administration (BPA) to mitigate for wildlife losses caused by hydropower dam construction and operation. Palisades Dam, constructed in 1956, inundated nearly 16,000 acres of wildlife habitat, including cottonwood forests, wetlands, agricultural lands and shrub-steppe (Riggin and Hansen, 1992). The BPA and IDFG prepared a South Fork Snake River /Palisades Wildlife Mitigation Project in 1986, identifying opportunities to compensate for loss of wildlife and habitat from construction and operation of Palisades Dam. BPA prepared an Environmental Assessment for the project, making a final decision to fund implementation of the project in 1995. Estimated total costs to implement mitigation for all components of the plan including big game, upland game, and waterfowl habitat is about $28 million (Ragotzkie, 1996).

The mitigation project focuses on habitat protection and enhancement measures to protect riparian habitat along the South Fork Snake, lower Henrys Fork, and Snake River upstream of Idaho Falls. Habitat is protected through acquisition of conservation easements or land from willing landowners through voluntary participation. Habitat enhancements would occur on public lands, including fencing riparian areas, grazing management, managing cottonwood forests for improved bald eagle nesting and winter habitat, revegetating areas for wildlife food and cover, supporting noxious weed control, and erosion control.

Currently, conservation easements are being pursued through 5 landowners covering about 2500 acres on the South Fork Snake River and

Pine Creek. Fee-title acquisition is being explored for about 150 acres on the South Fork Snake River (Ragotzkie, 1996). Coordination is also occurring with the BLM, Natural Resource Conservation Service, the Shoshone-Bannock Tribes and county weed supervisors to develop a biological noxious weed program on BLM and other public lands adjacent to the South Fork Snake River to control leafy spurge. This program provides opportunity to address some of the concerns about development and loss of wildlife habitat in the South Fork Snake River Basin.

IDAHO DEPARTMENT OF FISH AND GAME MANAGEMENT

In addition to its role in implementing the Palisades Wildlife Mitigation Plan, the IDFG is mandated to preserve, protect, perpetuate, and manage the fish and wildlife resources of Idaho. The Department's Fisheries Management Plan (1996-2000) contains several objectives that will support the Board's desire to protect the outstanding fishery in the basin. These include: preserving genetic integrity and population viability of native cutthroat trout; working cooperatively to obtain winter flows to enhance long-term population stability; and improving recruitment to the South Fork Snake River from tributary streams.

Additionally, the IDFG has the technical capability to conduct studies providing information necessary for the Board to pursue minimum stream flows for some important spawning tributaries in the basin. The IDFG responsibility in implementing the Palisades Wildlife Mitigation Plan will help in maintaining outstanding wildlife values identified in the basin.

SOIL CONSERVATION AND WATER QUALITY MANAGEMENT

Soil and water conservation districts are sub-units of state government managed by a local board of supervisors elected by local voters. The districts work with landowners on a voluntary basis addressing natural resource management in a site specific manner. Their activities help landowners and operators control soil erosion, and improve water quality and wildlife habitat. These objectives are accomplished with the aid of several partners including Natural Resources Conservation Service, Idaho Soil Conservation Commission, Idaho Association of Conservation Districts, and the Idaho Division of Environmental Quality.

The Natural Resources Conservation Service, an agency of the U.S. Department of Agriculture, provides on-site technical assistance to private landowners. Range and riparian improvements may be implemented through loans and grants available through the Idaho Soil Conservation Commission.

The Division of Environmental Quality (DEQ) maintains and enforces water quality standards. The DEQ makes grants to the soil and water conservation districts to assist in water quality plans, and for cost-sharing with farmers who apply Best Management Practices (BMPs). The East Side Soil and Water Conservation District has received funding for two State Agricultural Water Quality Program projects in the basin for agricultural land in the Antelope Creek and Granite Creek watersheds.

The DEQ has identified stream reaches in the South Fork Snake River Basin that are water quality limited (all beneficial uses are not being met) pursuant to Section 303(d) of the Clean Water Act. This designation requires development of Total Maximum Daily Loads (TMDLs) standards to control point and nonpoint pollution sources. Reaches are prioritized for development of TMDLs based on risks. All reaches in the South Fork Snake River were assigned a low priority, meaning although designated uses are not fully supported, the risk to human health and aquatic life, or recreational, economic and aesthetic values of the water body are minimal.

In 1995, the Idaho Legislature adopted water quality statutes to respond to 303d listings. The statutes implement a process to prioritize watersheds needing pollution management, and to develop water quality action plans through

community-based advisory committees. The approach was two-tiered, with Basin Advisory Groups (BAGs) developing recommendations to the Division of Environmental Quality regarding water quality standards and monitoring, pollution budgets and prioritization of impaired waters. Watershed Advisory Groups (WAGs) would develop and implement watershed action plans that would fulfill the TMDL requirement. The Upper Snake BAG covers the area including the South Fork Snake River Basin. The Upper Snake BAG has considered designating a South Fork Snake WAG to develop a TMDL plan for the South Fork Snake River Basin, but has not formally designated such a group.

The programs administered by the above-described entities offer opportunities to maintain water quality and other related goals in the basin. Availability of funding and personnel are important in the timeliness of the program implementation.

COUNTY LAND USE PLANS

Portions of three counties are located in the basin -- Bonneville, Jefferson and Madison counties. Each county has adopted, or is in the process of adopting, comprehensive land use plans and zoning ordinances. The comprehensive plans contain goals and policies directing the desired land use and activities in the county which are implemented through the ordinances.

Bonneville County adopted a comprehensive land use plan in 1995. The plan contains specific strategies for the Swan Valley area. Goals include maintaining existing agricultural lands; protecting water quality; permitting low density residential development that avoids sensitive areas; and preserving natural amenities (Bonneville County Commissioners, 1995). Buildings must be setback 75-feet from the highwater mark of waterways.

Jefferson County completed its comprehensive land use plan and zoning ordinance in 1988. Policies applicable to the South Fork Snake River Basin include the desire to preserve prime agricultural land; promoting housing development in areas capable of providing the utilities and services needed; preserving unique areas; encouraging compatible land uses in floodplains; and promoting development of floodways into linear parks and river access areas (Jefferson County Planning Commission, 1988).

Zoning is based on the size of the parcel. Parcels 20 acres or larger are zoned agricultural. The zoning category is intended to preserve agricultural and related uses, discouraging suburban development. Parcels from 5 to 20 acres in size are zoned agricultural residential. This zoning category was established to accommodate the transition from rural to low-density urban uses while maintaining agricultural uses. Parcels less than 5 acres are zoned residential. This zoning category requires a request for zoning change from commissioners. The minimum lot is 10,000 square feet. The zoning category provides minimum standards for residential single-family development. The county area in the South Fork Snake River Basin is predominately zoned agricultural (Smith, 1996). The zoning ordinance requires a 80-feet setback from the highwater mark of streams.

Madison County is currently conducting planning studies. The plan is comprised of three components -- a comprehensive land use plan, a zoning ordinance and subdivision ordinance. Public comment received at hearings for the comprehensive land use component are being evaluated. A hearing on the subdivision ordinance is scheduled in the immediate future. After hearings are conducted for a component of the plan, sections are submitted to the commissioners for review. A final set of hearings will be held before adoption by the county commissioners.

Depending on how these goals are interpreted and implemented, land use decisions made by counties can achieve some of the recommendations made by the Board in the South Fork Snake River Water Plan. Local citizens must continue to actively participate in hearings and make known their desires to county commissioners just as they have in helping the Board develop this plan.

Goals and Objectives

In adopting a comprehensive state water plan, the Board is guided by these criteria from the Idaho Code 42-1734A:

1. Existing rights, established duties, and the relative priorities of water established in the Idaho Constitution shall be protected and preserved.

2. Optimum economic development in the interest of and for the benefit of the state as a whole shall be achieved by integration and coordination of the use of water, the augmentation of existing supplies, and the protection of designated waterways for all beneficial purposes.

3. Adequate and safe water supplies for human consumption and maximum supplies for other beneficial uses shall be preserved and protected.

4. Minimum stream flow for aquatic life, recreation, aesthetics, and water quality, and the protection and preservation of waterways shall be fostered and encouraged. Consideration shall be given to the development and protection of water recreation facilities.

5. Watershed conservation practices consistent with sound engineering and economic principles shall be encouraged.

Specific goals and objectives for the South Fork Snake River Basin Plan reflect current local issues, current and future uses of water, and the natural resources of the basin. The top ranking issues identified by the public led to identification of a list of wants and needs, or desired outcomes, for the South Fork Snake River Basin. The South Fork Snake Advisory Group reviewed the desired outcomes at the March 1996 meeting, and developed a list of goals for each of the eleven issue categories. Goals are general statements about the outcome or desired future for the basin. Goals agreed to include:

Water Quality

1. Protect water quality of the South Fork Snake and all tributaries.
2. Accumulate data to allow monitoring and verification of water quality impacts.
3. Monitor and manage activities in the river corridor potentially impacting water quality to minimize pollution.
4. Minimize soil erosion.
5. Maintain or improve water in a biologically beneficial condition.

Fisheries

6. Maintain or improve the health of the cutthroat fishery.
7. Prevent over harvest of the fishery.

Riparian Management

8. Maintain or improve the health of the riparian area.

Wildlife

9. Maintain or improve wildlife habitat.
10. Recognize the value of waterfowl, wildlife and birds of prey.
11. Maintain or improve basin ecological integrity.

Recreation

12. Maintain or improve the quality of the outdoor recreation experience.
13. Maintain or improve the quality of the fishing experience.
14. Improve safety at the Big Feeder for boaters.

Development & Growth

15. Minimize or prevent adverse effects from development along the river corridor, particularly the canyon.
16. Protect private property rights.
17. Encourage citizens to be involved in the development or revision of county land use plans.

Agency Management

18. Management decisions should use the best available science.
19. Improve coordination among agencies, private landowners and the public in managing resources in the South Fork Snake River Basin.

Water Allocation

20. Work toward cooperation between all water users.
21. Look at ways to allow greater flexibility in allocating water to different uses and address the changing demands for water in the basin and state while respecting existing rights.
22. Identify areas where instream flows are appropriate.

Operation of Palisades

23. Balance flows and timing from Palisades Reservoir to meet the needs of irrigators, flood management, power generation, private property owners, fisheries, wildlife, cottonwood regeneration, and recreation.

Irrigation

24. Encourage irrigation efficiency.

Flood Management

25. Address future flood management in the South Fork Snake River Basin

Strategies Considered in Response to Issues, Concerns and Goals

Advisory group meetings focused on providing information and discussing the priority issues identified early in the process. The advisory group and public suggested strategies to address the issues and achieve goals. Strategies include actions, recommendations or policies that would accomplish the desired goal. Over an eight month period, the Board received more than 245 strategies from the advisory group, other members of the public, and agencies. These strategies represent the alternatives considered for the basin.

The advisory group, local citizens and agency representatives reviewed the alternative strategies. The group first conducted an evaluation of all the strategies, identifying those they could not support. Those strategies that received support by all were forwarded as recommendations to the Board. Strategies not receiving complete group support were discussed by meeting participants to determine if consensus could be reached by suggesting word changes or new strategies. When participants felt comfortable with a strategy it was added to a list of recommendations submitted to the Board. The recommendations supported by the Board are listed in the *Actions and Recommendations* section that follows. The strategies, or alternatives, considered are listed in Appendix C.

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ACTIONS AND RECOMMENDATIONS

A principal role of the Board is to establish water policy for the state, including the development of comprehensive water plans for specific geographic areas. In planning for the water resources of the state, the Board is charged with weighing and balancing competing uses and needs. Multi-objective resource planning necessarily involves making trade-offs aimed at achieving the best combination of objectives.

Actions and recommendations of the Board are consistent with the Idaho Code, private property rights, local and state management plans, and recognize public consensus achieved at South Fork Snake Advisory Group meetings conducted April, May and June, 1996. These actions and recommendations reflect the desires of local citizens of the basin and in the region. All local, state, and federal agencies are encouraged to administer their activities to help achieve the actions and recommendations contained in the Comprehensive State Water Plan for the South Fork Snake River Basin.

Actions

The South Fork Snake Plan comprised a review and analysis of the present and future needs and opportunities for fifteen resource categories[1] specified by the Idaho Legislature. A need was identified to provide for state protected river designation to protect current values for Idaho and to preclude federal designation.

STATE RIVER PROTECTION DESIGNATIONS

A comprehensive state water plan may designate waterways as "natural" or "recreational." As defined by the Idaho Code, a recreational or natural river is "a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values" [Idaho Code 42-1731 (7) and (9)]. Natural rivers are free of substantial man-made development in the waterway, and the riparian area is largely undeveloped. Recreational rivers may include man-made development in the waterway or the riparian area. A designation is made only if the Board determines the value of preserving the waterway is in the public interest and outweighs developing the river for other beneficial uses.

It is the policy of the Board to amend a comprehensive state water plan when it determines that amendments are in the public interest. If development opportunities conflicting with the designation become available before a review period, an amendment to the plan can be requested. The Board will consider proposals for amendment to the South Fork Snake River Basin Water Plan from private parties as well as state agencies. In the event the Board determines that a proposal will not substantially impair the values which were the basis of a protected river designation, the Board shall amend the plan following the procedures required for the adoption of the original plan (Idaho Code, Sections 42-1734A and B).

The Idaho Water Resource Board considers the impacts of protected river designations on the social, economic and environmental livelihood of the region, and determines the value of preserving the outstanding waterways of the South Fork Snake River Basin with their current beneficial uses outweighs the value of further development at this time. The Board believes

[1] Resource categories include navigation; power development; energy conservation; fish and wildlife; recreational opportunities; irrigation; flood control; water supply; timber; mining; livestock watering; scenic values; natural or cultural features; domestic, municipal, commercial, and industrial water uses; and other aspects of environmental or economic development [Idaho Code 42-1734A(3)] .

state protected river designations are preferable to federal protection, and are in the best interest of the residents of Idaho. Federal protection limits the flexibility of planning for the reach, and removes the option of amending the designation by action of the Idaho Water Resource Board and Idaho Legislature. Federal agencies are encouraged to manage lands to compliment the state protection designations.

Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited within the stream channel or below the highwater mark on the reaches designated "natural" rivers:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the stream bed; and
- mineral or sand and gravel extraction within the stream bed.

The Board determines which of the above prohibitions apply to rivers designated "recreational". Prohibitions for natural or recreational designations do not interfere with activities necessary to maintain and improve existing utilities, roadways, managed stream access facilities, diversion works, and for the maintenance of private property. State designation does not change or infringe upon existing water rights or other vested property rights. It does not restrict the expansion or maintenance of existing uses.

To protect the public interest, current resource use, and the multiple-use character of the basin, the Idaho Water Resource Board designates river/stream reaches as natural or recreational as indicated. The Board recognizes that no action using their comprehensive state water planning authorities can interfere with vested rights, or the repair, replacement, or continued operation of existing facilities and works.

Natural Rivers

The Board designates the following stream reaches as "natural" rivers:

Fish Creek (5.2 miles[2]): Headwaters to confluence with McCoy Creek

Big Elk Creek (4.5 miles): Idaho-Wyoming state line to 100 yards upstream of the Big Elk Creek trail head

Little Elk Creek (3.5 miles): Headwaters to confluence with Spring Run Canyon

Bear Creek and perennial tributaries (36.1 miles): Bear Creek from area where Skyline Road (Forest Road 077) no longer parallels the creek (located in T.2 S., R. 43 E., NE 1/4 of Section 20) downstream to Deadman Creek confluence, and the following perennial tributaries:

- South Fork Bear Creek: headwaters to mouth
- Deadman Creek: headwaters to mouth
- Chaparral Hollow: headwaters to mouth
- Warm Springs Creek: headwaters to mouth
- North Fork Bear Creek: headwaters to mouth
- Small Creek: headwaters to mouth
- Poison Creek: headwaters to mouth
- Currant Creek: headwaters to mouth
- Muddy Creek: headwaters to mouth

Palisades Creek and perennial tributaries (29.7 miles): Headwaters to junction with Forest Trail 099, and the following perennial tributaries:

- North Fork Palisades Creek: headwaters to mouth
- East Fork Palisades Creek: Idaho-Wyoming state line to mouth
- Corral Creek: Idaho-Wyoming state line to mouth
- Lost Spring Canyon: headwaters to mouth
- Dead Man Canyon: headwaters to mouth
- Little Dry Canyon: headwaters to mouth

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[2]Mileage was calculated with a geographic information system using hydrography at a scale of 1:100,000.

- Dry Canyon: headwaters to mouth, including Upper Palisades Lake
- Water Fall Canyon: headwaters to confluence with Dry Canyon

Fall Creek and perennial tributaries (13.1 miles): Fall Creek from its headwaters to confluence with Trap Creek, and the following perennial tributaries:

- East Fork Fall Creek : headwaters to mouth
- Willow Springs Creek: headwaters to mouth

Pine Creek and perennial tributaries (2.8 miles): Pine Creek 100 yards downstream of power line crossing (located in T. 2 N., R. 43 E., Section 15) to confluence with South Fork Snake River

North Fork Pine Creek and perennial tributaries (15.0 miles): North Fork Pine Creek from its headwaters to confluence with Elk Flat Fork, and the following perennial tributaries:

- Elk Flat Fork: headwaters to mouth
- Holter Creek: headwaters to mouth
- Red Creek: headwaters to mouth
- Corral Creek: headwaters to mouth

West Pine Creek (5.2 miles): Headwaters, including unnamed headwater tributaries to 100 yards upstream of West Pine Girls Camp (located in T. 3 N., R. 44 E., NW 1/4 of Section 29)

Burns Creek and perennial tributaries (17.3 miles): Burns Creek from its headwaters (and including unnamed headwater tributaries) to the Burns Canyon trail head, and the following perennial tributaries:

- Beartrap Canyon: headwaters to mouth
- Little Burns Canyon: headwaters to mouth
- Jensen Creek: headwaters to mouth
- Hell Hole Canyon: headwaters to mouth

State "natural" designation does not change or infringe upon existing water rights or vested property rights.

Recreational Rivers

The Board designates the following river/streams as "recreational" rivers:

South Fork Snake River (63.9 miles): Palisades Dam to confluence with Henrys Fork

Burns Creek (*tributary to reservoir*) (4.7 miles): Headwaters to Idaho-Wyoming state line

Trout Creek (4.6 miles): Headwaters, including all unnamed headwater tributaries, to confluence with Palisades Reservoir

McCoy Creek and perennial tributaries (62.9 miles): McCoy Creek from its headwaters to back waters of Palisades Reservoir, and the following perennial tributaries:

- Spring Creek: headwaters to mouth
- City Creek: headwaters to mouth
- Clear Creek: headwaters to mouth
- Camp Creek: headwaters to mouth
- Wolverine Creek: headwaters to mouth
- Miners Delight Creek: headwaters to mouth
- Kirk Creek: headwaters to mouth
- Iowa Creek: headwaters to mouth
- Box Canyon Creek: headwaters to mouth
- Hell Creek: headwaters to mouth
- Jensen Creek: headwaters to mouth
- Bitters Creek: headwaters to mouth

Indian Creek *(tributary to reservoir)* (1.8 miles): Idaho-Wyoming state line to Smith Canyon

Big Elk Creek (0.4 miles): One-hundred yards upstream of Big Elk Creek trail head to backwaters of Palisades Reservoir

Little Elk Creek (1.1 miles): Confluence with Spring Run Canyon to the backwaters of Palisades Reservoir

Bear Creek and perennial tributary (16.4 miles): Headwaters to point where Skyline Road (Forest Road 077) no longer parallels the creek

(located in T.2 S., R. 43 E., NE 1/4 of Section 20), and from Deadman Creek confluence to backwaters of Palisades Reservoir, and the following perennial tributary:

- Elk Creek: headwaters to mouth

Sheep Creek (5.4 miles): Headwaters to confluence with South Fork Snake River

Palisades Creek (8.2 miles): Junction with Forest Trail 099 to confluence with South Fork Snake River

Indian Creek (*tributary to main stem*)(5.9 miles): Headwaters to confluence with South Fork Snake River

Fall Creek and perennial tributaries (39.3 miles): Confluence with Trap Creek to mouth, and the following perennial tributaries:

- Beaver Creek: headwaters to mouth
- Trap Creek: headwaters to mouth
- Haskin Creek: headwaters to mouth
- Camp Creek: headwaters to mouth
- Gibson Creek: headwaters to mouth
- Blacktail Creek: headwaters to mouth
- South Fork Fall Creek: headwaters to mouth
- Currant Hollow: headwaters to mouth

Rainey Creek and perennial tributaries (25.1 miles): Headwaters to confluence with South Fork Snake River, and the following perennial tributaries:

- North Fork Rainey Creek: headwaters to mouth
- South Fork Rainey Creek: headwaters to mouth

Pritchard Creek (6.5 miles): Headwaters to confluence with South Fork Snake River

Pine Creek and perennial tributaries (21.6 miles): Headwaters to 100 yards downstream of power line crossing (located in T. 2 N., R. 43 E., Section 15), and the following perennial tributaries:

- Tie Canyon: headwaters to mouth
- Poison Creek: headwaters to mouth
- West Pine Creek: one-hundred yards upstream of West Pine Girls Camp to mouth
- Mike Spencer Canyon: headwaters to mouth

North Pine Creek and perennial tributary (8.1 miles): Elk Flat Fork confluence to mouth, and the following perennial tributary:

- Lookingglass Creek: headwaters to mouth

Black Canyon (9.1 miles): Headwaters to confluence with South Fork Snake River

Warm Springs (0.2 miles): Source to confluence with South Fork Snake River

Burns Creek (0.6 miles): Burns Canyon trail head to confluence with South Fork Snake River

Wolverine Creek (3.4 miles): Headwaters to confluence with South Fork Snake River

Cress Creek (0.1 miles): Source to confluence with Sunnydell Canal

A recreational designation for the South Fork Snake River is not intended to prevent a water user from cleaning, maintaining, or replacing an existing water diversion structure. A water user may remove obstructions from the stream channel such as gravel bars, if the obstructions interfere with the delivery or use of water under any existing water right.

Activities prohibited on "natural" rivers are also prohibited on "recreational" rivers in the South Fork Snake Basin with the following exceptions:

- Alterations of the South Fork Snake River stream bed necessary to keep the river within its historical meander below Heise, or other similar activities necessary to fulfill the flood management responsibilities of Flood Control District No. 1 are allowed in the reach from Grassy Banks (one mile above Heise gage) to the confluence with the Henrys Fork. Such activities must comply with the Stream Channel Protection Act and the rules adopted to implement the act.

• Alteration of the stream bed for installation of fisheries enhancement structures is allowed on the following reaches designated recreational: Bear Creek, Big Elk Creek, Fall Creek, North Fork Pine Creek, Palisades Creek, Pine Creek, Pritchard Creek, and Rainey Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

• Stream channel alterations are allowed for public agencies to reconstruct or realign recreation trails to prevent resource damage on the following reaches designated recreational: Cress Creek, Bear Creek, Trap Creek, South Fork Fall Creek, Palisades Creek, North Fork Pine Creek, and Rainey Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

• Stream channel alterations are allowed for public agencies to reconstruct or construct new livestock bridges to prevent resource damage on the following reaches designated recreational: Bear Creek, South Fork Fall Creek, Lookingglass Creek and North Fork Pine Creek. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

• Stream channel alterations are allowed for temporary roads for vegetation management on Burns Creek (tributary to Palisades Reservoir). Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

• Stream channel alterations for recreational dredge mining may continue on McCoy Creek from the headwaters to Fish Creek confluence, and on the following perennial tributaries: City Creek, Camp Creek, Miners Delight Creek and Iowa Creek. This activity is allowed as currently regulated by the Caribou National Forest through a Special Use Permit issued according to the guidelines established in the "Environmental Assessment for Small Placer Mining Operations in the Caribou Basin Area" (Record of Decision issued December 12, 1994), and with a Stream Channel Alteration Permit from the Idaho Department of Water Resources. Temporary diversions for the purposes of sluicing are allowed, but must obtain a Temporary Approval of Water Appropriation from the Idaho Department of Water Resources.

• Construction of boat ramps and docks may be allowed on the South Fork Snake River with Board and other regulatory agency approval for the reaches between Palisades Dam to Pine Creek confluence and Black Canyon to Henrys Fork confluence. Alterations of the stream bed must comply with the Idaho Stream Channel Alterations Rules and Regulations and Minimum Standards. This exemption does not apply to the reach between Pine Creek confluence to Black Canyon.

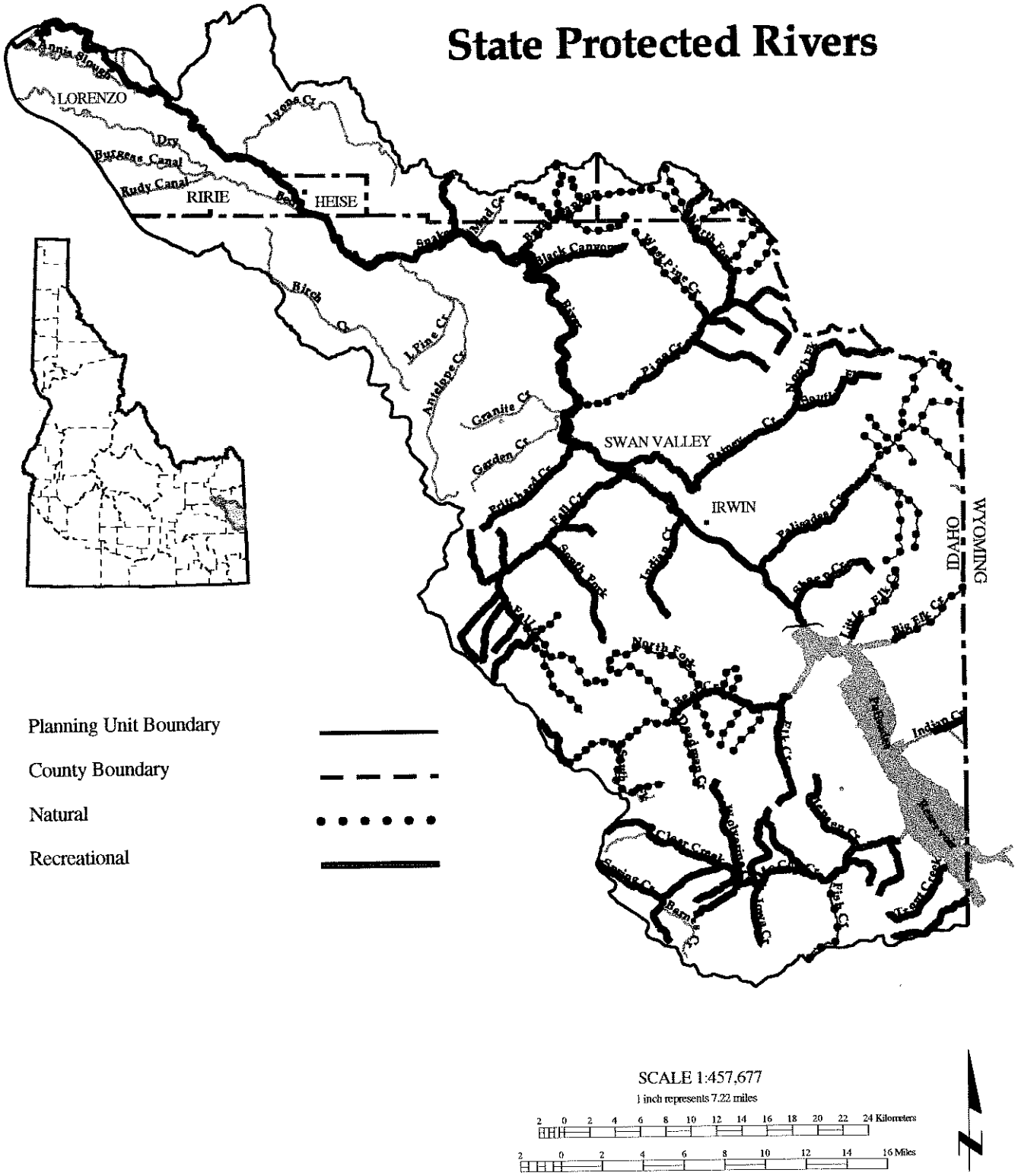
These prohibitions do not interfere with activities necessary to maintain and improve existing utilities, roadways, managed stream access facilities, diversion works, and for the maintenance of private property. State "recreational" and "natural" designation does not change or infringe upon existing water rights or vested property rights. Figure 21 shows the stream reaches with state protection designations.

MINIMUM STREAM FLOWS

It is the policy of Idaho that the Idaho Water Resource Board should seek to appropriate waters in the state for instream flow purposes when it is in the public interest. Idaho Code, Title 42, Chapter 15 provides the authority and spells out procedures for the Board to appropriate water for minimum streamflows. A minimum streamflow is a quantity of water, or lake level, in the public interest required to protect fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, navigation, transportation or water quality. By law, a minimum streamflow is not an ideal flow, but the minimum necessary to achieve the objectives. The water right is held by the Board and is junior to all earlier water rights. It is not a guaranteed minimum flow, but is only achieved after senior water rights are fulfilled.

Figure 21

State Protected Rivers



In order for the Board to acquire a minimum streamflow, a process separate from the development of a comprehensive state water plan must occur. Studies to determine the quantity and timing of the minimum streamflow will need to be conducted. The Director of the Idaho Department of Water Resources determines whether the instream flow right is granted in accordance with Title 42, Chapter 25 of the Idaho Code. Legislative review of instream flow rights granted by the IDWR is required.

To protect fisheries values, minimum streamflow studies to identify critical reaches have been recommended for several important cutthroat spawning tributaries and for kokanee habitat on Big Elk Creek:

- Bear Creek
- Big Elk Creek
- Burns Creek
- Fall Creek
- Palisades Creek
- Pine Creek

Idaho Code requires specific data to support an application for a minimum streamflow. The Board currently does not have the data required by the Code to pursue minimum streamflows on the recommended streams. The Board recommends that IDFG, in cooperation with BLM and Forest Service, conduct studies to quantify flows and acquire other necessary information to process minimum streamflow applications for the above-mentioned streams within the next five years. If the appropriate information is available, and indicates a minimum streamflow is warranted, the Board will take action.

AMENDMENTS TO STATE WATER PLAN

The *Idaho State Water Plan* is a statewide policy plan initially adopted by the Board in 1976. This effort has evolved into a continuing process directed towards formulation, adoption, and implementation of water management policies which guide development, conservation and protection of the State's water resources. While the *Idaho State Water Plan* provides broad direction about water policy and management for the state, comprehensive state water plans provide more detailed guidance for specific basins or watersheds. During preparation of a component of the comprehensive state water plan, the polices in the *Idaho State Water Plan* are reviewed and amendments relative to that basin may be proposed.

The *Idaho State Water Plan* contains a policy which provides for protection of potential reservoir sites from significant land use change, and lists sites to reserve within Idaho (IWRB, 1992). The Lynn Crandall site on the South Fork Snake River near the Burns Canyon confluence was one of the sites identified. Information received at public meetings and recommendations from the South Fork Snake Advisory Group asked for removal of Lynn Crandall as a potential reservoir site in the *Idaho State Water Plan*. Some input was received supporting continued consideration of the site as a future storage site.

The public expressed concerns about impacts to the cutthroat fishery, wildlife, recreation and scenic values with construction of the Lynn Crandall project. The resource inventory and evaluation described in this plan document outstanding fish and wildlife, recreation and scenic values for this reach of the South Fork Snake River. Weighing the environmental and social values impacted by construction of Lynn Crandall, the Board has determined it is in the public interest to remove Lynn Crandall as a potential reservoir site from the *Idaho State Water Plan*. Additionally, the Board requests the USBR to relinquish land withdrawals reserved for the project site. The USBR filed a water right application for storage for the Lynn Crandall Project with IDWR having a 1969 priority date. No action has been taken to pursue a permit or license. The Board requests that the USBR withdraw this application.

Recommendations

The Board does not have the authority or funding to implement many of the recommendations contained in the Comprehensive State Water Plan. However, the Board does have the authority to establish water policy for the state, planning for the improvement, development and conservation of water resources. These plans are also submitted to the Idaho Legislature for review and ratification. The plan for the South Fork Snake River Basin was developed with significant input and participation by citizens and agencies. The Board requests the agencies and entities referenced implement the recommendations contained in the plan, and state agencies "exercise their duties in a manner consistent with the comprehensive state water plan" [Idaho Code 42-1734B (4)]. Federal agencies are encouraged to manage their lands in a manner consistent with the recommendations contained in this plan.

NORTHWEST POWER PLANNING COUNCIL (NWPPC) PROTECTED AREA DESIGNATIONS

The Board has designated the rivers listed on pages 89-91, and shown in Figure 21, as state protected rivers. The Board recommends that NWPPC actions be in accordance with these designations.

OPERATION OF PALISADES RESERVOIR

Discussion at advisory group meetings regarding instream flows below Palisades Dam did not result in consensus with final recommendations forwarded to the Board. However, many suggestions and ideas were presented that merit further exploration.

Much of the discussion about releases at Palisades Dam indicate a need for all water interests to gather collectively and discuss their concerns. The Board believes this approach would benefit water interests in the South Fork Snake River Basin. The Board recommends that the U. S. Bureau of Reclamation work cooperatively and meet at least semiannually (before and after the irrigation season) with all water interests in a facilitated forum to exchange information and ideas about releases from the Upper Snake System (including Palisades Dam). A watershed council could be the ideal forum to facilitate these meetings. Semiannual meetings would provide a means for all water interests to talk to each other and understand others' concerns. Water interests would have an opportunity to collectively evaluate options for water resource management within legal, administrative and operating constraints to maximize benefits for all interests. Some options that may be explored by this forum include:

> Continued coordination and exploration of timing releases for objectives such as salmon flow augmentation, Idaho Power releases, and aquifer recharge to achieve other multiple benefits such as winter flows for the fishery, improving Canada geese nesting success, and providing recreation opportunities.
>
> Explore opportunities to purchase water from the water bank to guarantee minimum winter flows for the fishery, and identify entities willing to do so.

The USBR's Snake River Resource Review Project provides an outstanding opportunity to model different management scenarios for the Upper Snake System. The project will develop a decision support system helping managers to analyze different operation alternatives for the Snake System above Brownlee Reservoir. The Board supports the cooperative efforts of the Idaho Department of Water Resources and the USBR to develop an improved river management decision-making system for the Upper Snake. The Board encourages an analysis of the potential risks associated with filling the Upper Snake System reservoirs under various release scenarios at Palisades Dam, including winter flows for fishery maintenance.

SNAKE PLAIN AQUIFER RECHARGE

The Snake Plain Aquifer provides an opportunity to store water for beneficial use. The Board makes use of water in the basin as part of

the recharge program. To efficiently manage the state's water, a technically sound, hydrologic-based aquifer recharge plan needs to be prepared. The plan needs to establish clear objectives for the recharge program, determine locations and timing to apply recharge water to maximize recharge objectives, and determine consistency with conjunctive management policies. As part of this effort, some of the constraints associated with winter water savings should be reexamined.

WILD AND SCENIC RIVER SYSTEM

The Forest Service and BLM have found the South Fork Snake River and other waterways in the basin eligible for further study as potential federal wild and scenic rivers. Because of the comprehensive scope of state water planning, the Board encourages the BLM and Forest Service to work within the state water planning process rather than pursuing federal protection of waters within Idaho. State water planning provides a means of ensuring coordinated water planning with federal and state governments. Additionally, the Board requests that the Forest Service and BLM manage lands in a manner compatible with state protection designations.

LAND DEVELOPMENT IN THE BASIN

Issues and concerns associated with land development pressures in the basin frequently were mentioned during public meetings. Although a priority issue, the advisory group did not have an opportunity to work towards agreement on recommendations for this issue topic. The Board believes that maintenance of the outstanding resource values inventoried in the South Fork Snake River Basin is largely dependent on the direction and character of future development. Counties and local communities have the most influence over the future character of the basin through their planning and zoning decisions.

The Board supports the efforts of county commissioners, community officials and planning departments to work closely with the public when making decisions about land use development in the South Fork Snake River Basin. Formation of a watershed council with active participation by local government may improve communication further, and help identify local concerns and goals to achieve the future landscape setting and community desired by the local citizens. The Board encourages the communities of Swan Valley and Irwin to work cooperatively in coordinating planning activities with each other and Bonneville County.

Cooperative agreements for watershed protection need to be established between developers, farmers, and land managers in the basin, to insure that the impending changes to the South Fork Snake River Basin do not have adverse consequences for the water quality and the biological communities. Increased urbanization, soil types and the hydrologic conditions of the basin indicate conventional septic systems will not be adequate. The Board recommends that counties investigate options for financing and constructing sewage systems in the Swan Valley, Conant Valley and Irwin areas to prevent pollution of ground and surface water.

It is recommended that authorities closely monitor permitting and installation of septic systems to ensure protection of the water quality of the South Fork Snake River and its tributaries. Site planning should consider the soil assimilative capacity in selecting lot sizes. Careful review and establishment of stringent guidelines by county officials and Health District VII personnel for implementation of sewage systems should continue. The IDWR and Health District VII should continue to coordinate installation and permitting of septic systems and wells to protect ground water in the basin.

FLOOD MANAGEMENT

As the basin sees an increase in population and development, potential impacts from flooding will increase. The counties and communities in the basin participate in the National Flood Insurance Program (NFIP). Participation has resulted in adoption of floodplain ordinances which outline land use measures to minimize flood damage. The Board encourages these

entities to continue their participation in the NFIP so that risks from flooding can be minimized, and land owners have the opportunity to purchase flood insurance. The Board encourages the counties and communities to continue to take responsibility for monitoring development in the floodplain to ensure floodplain ordinances are followed, and development does not increase potential flood damage.

Flood control operations of Palisades Dam are guided by flood control rule curves with a flood stage flow of 24,500 cfs (Beus, 1996). Flows in excess of 25,000 cfs at Heise have occurred on four occasions since construction of Palisades Dam (1957). The Board recommends development should not encroach into the area inundated by these flows to minimize flood damage.

The levees below Heise were constructed to provide protection for 100-year flood events. Deposition in the South Fork Snake River channel has, and will continue, to decrease the effectiveness of these levees to contain flows of 30,000 cfs (the 100-year flood event). Sustained high velocity flows may erode levees and increase flooding risks. Major river channel shifts could impinge the levees in this reach. Currently levee maintenance by Flood Control District No.1 has consisted of riprap repairs. Current values of lands adjacent to the levees are not high enough to justify significant investments for maintenance of the levee system. However, future development may increase land values and require more expensive options. The counties are encouraged to manage lands adjacent to the levees so that land values do not require expensive flood control measures. The Board recommends that the U.S. Corps of Engineers conduct a study to identify appropriate and cost-effective flood management options to address the issue of deposition in the river channel.

MANAGEMENT OF RECREATION RESOURCES

The demands on recreation resources in the South Fork Snake River Basin have increased significantly in the past five years. These demands are the result of the outstanding recreation opportunities available on the South Fork Snake River and the growing regional and local populations. The budgets of agencies responsible for managing recreation opportunities in the basin are not keeping pace with the demand, and many have experienced reduced budgets in recent years. In order to maintain the quality of the recreation experience and protect associated resources contributing to the experience, sufficient funding must be procured.

The Omnibus Consolidated Rescissions and Appropriation Act of 1996 provides authority for the BLM and Forest Service to manage recreation fee demonstration projects. The program would allow collection of fees, and return 100 percent of the revenues for the operation, maintenance, improvement and expansion of projects at the site of collection. The Board encourages the BLM and Forest Service, in cooperation with other state and county recreation management agencies, to explore the option of collecting fees for facilities along the South Fork Snake River corridor under this program. Revenues should be used to help offset the cost of operations, maintenance and enforcement in the river corridor, and protect outstanding resource values identified in the South Fork Snake River Plan.

SOUTH FORK SNAKE RIVER BASIN PLANNING BOUNDARIES

Public comment has identified some tributaries to the Salt River that would best be evaluated as part of the South Fork Snake River Basin. Adequate evaluation of these tributaries has not occurred as part of the Board's comprehensive state water planning process for the current effort. During the next review or revision to the South Fork Snake River Basin Comprehensive State Water Plan, the Idaho Water Resource Board will expand the planning basin boundaries to include tributaries to the Salt River originating in Idaho. The tributaries include: Jackknife Creek, Tincup Creek, Stump Creek, Tygee Creek, Crow Creek, Jack Creek and their tributaries.

ADDITIONAL RECOMMENDATIONS

The following recommendations were generated during South Fork Snake Advisory Group meetings conducted in April, May and June 1996. The recommendations that follow reflect strategies that received support during group discussions at advisory group meetings. The Board adopts these recommendations as part of the Comprehensive State Water Plan for the South Fork Snake River Basin.

Water Quality

1. Agencies and property owners are encouraged to use appropriate best management practices (BMPs) for all land uses. Soil conservation districts can encourage implementation of BMPs to minimize soil erosion appropriate to farming and grazing operation and needs.

2. Local soil conservation districts are requested to seek funding and identify additional drainages that could benefit from the State Agricultural Water Quality Program, promoting voluntary participation and local decision-making.

3. Soil conservation districts are asked to review the Conservation Reserve Program (CRP) to identify additional incentives for farmers to reduce erosion.

4. Land management agencies are encouraged to increase education and enforcement to reduce erosion from off-road vehicle use.

5. DEQ and IDFG are encouraged to continue to maintain or improve water quality in a condition suitable for the preservation of healthy populations of the native cutthroat trout.

6. DEQ and Health District VII are encouraged to study the impacts of possible pollution from septic tank discharge in the South Fork Snake River Basin. This would include determining appropriate housing densities and sanitation technologies given soils types and other relevant factors.

7. BLM and Forest Service requirements to pack out human waste in the canyon section of the South Fork Snake River should continue.

8. The soil and water conservation districts, landowners and a watershed council are encouraged to work together to retain Conservation Reserve Program (CRP) lands in grass cover after contracts expire, or determine other feasible alternatives.

9. Agencies collecting water quality data, including DEQ, IDWR, USGS, IDFG, and universities, are encouraged to develop a common database to allow sharing of information between agencies.

10. The Board supports citizen involvement in the formulation of water quality monitoring plans and reporting by DEQ and the Health District. These data should be reported regularly.

11. DEQ is encouraged to implement an appropriate water quality monitoring program to ensure that adverse water quality trends are detected in a timely manner.

12. The Idaho Department of Agriculture and canal companies are encouraged to educate people about the potential effects to downstream users of dumping into canals and other waterways.

13. DEQ, the Health District, and counties are encouraged to explore feasible options for counties in the basin to finance sewage systems for water quality protection.

14. Idaho Department of Agriculture is encouraged to educate pesticide users that any rinsing, dumping or spilling of pesticides into waterways is prohibited and can adversely impact water quality.

Fisheries

1. To safeguard against over harvest in the future while providing for increasing recreational demand, the Board supports IDFG efforts to continue focusing on trout habitat maintenance,

and increasing overall habitat quality and quantity. If over harvest occurs, Idaho Department of Fish and Game is encouraged to develop more restrictive regulations.

2. IDFG is encouraged to continue working with other land management agencies and land owners to increase spawning habitat by protecting spawning tributaries and screening tributary diversions.

3. The Board recommends the NRCS, IDFG and Trout Unlimited initiate further planning and evaluation of the Rainey-Palisades Creek irrigation project to determine if other alternatives are available to improve irrigation efficiency and fish passage. These entities should also explore cooperative funding options.

Riparian Management

1. Land management agencies are encouraged to educate the community about the importance of cottonwood regeneration.

2. The Board recommends the Legislature pass legislation to allow tax incentives for leaving riparian areas undeveloped, or improving riparian habitat and badly eroded areas.

3. Control noxious weeds through use of biological techniques by encouraging and supporting continued efforts by the South Fork Biological Weed Control Committee.

4. Recommend state and federal agencies, and local governments work cooperatively to identify options to preserve and enhance the cottonwood forest. Options to consider include fencing high use areas on the main stem or tributaries, beaver control, or creative land zoning.

5. The BLM, Forest Service and IDFG are encouraged to investigate the feasibility and expense of planting cottonwoods.

6. A cooperative study involving state and federal agencies investigating the feasibility of using flood flows to help promote cottonwood regeneration is recommended. Determine the most plausible flows that will not significantly impact property. Determine other beneficial and adverse impacts that would occur with these flows.

Wildlife

1. Encourage BLM, Forest Service, U.S. Fish and Wildlife Service and/or IDFG to install posters at boat put-ins to warn people about disturbing or harassing birds (especially bald eagles) and other wildlife.

2. The IDFG is encouraged to work cooperatively with USBR regarding releases to ensure Canada geese nesting success.

3. Organization by IDFG of an annual volunteer effort for regular maintenance of goose nesting boxes is recommended.

Recreation

1. Idaho Department of Parks and Recreation, county sheriffs, and boating organizations are requested to encourage, educate and promote proper boating etiquette on the South Fork Snake River. This could involve implementation of a program to help various recreation users resolve conflicts and learn to respect each other.

2. Legislation is needed allowing the Idaho Outfitters and Guides Licensing Board to issue larger fines to ensure strict enforcement of outfitter and guide regulations. Legislation should allow confiscation of property in addition to monetary fines for individuals who illegally practice outfitting.

3. The Board supports establishing a Memorandum of Understanding (MOU) between the Idaho Department of Fish and Game, Idaho Outfitters and Guides Licensing Board, U. S. Forest Service, Bureau of Land Management, and Bonneville County to coordinate efforts to enforce regulations for the outfitting and guiding industry and recreational activities on the South Fork Snake.

Agency Management

1. Concerned citizens are encouraged to establish a watershed council for the South Fork Snake River Basin to help coordinate management agencies' and local officials' activities and ensure that citizens' concerns are accommodated in the decisions. Membership and participation should be broad-based, including all interest groups and agencies.

Use the watershed council as a forum to:

- Establish agreements in cooperation with landowners along the river to protect water quality.
- Coordinate with landowners and agencies to resolve conflicts.
- Educate homeowners about the sources of pollution harmful to aquatic life, i.e., lawn chemicals, septic tank discharge, automotive and household fluids, and siltation.
- Educate landowners about the opportunity to obtain loans and grants from the Soil and Water Conservation Districts (through the Idaho Soil Conservation Commission) for range and riparian improvements.

2. The watershed council should explore funding opportunities to support council activities, including the availability of mitigation monies from the Bonneville Power Administration.

Water Allocation

1. Agencies and organizations desiring instream flows, such as IDFG and Trout Unlimited, are encouraged to explore ways to secure these flows. Options to consider might include buying reservoir storage space, purchasing from the water bank, and/or working with irrigators to identify minimum flows in the river.

Operation of Palisades Project

1. If possible within operating constraints, the USBR is encouraged to release water early enough from Palisades and Jackson dams with the goal of maintaining flows less than 18,000 cfs during July to enhance recreation.

2. Wildlife agencies and organizations are encouraged to work with irrigators and the USBR on any compromises to achieve flow rates to better balance wildlife needs.

3. The USBR is requested to establish ramping rate protocols for Palisades Dam that can be accommodated in system constraints.

4. The USBR is encouraged to manage releases from the Upper Snake projects to integrate flows needed for fisheries, recreation, wildlife and riparian habitat, in addition to irrigation and flood control objectives.

Irrigation

1. The IDWR is encouraged to quantify how improved efficiency effects aquifer recharge and water levels at wells and springs.

2. The watermaster and canal companies are encouraged to investigate options for improving voice messaging and posting messages over the weekend to Water District One to improve efficiency in managing water.

Flood Management

1. A study to address the high water table and flooding concerns in Ririe and surrounding areas is recommended.

2. Flood Control District No. 1 should maintain existing dikes/levees/riprap for property currently protected. Do not allow expansion of dikes/levees/riprap to make additional land available for development.

3. The counties are encouraged to discourage building in the floodplain.

4. The counties are encouraged to restrict development adjacent to the South Fork Snake River corridor that would infringe upon the U.S. Bureau of Reclamation's ability to release flood stage flows of 24,500[3] from Palisades Dam.

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[3] Source for 24,500 cfs flood stage flow is Beus, 1996.

Impacts of Actions and Recommendations

On waterway reaches designated natural, the Board must prohibit construction or expansion of dams or impoundments; construction of new hydropower projects; construction of water diversion works; dredge or placer mining; alterations of the stream bed; and mineral or sand and gravel extraction within the stream bed (Idaho Code 42-1734A(5)). This designation does not change or infringe upon existing water rights or other vested rights.

On waterway reaches designated recreational, the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; construction of water diversion works; dredge or placer mining; and mineral or sand and gravel extraction. Within the stream channel, alterations would be prohibited except those necessary (1) to maintain and improve existing utilities, roadways, diversion works, fishery enhancement structures, and stream access facilities; (2) for the maintenance of private property; (3) for construction of new fishery enhancement facilities on Bear, Big Elk, Fall, North Fork Pine, Palisades, Pine, Pritchard and Rainey creeks; (4) for reconstruction or realignment of recreational trails on Cress, Bear, Trap, South Fork Fall, Palisades, North Fork Pine, and Rainey creeks; (5) for reconstruction or construction of new livestock bridges on Bear, South Fork Fall, Lookingglass and North Fork Pine creeks; and (6) for temporary roads for vegetation management on Burns Creek (tributary to reservoir). Recreational dredge mining is allowed on McCoy Creek when conducted in accordance with Special Use Permits granted by the Forest Service and the Stream Channel Alteration Permit program administered by IDWR.

Construction of private river access facilities (i.e., boat docks) on the South Fork Snake River may be allowed with approval by the Idaho Water Resource Board and other regulatory agencies for the following reaches: between Palisades Dam to Pine Creek confluence and between Black Canyon to Henrys Fork confluence. Construction must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards. Private river access facilities are not allowed on the South Fork Snake River from Pine Creek confluence to Black Canyon.

No provision of the Comprehensive State Water Plan will limit, restrict, or conflict with approved applications for the appropriation of water or with any vested property rights, i.e. existing water rights, diversion, mineral rights, and other private property rights. No provision of this plan will prevent a water user or their agent from cleaning, maintaining, or replacing an existing water diversion structure. A water user or their agent may remove any obstructions from the stream channel, if such obstruction interferes with the delivery of, or use of, water under any existing water right. No provision of this plan is intended to interfere with the Flood Control District No. 1's maintenance of the levee system below Heise. Management of land adjacent to protected rivers remains the responsibility of the land owners or managers, and local planning authorities. Designation of waterways as protected rivers will not affect the operation or legal use of any existing hydropower project which does not enlarge existing boundaries or impoundments.

Changes in land use activities in the basin may result in requests for changes in nature of use, place of use, or point of diversion of existing water rights. These activities will require appropriate review and approval by the Idaho Department of Water Resources and may be prohibited if the Director determines changes are not in the public interest. The state protection designations, in addition to maintaining the outstanding fish and wildlife, recreation and scenic values identified in the basin, protect the current water uses in the basin.

Construction of Lynn Crandall would impound the canyon section of the South Fork Snake River and alter the hydrologic regime. This plan prohibits construction of this project. The opportunity to store water available in high water years, and maximize power generation at Palisades Powerhouse are lost. Changes in flow

below the dam and a change from a river to reservoir environment in the canyon would significantly impact the outstanding cutthroat fishery in the canyon, associated recreational opportunities, and the riparian environment. The fishery and recreation are an important part of the local economy and attract people from around the nation. It is also considered an important part of the quality of life to the local citizens.

Responsible timber, farm and ranch management practices are fully consistent with protected designations and can continue unhindered under such designations.

The Snake River Activity/Operations Plan, BPA Wildlife Mitigation Plan, resource management plans of soil conservation and water districts, and IDFG Fisheries Management Plan will have a positive influence in the basin. Continued implementation of these plans will help reduce erosion, siltation, and destruction of water quality, and in turn help maintain or improve water quality, and wildlife and fishery habitat. The South Fork Snake River Plan does not impact continued implementation of these plans.

Water quality activities of the DEQ can be enhanced through formation of a local watershed council as recommended by the Board, providing an entity to function as a WAG for the basin. The watershed council will improve agency communication and coordination, and give local citizens a stronger, coordinated voice in resource management in the basin.

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GLOSSARY AND ACRONYMS

AF - acre-feet

AFA - acre-feet per acre

Beneficial use - a set of uses of water which are deemed by law to provide legitimate basis for a water right.

Best management practices - the state-of-the-art practices that are efficient and effective, practical, economical, and environmentally sound to minimize soil erosion.

BLM - U.S. Department of Interior, Bureau of Land Management

Board - the Idaho Water Resources Board (IWRB).

BPA - U. S. Department of Energy, Bonneville Power Administration

CDC - Idaho Department of Fish and Game, Conservation Data Center

cfs - cubic feet per second, a unit of measure for the rate of discharge of water. One cubic foot per second is the rate of flow of a stream with a cross section of one square foot which is flowing at a mean velocity of one foot per second. It is equal to 448.8 gallons per minute, or 1.98 acre-foot per day.

CoE - U. S. Army Corps of Engineers

Comprehensive state water plan - the plan adopted by the Board pursuant to section 43-1734A, Idaho Code, or a component of such plan developed for a particular water resource, waterway or waterways and approved by the Idaho Legislature.

Confluence - the flowing together of two or more bodies of water.

Conservation - increasing the efficiency of energy and water use, production, or distribution.

Consumptive use - the amount of water that actually is consumed during its application to beneficial use and is removed from the stream system.

Culinary supply - water meeting all applicable safe drinking water requirements suitable for residential and commercial use.

DCMI - Domestic, commercial, municipal and industrial uses.

> **Domestic** - water used for residential household purposes and residential lawn and garden watering. Municipal irrigation of parks and golf courses is included here.
>
> **Commercial** - water used by hotels, motels, restaurants, office buildings, retail sales stores, educational institutions, churches, hospitals, and government and military facilities.
>
> **Municipal** - consists of the sum of "residential" and "commercial" uses, which are not usually identified separately in available records of water use.
>
> **Industrial** - water used to manufacture products. Places of industrial use include meat packing, dairies, cheese factories, other food processing enterprises, gravel washing, and ready-mix concrete operations.

DEQ - Idaho Department of Health and Welfare, Division of Environmental Quality

Ecosystem - a complex system composed of a community of flora and fauna taking into account the chemical and physical environment with which the system is interrelated.

Endangered Species Act - Section 7 of this federal statute, (16 U.S.C. §1536), requires that the government take no action which may jeopardize the continued existence of any endangered or threatened species or adversely modify its critical habitat. Where the federal government is involved in a water project (either by building it or issuing a permit or license), the Endangered Species Act may prohibit the government from proceeding if the loss of water will be harmful to such species.

Endangered species - any species which, as determined by the U.S. Fish and Wildlife Service or National Marine Fisheries Service, is in danger of extinction throughout all or a significant portion of its range.

EPA - *Environmental Protection Agency*

FERC - Federal Energy Regulatory Commission established in 1977 (replacing the Federal Power Commission) with the primary responsibility of ensuring the Nation's consumers adequate energy supplies at just and reasonable rates and providing regulatory incentives for increased productivity, efficiency, and competition. Its primary functions are to establish and enforce rates and regulations regarding interstate aspects of the electric, natural gas, and oil industries. It also issues licenses for non-Federal hydroelectric plants and certifies small power production and cogeneration facilities.

Floodplain - the land that may be submerged by floodwaters. The plain built up by stream deposition. The 100-year floodplain identifies the land in the floodplain subject to a 1 percent or greater chance of flooding in any given year.

Floodway - the channel of the stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

Habitat - the place or type of natural site where a plant or animal normally lives and grows.

Head - the elevational difference between the surfaces of water; usually upstream and downstream of a turbine or pump. The differential of pressure causing flow in a fluid system, usually expressed in terms of the height of a liquid column that the pressure will support.

Highwater mark (line) - the line that separates the aquatic vegetation from terrestrial vegetation.

Hydropower project - any development which uses a flow of water as a source of electrical or mechanical power, or which regulates the flow of water for the purpose of generating electrical or mechanical power. A hydropower project development includes all powerhouses, dams, water conduits, transmission lines, water impoundments, roads, and other appurtenant works and structures.

Idaho Code - the Idaho laws, in this case those pertaining to water issues.

IDFG - Idaho Department of Fish and Game

IDWR - Idaho Department of Water Resources

IOGLB - Idaho Outfitters and Guides Licensing Board

Irrigation - water used for irrigation of cropland. Residential lawn and garden uses are not included.

IWRB - Idaho Water Resource Board

kwh - Kilowatt- hour - unit of energy equal to that expended by one kilowatt in one hour.

Kilowatt (kw) - unit of electric power equal to 1,000 watts, or about 1.34 horsepower.

Lava plain - a broad stretch of nearly level to gently undulating surface underlain by basaltic flows.

Loam - moderately coarse, medium and moderately fine-textured soils that include such textural classes as sandy loam, fine sandy loam, very fine sandy loam, silt loam, silt, clay loam, sandy clay loam and silty clay loam.

Main stem - the main channel of a river, in this plan it is referring to the South Fork Snake River.

Megawatt (MW) - unit of electrical power equal to 1,000,000 watts, or about 1,340 horsepower.

Minimum stream (instream) flow - the water that is not diverted and used but rather remains for wildlife habitat, recreation, navigation, and aesthetic beauty.

Natural River - a waterway which possesses outstanding fish and wildlife, recreation, geologic or scenic values, which is free of substantial existing man-made impoundments, dams or other structures, and of which the riparian areas are largely undeveloped, although accessible in places by trails and roads.

NWPPC - Northwest Power Planning Council

Placer or dredge mining - any dredge or other operation to recover minerals with the use of a dredge boat or sluice washing plant whether fed by bucket line or separate dragline or any other method. This could include, but is not limited to, suction dredges which are capable of moving more than 2 cubic yards per hour of surficial material.

Plain - a region of general uniform slope, comparatively level, of considerable extent, and not broken by marked elevations and depression.

PNRBC - Pacific Northwest River Basins Commission

Preliminary permit - a FERC authorization granting priority right to file a license application, and authorizing the permittee to conduct studies and analyses necessary to prepare a complete license application. A preliminary permit does not permit any construction.

Private, Domestic, and Stock - water used from private wells or springs for individual homes, usually in rural areas not accessible to public water supply systems.

Public interest - something that impacts the majority of the people, usually beneficially.

Public water supply - water supplied to either private or publicly owned community systems which serve at least 15 service connections or 25 individuals at least 60 days per year. Water from public supplies is used for residential, commercial, and industrial purposes, including irrigation of publicly owned areas.

Ramp rate - the maximum allowable rate of change in output from a power plant. The ramp rate is established to prevent undesirable effects due to rapid changes in loading, or in the case of hydroelectric plants, discharge.

Recreational dredge mining - dredge mining in which the nozzle is 5 inches or less, and moves less than 2 cubic yards per hour.

Recreational River - a waterway which possesses outstanding fish and wildlife, recreation, geologic or scenic values, and which might include some man-made development within the waterway or within the riparian area of the waterway.

Riparian - living on or adjacent to a water supply such as a riverbank, lake, or pond; that area within 100 feet of the mean highwater mark of a waterway.

River basin - the total drainage or catchment area of a stream (i.e., the watershed).

Riparian vegetation - vegetation that is associated with aquatic (streams, rivers, lakes) habitats.

RVD - Recreational Visitor Days. One RVD is equivalent to one person spending 12 hours at a particular activity.

SAWQP - State Agricultural Water Quality Plan

SCS - U.S. Department of Agriculture, Soil Conservation Service. This agency reorganized and changed its name to the Natural Resource Conservation Service (NRCS) in 1994.

Secondary systems - pressurized lawn and garden irrigation systems using untreated water for irrigation of lawns, gardens, and publicly owned open areas.

Threatened species - a species, determined by the U.S. Fish and Wildlife Service or National Marine Fisheries Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

TMDL - Total Maximum Daily Load. Total maximum daily load is the sum of all pollutants in a waterway. Pollutant levels established through TMDL standards must be at or below the level established for the waterway to abide by water quality standards.

Turbidity - a measure of the extent to which light passing through water is reduced due to suspended materials. Excessive turbidity may interfere with light penetration and minimize photosynthesis, thereby causing a decrease in primary productivity. It may alter water temperature and interfere directly with essential physiological functions of fish and other aquatic organisms, making it difficult for fish to locate a food source.

USBR - U.S. Department of Interior, Bureau of Reclamation

USGS - U. S. Geological Survey

Vested rights - those rights that are fixed and not contingent upon any future actions; for example, mining claims or a water right. A protected river designation cannot interfere with vested property rights made prior to the designation.

Water table - the highest part of the soil or underlying rock material that is wholly saturated with water. On some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Waterway - a river, stream, creek, lake or spring, or a portion thereof.

Wetlands - lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. Wetlands must have the following three attributes: (1) at least periodically, the land supports predominately hydrophytes; (2) the substrate is predominately undrained hydric soil; and (3) the substrate is on soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

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APPENDICES

APPENDIX A:
SOUTH FORK SNAKE ADVISORY GROUP

ADVISORY GROUP MEMBERS

Mark Bennion - South Fork Snake River canyon landowner
Dr. Steven Christensen - Ririe area landowner
Bill George - Blue Ribbon Coalition
Renell Weeks - Swan Valley area landowner
John Hill - Outfitters and guides
Ron Hover - Idaho Wildlife Council
Gerald Jeppesen - Madison County Commissioner
Tamar Jergensen - South Fork Snake Watershed Council
Theron McGarry - Grazing
Jon Ochi - Idaho Rivers United
Shaun Robertson / Chad Colter - The Shoshone-Bannock Tribes
Bill Shurtliff - Bonneville County Commissioner
Claude Storer - Irrigator / Committee of Nine
Kenneth Stromberg - Jefferson County Commissioner
Bill Terry - Trout Unlimited, Upper Snake River Cutthroats Chapter
Delbert Winterfeld - Dryland farmer / Soil Conservation Districts
Gerald Wolz - Private citizen / recreationist

SUMMARY OF SOUTH FORK SNAKE ADVISORY GROUP MEETINGS

The following summarizes the nine advisory group meetings held between June 1995 and June 1996. Attendance sheets and more specific information about each of these meetings is contained in IDWR files.

Meeting #1 - Monday, June 19, 1995; 7:00 - 10:00 p.m.; Ririe Lions Hall, Ririe, Idaho

The meeting began with introductions and review of material mailed to the South Fork Snake Advisory Group (SFSAG) earlier. The Idaho Water Resource Board (Board) and Idaho Department of Water Resources' (IDWR) staff answered questions about the planning process and the Board's authority. The SFSAG and the two Board members present (Jerry Rigby and Dave Rydalch) signed a Letter of Acknowledgment. The letter formally recognizes the willingness of all SFSAG members to participate on the advisory group.

An Issue Summary list, containing a condensed version of all public comment, was reviewed. Issues were grouped into eleven categories. IDWR recorded comments about the issues on flipcharts. After discussing five of the eleven categories, the SFSAG decided to send comments about the remaining issue categories to IDWR by July 10. IDWR would compile a final issue list with items that the Board has control or authority to carry out highlighted. IDWR will mail this list to the SFSAG on July 10. The SFSAG would review this list, set priorities, and send back the prioritized list to IDWR by July 30.

Meeting #2 - Monday, August 28, 1995; 6:30 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

This meeting focused on issues concerning water quality, fisheries, riparian management and wildlife. Four speakers were invited to present information to the SFSAG. They included Chris Mebane of the Division of Environmental Quality (DEQ), Bob Martin from the Idaho Department of Fish and Game, Mike Merigliano from the University of Montana, and Justin Naderman with the Idaho Department of Fish and Game.

Chris Mebane from the Eastern Region of the Division of Environmental Quality presented information on water quality. He described the results of a water quality study conducted September through October 1994 during

drawdown of Palisades Reservoir. In brief, the study concluded that state standards for turbidity and dissolved oxygen were not exceeded. Temperature parameters were exceeded. He also discussed water quality limited streams and reaches in the South Fork Snake River Basin. The South Fork Snake River in the basin is listed as a water quality limited reach because of reduced flows and not due to pollutants. Future actions of DEQ with respect to monitoring water quality segments were discussed in brief.

Bob Martin, Environmental Coordinator for Region 6 of the Idaho Department of Fish and Game, presented information on the fisheries. Habitat, recruitment needs, and comparison of growth rates of trout in the South Fork Snake River to other Idaho waterways were discussed. The importance of vegetation, and tributary and side channels for spawning were mentioned. Some discussion occurred about the threat of hybridization of cutthroat trout with rainbow trout, and disease.

Mike Merigliano, a research assistant with the University of Montana, discussed his research on cottonwood regeneration on the South Fork Snake River from Palisades Dam to Heise. Slides were presented depicting the historic development of cottonwood stands on the South Fork Snake River, and how this related to historic flood regimes before and after Palisades Dam.

Justin Naderman, Regional Wildlife Biologist with IDFG, summarized information about wildlife in the South Fork Snake River Basin. He first discussed bald eagle habitat requirements and the significance of the South Fork Snake River population, because it is the primary producer in the Greater Yellowstone Ecosystem. He discussed Canada geese and flow regime needs for successful reproduction. A flow of 8000 cubic feet per second is ideal with a constant flow Mid-May to March. Also noted were the important wintering habitat for elk, deer and moose, the presence of mountain goat and black bear in the basin.

After the presentations by the speakers, attendees were asked to submit strategies addressing the issues presented at this meeting.

Meeting #3 - Monday, November 6, 1995; 6:30 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The third South Fork Snake Advisory Group meeting focused on agency management & direction, growth & development, and recreation topics. A worksheet that summarized the top ranking issues for these topics was distributed. The worksheet's purpose is to provide a means for the advisory group and public to suggest strategies or solutions to address the wants/needs listed under each issue topic. A master list of all suggestions is being compiled and will be considered and refined by the SFSAG at a meeting in the Spring of 1996.

Summaries on other agency planning efforts occurring within the basin, existing and potential water development, and recreation information were distributed. A chart listing current planning efforts by other agencies within the basin was reviewed. This chart lists six major planning efforts currently occurring within the South Fork Snake River Basin, and four additional activities that include the basin. The scope, status, and contacts for these planning efforts were briefly discussed.

A "Suitable Timber" map was discussed. The map depicts areas that the Targhee National Forest have identified as technically capable and available to grow and harvest timber. A map depicting "Mines and Prospects" was described. A "Water Development" map was presented and a written summary distributed describing existing and potential water development. A "Land Development" map was described depicting all platted subdivisions located in the basin. Rhett Bradford, Mayor of the City of Irwin, spoke about land use development and its effects to the area.

Wade Brown, recreation planner with Bureau of Land Management, discussed recreation activity on the South Fork Snake River. He reviewed use statistics and recreation trends, river access, and impacts and monitoring. Ellen Berggren, from the Idaho Department of Water Resources, provided some additional information about recreation in the basin. Some information about regional recreation trends and use from studies conducted by University of Idaho in 1987 and 1993 were described. Estimates of recreation use by activity for each agency were reported. Some information on angler use and catch rates were reported for past years. Recent information is not available. Information on estimated hunters days was also presented. Number of clients serviced by the outfitting industry over the last five years were presented. A written summary of this information was distributed.

A listing of all strategies submitted to the Board to date were available for review at the meeting. Attendees were given the opportunity to add strategies to these lists during meeting breaks and at the end of the meeting.

Meeting #4 - Monday, January 22, 1996; 6:30 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The fourth South Fork Snake Advisory Group meeting focused on water quantity & allocation, irrigation, flood management, and operation of Palisades Dam. Mapped information addressing these topics was displayed for public review. Maps depicted irrigated and non-irrigated agricultural land in the South Fork Snake River Basin and the region, flood control district boundaries, canal company boundaries, and existing and potential water development projects.

Phil Rassier with the Attorney General's office talked about Idaho water law. His presentation included explanation of the following topics: the history and definition of the prior appropriation doctrine; allocation of water in times of shortages; definition of changes to water rights such as enlargement, transfers and expansions; losses of water rights; management of groundwater and conjunctive management; explanation of the public trust doctrine and federal reserved rights; and the Snake River Basin adjudication. Mike Beus discussed operation of the Upper Snake System with a focus on Palisades Reservoir. He noted that there were several constraints that guided operation of the system. These included federal and state law, project authorizations, contracts with irrigators, and federal and state regulatory constraints including the Endangered Species Act.

A listing of all strategies submitted to the Board to date were available for review at the meeting. Attendees were given the opportunity to add strategies to these lists during meeting breaks and at the end of the meeting.

Meeting #5 - Monday, February 26, 1996; 6:30 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The main objective of the fifth South Fork Snake Advisory Group meeting was to review the evaluation of outstanding fish and wildlife, scenic and recreation resources conducted by the Idaho Department of Water Resources. First an explanation of why the Board needs to identify outstanding resource values was provided. Then the criteria used to determine outstanding resource values were presented.

Dave Greegor, aquatic biologist with the Department, described the biological evaluation. The biological evaluation reviewed available data about aquatic and riparian habitat and species, and the presence of crucial species and habitats. Ellen Berggren, water resources planner with the Department, described the recreation and scenic values evaluation.

After the presentations, people were invited to examine the maps and supporting documentation for the outstanding resource evaluations. Flip charts were also provided to offer additional suggestion for recommendations, actions or policies for inclusion in the South Fork Snake River Basin Plan.

Meeting #6 - Monday, March 25, 1996; 6:30 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The main objective of the sixth South Fork Snake Advisory Group meeting was to review and finalize the goals for the South Fork Snake River Basin, and evaluate the strategies compiled since August 1996. Based on the issues and concerns identified at past meetings a set of goals, or the desired future, were drafted. Goals listed under each of the eleven issue categories were reviewed and discussed by the group. Revisions were made to many so that all in attendance felt comfortable with them.

Next the South Fork Snake Advisory Group was given a twenty-five page list of strategies to evaluate. The list was compiled from suggestions received from the advisory group and public. The advisory group was asked to review all the strategies on the list and circle those they could not support as written. The purpose of this exercise was to identify strategies agreeable to everyone, and identify where conflict may exist. Those strategies that have group agreement will be presented to the Board for inclusion in the South Fork Snake River Basin Plan. Strategies where there is not agreement by the group will be discussed at the remaining meetings, determining if strategies can be revised so they are acceptable to all, or to suggest other ideas.

Meeting #7 - Monday, April 15, 1996; 7:00 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The seventh South Fork Snake Advisory Group meeting reviewed the final goals established for the South Fork Snake River Basin, and the results of the strategy evaluation that occurred at the previous meeting. First, the results of the strategy evaluation were briefly discussed. Advisory group members reviewed 245 strategies at the last meeting. They were to identify those they did not support as written. Of the 245 strategies reviewed, the advisory group agreed on about 9 percent of them. The group was close to agreement for another 30 percent of the strategies (only one or two individuals did not support). About 32 percent of the strategies received moderate agreement (three or four individuals did not support). More substantial disagreement occurred for the remaining 30 percent of the strategies (five or more people did not support).

Planning staff at IDWR identified all the strategies where a consensus seemed close (disagreement by three or fewer advisory group members), grouping strategies with similar topics together. The advisory group reviewed and discussed each group of strategies, focusing on one group at a time. The process involved discussion of the strategies, suggestions for wording changes, or suggestions for new strategies. When the group felt comfortable with the final strategies, discussion moved to the next category.

Meeting #8 - Friday, May 17, 1996; 7:00 - 10:00 p.m.; Ririe Senior Citizens, Ririe, Idaho

The objective of the eighth South Fork Snake Advisory Group meeting was to make recommendations to the Board for natural or recreational river designations, and identify waterways for minimum streamflow study. Ground rules proposed to help the group work cooperatively were reviewed before beginning discussion about natural and recreational designations. The definition of a state natural or recreational river was briefly discussed, and the restrictions associated with each designation were described.

The advisory group discussed potential designations for Pine, Burns, Bear, and Big Elk creeks, and Warm Springs. These discussions resulted in agreement on several points. Since discussions for individual streams were taking a great deal of time, Ellen Berggren (Idaho Department of Water Resources) proposed reviewing the list of eligible streams to determine which did not have group support for designation. Based on the comments and discussion for the previous streams, Ellen would make a preliminary cut at specific designations for the streams selected by the group. This preliminary cut would be sent to the advisory group for their

review before submitting recommendations to the Board. This approach resulted in the group agreeing to designate all eligible streams with stipulations made for some waterways.

Discussion next addressed the issue of a minimum streamflow for the main stem South Fork Snake River. The discussion noted the legal constraints associated with operation of Palisades Dam, and the need to manage flows to meet contractual obligations to irrigators. Several suggestions were offered to meet contractual obligations to irrigators and attempt to achieve flows to maintain fisheries. Consensus was not reached on all items. The group then discussed and proposed minimum streamflow study for several tributaries to the main stem.

Meeting #9 - Monday, June 3, 1996; 7:00 - 10:00 p.m.; Ririe Senior Citizens Center, Ririe, Idaho

The final meeting's objective was to conclude discussions about the remaining strategy topics. The meeting devoted 20 minutes of discussion time to each of the following topics: water allocation, flood management, water development, operation of Palisades, riparian management, and water quality. Eight additional topics that did not deal with water management, but were indirectly related, remained. Individuals at the meeting were asked to rank the top two topics they would like to discuss. At the end of the meeting, the top ranked categories would be discussed using the time remaining. Recreation issues were ranked the highest by the group and were discussed in the time remaining.

The process involved discussion of the strategies, suggestions for wording changes, or suggestions for new strategies. When the group felt comfortable with the strategies, discussion moved to the next category. A final list of draft strategies/recommendations developed during advisory group meeting discussions was submitted to the SFSAG within the next two weeks, allowing one final opportunity to review them before they were submitted to the Board.

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APPENDIX B: ISSUE SUMMARY

The following list was derived from comments provided by individuals attending public meetings held by the Idaho Water Resource Board from February 27 through March 2, 1995; a South Fork Snake Advisory Group meeting on June 19, 1995; and written comments. Eleven broad categories were identified. Individual comments were arranged under the appropriate category heading. Repetitious comments were grouped together and condensed to a single statement. The order of presentation does not indicate significance or importance of the issue.

Water Quality

- protect water quality of all tributaries
- accumulate data to allow monitoring and verification of water quality impacts
- minimize erosion through protection of natural vegetation and encouraging use of BMPs for all land uses
- establish cooperative agreements with landowners along the river to help protect water quality
- establish policy applicable statewide regarding flows outside the state and into the Lower Columbia (water quality and quantity)
- monitor and manage activities (float trip sanitation, development in corridor, livestock) potentially impacting water quality in basin to minimize water pollution
- water quality concerns from releases at Palisades Dam
- maintain water quality in a biologically beneficial condition when it leaves basin

Fisheries

- maintain a quality fishing experience
- minimum stream flows to maintain fishery year round
- protect areas where streams merge for fisheries
- protect fishery on South Fork from overuse

Riparian Management

- tax incentives for riparian improvements
- control noxious weeds along river using method safe for the water
- preservation of riparian vegetation in developed areas
- funds to help fence along the river
- maintain and enhance riparian visual corridor
- preserve and maintain cottonwoods -- flooding required for regeneration, use bank storage for cottonwood regeneration in years of excess water
- control bank erosion to protect natural vegetation

Wildlife

- protect wildlife habitat -- instream flows, cottonwood restoration/protection, eagle and geese nesting, canyon which is important to eagle
- concerns about beaver in some sections of the river and recommendations to transplant to others

- recognize the value of waterfowl, wildlife habitat and birds of prey

- maintain basin ecological integrity

- concerns about BPA wildlife mitigation plan

Recreation

- conflicts between motorized and non-motorized uses

- appropriate types and amount of recreation use on the South Fork Snake River

- maintain or improve access to river for recreation

- concerns about commercial outfitters

- safety concerns at the Big Feeder Diversion

- improved enforcement of violations

- long range recreation use management plan to address safety, sanitation, carrying capacity, and interpretive signs

- maintain quality outdoor recreation experience -- fishing, hunting, camping, hiking, rafting, and aesthetic values

- adjust releases from Palisades Dam to be in line with other uses (fish, wildlife and recreation)

- means to obtain current information on flows and predicted flows

- concerns about out-of-state demands for recreation resources

- need daily fees assessed to users or registration system

- determine impacts to recreation if Lynn Crandall storage reservoir were built

- manage for all recreation uses

- recreation users need to be courteous to each other

- policies pertaining to recreation uses should be general in nature

Development and Growth

- protect rural lifestyle and economy

- control subdivisions

- concerns about land uses and development along the river, particularly in the canyon, and associated impacts

- cooperative agreements with landowners along the river to help protect resource values

- establish setbacks for riparian corridor protection

- concerns about dams in canyon or on other reaches of the Snake

- concerns about impacts to private property rights

- existing mineral rights

- no additional boat ramps

- concerns about hydropower development

- concerns about timber sales

- need additional storage in the basin to store in high water years

Agency Involvement and Management Direction

- effects to private land ownership rights

- regulations with flexibility to apply to individual conditions at specific streams, not blanket regulations -- allow local input

- improved coordination between all agencies with responsibilities in the South Fork Snake River basin

- recommend formation of a group to coordinate with landowners regarding easements, etc.

- federal versus local control of resources

- concerns about BPA wildlife mitigation plan

- communication with all stakeholders facilitated and improved

- management decisions using the best available science

- form watershed council

- concerns about omitted lands and the outcome

- public education literature dealing with water and land use issues

- support and opposition to federal and state designations of rivers and streams

Water Quantity and Allocation

- maintain existing water rights, including instream livestock watering

- make water available for instream flows by changing water law to encourage water conservation or allowing changes from consumptive uses (irrigation) to non-consumptive instream uses

- investigate transfer of storage rights from Palisades Reservoir to ground water rights

- concerns about salmon flow augmentation

- federal versus local control of water

- prevent purchase of water rights where change in use may interfere with current practices

- develop policy applicable statewide regarding flows outside the state and into the Lower Columbia

- maintain a balance between all uses

- protect downstream users of water

- minimum stream flows suggested to benefit or maintain irrigation, fisheries, recreation, and wildlife

- develop policy on water spreading

- concerns about zero river flow

Operation of Palisades Project

- adjustment to flows and timing to meet the needs of irrigators, private property owners, fisheries, wildlife, cottonwood regeneration, and recreation

- improve communication of current and planned water releases out of Palisades Reservoir to all groups

- concerns about use of Palisades Reservoir water for salmon flush

- transfer surface water rights / storage at Palisades Reservoir for ground water rights

- use water bank storage for cottonwood regeneration in years of excess water

- increase volume and velocity of water between Palisades Dam to American Falls to prevent eutrophication in stagnant bays and coves

- recognize releases from Palisades Dam are determined by irrigation and flood management needs

Irrigation

- improve efficiency of irrigation to make water available for instream flows

- examine pressurized gravity irrigation system study conducted by SCS at Rainey and Palisades creeks

- irrigators need to communicate better with a better delineation of district boundaries

- allow continued access to the river for water rights diversions, maintenance and construction (point of diversion transfers)

- minimum stream flows or other recommended actions should not interfere with irrigation water rights

- improve water accounting responsiveness (weekend too long)

Flood Management

- concerns about future expansion of levees below Heise

- high water table causing flooding concerns in the Ririe and surrounding area

- survey from Palisades Dam to Heise to delineate highwater mark and existing floodplain

- flooding requirements for cottonwood regeneration

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APPENDIX C: STRATEGIES CONSIDERED

BACKGROUND INFORMATION

The Idaho Water Resource Board (Board) identified eleven categories of issues through public meetings, written comment and discussion with the South Fork Snake Advisory Group (SFSAG). The SFSAG then ranked specific items under each issue category for importance and effort the group would like to expend in addressing these issues. The issues receiving a score of 30 or higher for effort were restated as a want or need. The SFSAG and public provided strategies or solutions to address wants and needs. A "strategy" is an action, policy or recommendation that would accomplish or implement the want or need. Attached is a list of all strategies received by the Board, and reviewed by the SFSAG. These represent alternatives considered for the South Fork Snake Plan. Not all strategies were forwarded to the Board as recommendations.

WATER QUALITY

WQ - WANT OR NEEDS:

Protect water quality of all tributaries.

Accumulate data to allow monitoring and verification of water quality impacts.

Monitor and manage activities in the river corridor potentially impacting water quality to minimize pollution.

Minimize erosion.

Maintain water in a biologically beneficial condition when it leaves the planning basin (confluence with the Henrys Fork).

SUGGESTED STRATEGIES:

1. Establish appropriate buffer zones along streams (to be established by qualified biologist) where logging will not occur.

2. Construct fences to keep livestock out of riparian areas in grazing allotments.

3. Establish zoning requirements to prohibit building in riparian areas.

4. Establish cooperative agreements with land owners along the river to protect water quality.

5. Accumulate data to allow monitoring and verification of water quality impacts. Measure water temperature, turbidity, oxygen, and presence of E. coli.

6. Encourage best management practices (BMPs) for all land uses.

7. Extensive studies need to be conducted now to determine the maximum concentration of dwellings that the land can support (by drainage). Link density of dwellings in a development to a level adequate to protect water quality. This information should be provided to the local planning authorities so development can be planned so as not to impact water quality.

8. Maintain minimum flows in streams (Streams should not be dewatered).

9. Recommend enabling legislation to allow communities to extract fees from new land sales to be used for future sewage systems.

10. Seek funding and identify additional drainages that could benefit from State Agricultural Water Quality Programs similar to those being implemented by the East Side Soil & Water Conservation District on agricultural land

in the Antelope and Granite creek watersheds. The programs are applying BMPs to reduce soil erosion. Goals of the projects are to treat 75 percent of the critical areas. Critical areas are non-irrigated cropland, all irrigated cropland with slopes exceeding 4 percent, and any concentrated feeding operations. These projects promote voluntary participation and local decision making.

11. Encourage all land owners to leave undisturbed strips along streams (both the main stem and tributaries). This will benefit landowners as well as the public, by preventing loss of acreage to erosion.

12. Encourage establishment of conservation easements for agricultural lands to prevent future development for other uses.

13. Educate homeowners about the sources of pollution harmful to aquatic life, i.e. lawn chemicals, septic tank discharge, automotive and household fluids, and siltation.

14. Investigate Conservation Reserve Program (CRP) and identify the incentives for farmers to reduce erosion. Incorporate these incentives into overall state water plan.

15. Keep homes 600' minimum distance from river and stream banks.

16. The Legislature should provide adequate funding to ensure that the Division of Environmental Quality can conduct an adequate program to monitor water quality in all streams where human activity has the potential to degrade water quality. Accumulate data to determine the source and sources of water contamination of rivers; and the amount and nature of contamination by sewage and animal waste.

17. All industrial and farming uses, and city and rural sewage systems should be monitored to ensure surface and drinking water is not contaminated by these uses.

18. Monitor canal water which may be contaminating well water.

19. Use funds collected through daily use permit system to allow a selected state agency, or to hire a private firm or contractor with a university or private foundation, to develop a monitoring program. This monitoring program could be developed by a graduate student as part of a Masters degree program. Eventually, other MS candidates could monitor the water quality and model the river ecosystem.

20. Water quality monitoring plan could include such actions as water sampling, BMP effectiveness evaluations, beneficial use assessments, and photo point sampling.

21. Impose requirements to pack out human waste anywhere on the South Fork Snake River.

22. Require frequent rotation of livestock in grazed areas along the main stem so that no part of the riparian area is overgrazed.

23. The following criteria should be considered in a holistic water quality program:

- water quality (flow rate, temperature, biological oxygen demand, chemical oxygen demand, oxygen content, organic content, pathogens)
- number of river users
- monitor irrigation withdrawals rates
- monitor low flow augmentation
- monitor activities that impact water quality (grazing, development along the river, etc.)
- monitor water fowl populations
- monitor eagle populations along the river
- monitor wildlife populations
- monitor fish (type, size, quantity)
- monitor water quality downstream, if any residential or grazing uses, to verify water quality

24. Development should have a minimum setback so that it is visually out-of-sight from the river channel.

25. Buffer zones should be established along the river and around the reservoirs to control erosion and minimize human impacts.

26. Run off from livestock pastures should be treated to some minimal standard before entering river.

27. In the canyon section of the South Fork Snake River (Conant - Black Canyon), provide public overnight toilets or designated toilet areas to minimize impacts of human waste.

28. Riparian vegetation should be protected and clear cutting should cease to be used as a forestry technique.

29. Increase education and enforcement to reduce erosion from off-road vehicle use.

30. Build sediment ponds in eroding tributaries.

31. Give tax incentives, grants or loans to landowners to repair badly eroded areas.

32. The Conservation Reserve Program (CRP) should be continued by the federal government.

33. Plant willows.

34. *Establish riparian zone of at least 150 feet* along the South Fork Snake River to help preserve aesthetics, wildlife and riparian values.

35. Encourage landowners to retain Conservation Reserve Program (CRP) lands in grass cover after contracts expire to reduce soil erosion.

36. State authorities should work with all entities to provide sufficient water to maintain water quality (flow rates, temperature and chemical standards) as it leaves the state sufficient to meet the needs of salmon/steelhead and other fisheries in the state.

37. Biologically beneficial condition should be defined as a condition suitable for the preservation of healthy populations of the native cutthroat trout.

38. DEQ should monitor the water quality for sediment, coliform bacteria, oxygen content, and identifiable agricultural chemicals.

39. Baseline and historic water quality data should be examined to determine if degradation has occurred. State authority should identify polluters and implement appropriate fines on responsible parties.

40. Establish monitoring site at the confluence to measure temperature, turbidity, oxygen content at each fork.

41. Encourage implementation of BMPs appropriate to the farming operation and needs to minimize soil erosion. BMPs may include:

conservation tillage
crop residue use/no till
chiseling/subsoiling
cross slope farming
conservation cropping sequence
pasture and hayland planting
integrated pest management
nutrient management
planned grazing system
fencing
brush control
spring developments
pasture and hayland management
strip cropping
terrace and sediment basins
grassed waterways
windbreaks
conservation cover (CRP)
vegetative filter strips

42. *Divide reservoir and river system into* segments where different biological conditions can be maintained. The river system should not be managed as a single biological environment. (The reservoir should be allowed to maintain a different quality than the free-flowing river.) The river will be a cold water fishery and able to support cold water fish (trout). This will require a high dissolved oxygen level, low BOD/COD, low temperatures, and high flow rates. The reservoir on the other hand could be managed as a cool water fishery and allow fishing in shallow warm water for blue gill and bass and deep cold water fishing. Once the segments of the river system are defined, the basin will need to be monitored to ensure these segments are

maintained to beneficial use. The monitoring and enforcement will be funded through river use permit fees.

43. To maintain the beneficial conditions of the reservoir, the turbines of the Palisades Powerhouse need to be modified as will the irrigation intake structures to protect wildlife, fish and humans, etc.

FISHERIES

F - WANTS OR NEEDS:

Maintain a healthy cutthroat fishery.

Prevent over harvest of the fishery.

Maintain quality fishing experience.

SUGGESTED STRATEGIES:

1. The Water Plan should recommend as a goal that every stream in the basin be allocated a minimum streamflow adequate for the survival of its fisheries; the allocation should be approached through the voluntary transfer of water rights to instream use as, for example, increased efficiency allows irrigators to cultivate the same amount of land with less water.

2. A minimum flow should be maintained in <u>all streams</u> (Do not allow streams to be dewatered).

3. Minimum stream flows are needed on <u>all trout spawning</u> tributaries.

4. Establish a minimum streamflow of 1500 cfs at Lorenzo Bridge.

5. Strengthen the informal minimum flow agreement between U. S. Bureau of Reclamation and Idaho Department of Fish and Game.

6. A minimum flow of 2200 cfs is the lowest acceptable flow on the South Fork Snake River.

7. The Idaho Water Resource Board should pursue a minimum streamflow of 1500 cfs during the winter for the main stem South Fork Snake River from Palisades Dam to the confluence with the Henrys Fork to maintain a healthy fishery, and for the benefit of wintering and nesting bald eagles.

8. The Idaho Water Resource Board should pursue a minimum instream flow study on Pritchard Creek, and in five years recommend a minimum streamflow to protect fisheries and riparian habitat values.

9. The Idaho Water Resource Board should pursue a minimum instream flow study on Pine Creek, and in five years recommend a minimum streamflow to protect fisheries and riparian habitat values.

10. The Idaho Water Resource Board should pursue minimum streamflow studies for the most important tributaries, and in five years recommend a minimum streamflow to protect fisheries and riparian habitat on those tributaries. Accomplishing this action may be limited by funding over the next 5 years, and minimum streamflow studies may have to be prioritized. The highest priority tributaries needing flow protection include Pine Creek, Burns Creek, Warm Springs, Palisades Creek, Rainey Creek (headwaters to lower Targhee NF boundary), Pritchard Creek, Big Elk Creek, Fall Creek, McCoy Creek, Bear Creek, and Indian Creek (tributary to Palisades Reservoir).

11. For the main stem South Fork from Palisades Dam to the confluence with the Henrys Fork, flows should be maintained <u>above</u> 1,500 cfs during the fall and winter period (October 1 - March 30). The most important habitat for over-wintering juvenile trout is in side-channels, which are most affected by flow reductions and fluctuations. The flow versus habitat relationship for fish (Schrader and Griswold 1994) indicates the greatest rate of loss of habitat occurs between 1,540 and 1,240 cfs. Of the weighted habitat available to subyearling cutthroat trout at 3,370 cfs, approximately one-third is lost as flows are reduced to 1,540 cfs, and over half is lost at 1,240 cfs. For brown trout, about half is lost at 1,540 and two-thirds at 1,240 cfs. Survival of

overwintering juvenile trout is critical to maintain the South Fork and tributary fisheries.

12. Acknowledge the importance of the South Fork Snake River as a nationally significant fishery.

13. Agencies with jurisdiction over the river perform their management duties with fisheries values in mind.

14. The Board should not micro-manage the IDFG role.

15. Maintain current catch rates and fishing regulations. (The quality of the fishing experience is a personal matter and should not be regulated. People will seek their own places and times according to their personal wants and needs. Overregulation impacts quality of the experience.)

16. Change fishing regulations to catch and release, no bait, and artificial lures only.

17. Water levels in the South Fork Snake River must be maintained between 2200 and 16,000 cfs.

18. Allow fishing all year round on the South Fork Snake River to avoid opening day crowds.

19. Two types of fishing activity in the South Fork basin -- reservoir and river. The entire watershed should be evaluated to determine the heaviest concentration of users and to limit users to a level to maintain a quality experience.

20. Catch and release only to increase number and size of fish.

21. Establish permit fees to maintain the fishing experience.

22. Change regulations to enhance size of fish below Swan Valley Bridge.

23. Manage the section below Poplar as a trophy fishing area. Require release of fish under 20 inches.

24. Improve catch rates by requiring release of everything between 12 and 20 inches.

25. Manage fishery as a wild cutthroat fishery.

26. Remove obstructions to free passage of fish where spawning tributaries enter the main stream.

27. IDFG should regulate fishing in areas where streams merge to protect spawners entering tributaries. Habitat should be protected and enhanced by local authority, BLM, Forest Service and counties.

28. IDFG should be encouraged to seek measures to prevent the imminent takeover of the cutthroats by rainbows. Genetic integrity of cutthroats is very important, discourage hybrids.

29. The river should be managed to emphasize production of cutthroat; other species are secondary. Minimize efforts to maintain brown trout since it is a non-native fish.

30. Remove slot limit on rainbow trout and hybrids, but maintain slot limit for brown trout.

31. Eliminate year round fishing below Heise.

32. Increase length limit to 17" or 18" minimum.

33. Reduce take home limit to one fish.

34. Eliminate bait fishing.

35. Have Id. Dept. Of Fish and Game determine the fish carrying capacity of the South Fork Snake River to determine the biological limit of people on the river. Study should answer the following questions: When are wildlife adversely impacted by the numbers of people? When is the fishery adversely impacted?

36. In times of drought with low flows that will harm fish, increase allowable harvest of fish.

37. Reduce fishing access on the river.

38. With existing regulations, over harvest does not appear to be a problem. As needed, IDFG can develop more-restrictive regulations. However, to safeguard against over harvest in the future, while providing for an increasing recreational demand, current trout habitat needs to be maintained, and overall habitat quality and quantity needs to be increased.

39. Catch and release all cutthroat trout.

40. Increase spawning habitat by protecting spawning tributaries and require fish screens in tributaries.

41. Stop the stocking of any ponds or streams in Idaho to stop the spread of whirling disease.

42. Conduct studies to determine how to prevent hybridization of the cutthroat and rainbows.

43. Fishery management should focus on protection of rainbow and brown trout, not just the cutthroats.

44. Reduce sedimentation into stream with improved farming practices to minimize harmful effects to salmonid eggs and fry.

45. Increase upper limit of the slot to 18".

46. Pritchard Creek provides potential spawning habitat for cutthroat trout from the South Fork Snake River. Designate Pritchard Creek as a state natural river from its source to the lower Targhee National Forest boundary. The following activities should be prohibited in the natural reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining;
5) Mineral or sand and gravel extraction within the stream bed; and
6) Alterations of the stream bed.

47. Designate Pritchard Creek a state protected recreational river from the lower Targhee National Forest boundary to the confluence with the South Fork Snake. The following activities should be prohibited in the recreational reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

48. The Idaho Water Resource Board should pursue a minimum instream flow study on Pritchard Creek, and in five years recommend a minimum streamflow to protect fisheries and riparian habitat values.

49. Rainey Creek is an extremely important spawning tributary of the South Fork Snake River supporting cutthroat trout. Designate Rainey Creek as a state protected recreational river from its source to the confluence with South Fork Snake. The following activities should be prohibited:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access

facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

50. Designate Pine Creek as a state protected natural river from the Targhee National Forest boundary to its mouth at the South Fork Snake. The following activities should be prohibited in the natural reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining;
5) Mineral or sand and gravel extraction within the stream bed; and
6) Alterations of the stream bed.

51. Designate Burns Creek as a state protected recreational river to protect important cutthroat trout spawning habitat.

52. The Idaho Water Resource Board should pursue a minimum instream flow study on Pine Creek, and in five years recommend a minimum streamflow to protect fisheries and riparian habitat values.

53. Pine Creek is an extremely important cutthroat trout spawning tributary for the South Fork Snake River. Designate Pine Creek a state protected recreational river from its source to the county road just below Highway 31 bridge as the lower Targhee National Forest boundary. The following activities should be prohibited in the recreational reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

54. The South Fork Snake River possesses outstanding fish and wildlife values including unique, diverse cottonwood gallery forest, blue ribbon native trout fishery, and nesting and wintering bald eagles. Designate the South Fork Snake River from Palisades Dam to the Conant Valley power line as a state protected recreational river. The following activities should be prohibited on the recreational reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

55. Designate the South Fork Snake River from Conant Valley power line to the Riley Diversion as a state protected natural river. The following activities should be prohibited on the natural reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining;

5) Mineral or sand and gravel extraction within the stream bed; and
6) Alterations of stream bed.

56. Designate the South Fork Snake River from the Riley Diversion to the confluence with Henrys Fork as a state protected recreational river. The following activities should be prohibited on the recreational reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

57. The principal threat to the future of the South Fork Snake River fishery is habitat quantity and quality. IDFG manages the entire South Fork Snake River as a wild trout fishery. Therefore, the river fishery depends on spawning access to tributaries, recruitment of juveniles back to the river, and survival of juveniles through the fall and winter period. If the river and tributary fisheries are to be maintained or improved to accommodate an increasing recreational demand, the following habitat-related objectives are needed :

- Ensure fish passage between the tributaries and main stem;
- Maintain or improve water quality;
- Provide adequate flows in the main stem and tributaries to support a healthy fish community;
- Protect and enhance riparian vegetation conditions;
- Install screens at diversions, where feasible;
- Install fish passage facilities at man-made barriers, where feasible;
- Protect riparian and riverine habitats from the following: construction or expansion of dams or impoundments; construction of hydropower projects; construction of water diversion works; dredge or placer mining; alterations of the stream bed; and mineral or sand and gravel extraction within the stream bed.

RIPARIAN MANAGEMENT

RM - WANT OR NEED:

Preserve riparian vegetation in developed areas.

SUGGESTED STRATEGIES:

1. Encourage homeowners to leave willows, cottonwoods and other native vegetation in place along the stream banks as opposed to manicured lawns, etc.

2. Zoning requirements should be imposed to prohibit removal of vegetation within a buffer zone along the river/streams, and prohibit construction in riparian areas.

3. Investigate the feasibility of floods for cottonwood regeneration of 30,000-40,000 cfs every 20 years. If impractical, promote planting of cottonwoods.

4. Give preservation of cottonwood forest an extremely high priority, because of its significance as an ecosystem.

5. Minimize construction of new roads in riparian corridor.

6. Discourage development on the floodplain.

7. Promote education of the importance of cottonwood regeneration.

8. Local authorities need to develop regulations to maintain native vegetation in riparian corridor (cottonwood areas), and streams and sloughs in their natural state. This may be accomplished by

limiting development and requiring developers or residences to be setback from the river so that they are not visible from the river.

9. Flood flows are not feasible for cottonwood regeneration. Protection of cottonwood vegetation should be achieved by regulation from local authorities and re-planting.

10. Plant cottonwoods in and around mature stands.

11. Fence all livestock from cottonwood forests and riverbanks.

12. Utilize a "flood stage" flow level of 35,000 + cfs every 10 years to flush the system and to encourage cottonwood regeneration.

13. Require flood insurance for new houses built in the 100-year floodplain to discourage construction in the riparian zone and to prevent damage to property during floods. It would also reduce the need for state-federal matching funds to save people who build in the floodplain.

14. Educate landowners about the opportunity to obtain loans and grants from the SWCDs (through the Idaho Soil Commission) for range and riparian improvements.

15. Delineate the zone of land affected by flows of 30,000 to 35,000 cfs needed to regenerate cottonwood. Prohibit development impacted by flooding in these zones.

16. Recommend to County Planning and Zoning Commissions that future development should only be permitted when located outside of sensitive areas, including river shorelines.

17. Provide tax incentives for leaving riparian areas undeveloped or improving riparian habitat.

18. The South Fork Snake River should be designated as a National Wild and Scenic River from Conant Valley to Black Canyon to preserve the cottonwood forest, considered one of the most ecologically important riparian area in Idaho.

19. All private property from Conant Valley to Black Canyon should be purchased to protect cottonwood forest.

20. Hire the services of experts in planting cottonwood to determine the feasibility and expense of planting.

21. Discourage construction in riparian zones to protect riparian habitat. Promote setbacks, conservation easements, and other appropriate legal techniques.

WILDLIFE

W - WANTS OR NEEDS:

Maintain wildlife habitat.

Recognize the value of waterfowl, wildlife habitat and birds of prey

Maintain basin ecological integrity.

SUGGESTED STRATEGIES:

1. River use should be limited or excluded in critical goose nesting areas during critical times (March through May) to prevent disturbance. The primary nesting areas would be Rainey Creek to Conant Valley and Heise Bridge to the Henrys Fork confluence.

2. Maintain river flows above 1500 cfs to benefit eagles by preventing ice buildup and enhancing food supply.

3. Control noxious weeds which displace native vegetation and reduce the productivity of the habitat. Promote biological control, as opposed to chemical control, to achieve these objectives and protect water quality. Educate landowners about this opportunity to control noxious weeds through the South Fork Biological Weed Control Committee.

4. Address grazing pressures from the elk herds.

5. Manage predators such as cougar, coyote, foxes, etc. to improve pheasant and quail populations.

6. For the main stem South Fork from Palisades Dam to the confluence with the Henrys Fork, maintain flows above 1,500 cfs during the fall and winter period (October 1 - March). Bald eagle productivity depends on the condition of birds following winter, as well as the foraging conditions during the nesting period, which begins on approximately February 1. The bald eagles that nest in the basin tend to winter on the South Fork. Winter low flows that lead to extensive ice-over for extensive periods of time reduce the productivity of nesting bald eagles during the summer following the low flows and extensive icing conditions.

7. Pritchard Creek and its supporting riparian habitat provides habitat for large numbers of big game. Designate Pritchard Creek as a state natural river from its source to the lower Targhee National Forest boundary. The following activities should be prohibited in the natural reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining;
5) Mineral or sand and gravel extraction within the stream bed; and
6) Alterations of the stream bed.

8. Designate Pritchard Creek a state protected recreational river from the lower Targhee National Forest boundary to the confluence with the South Fork Snake. The following activities should be prohibited in the recreational reach:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining; and
5) Mineral or sand and gravel extraction within the stream bed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

9. Protect and enhance wildlife habitats, especially wetlands and big game winter ranges by minimizing development in these habitat areas. The main stem river corridor and adjacent lands are crucial winter habitat for many wildlife species. New developments in big game winter range would reduce the size of big game populations and the associated recreational hunting and observing opportunities.

10. Minimize impacts of livestock grazing, logging, road construction, and farming through implementation of best management practices.

11. The more rare species, or those of significance to users of the river corridor, should be given specific recognition, including the bald eagle, peregrine falcon, geese, moose, bears, elk, and cutthroat and brown trout.

12. Install information posters at the put-in to warn people about harassing or disturbing birds (especially bald eagles) and other wildlife.

13. Maintain a buffer zone of several hundred feet above highwater to maintain wildlife and waterfowl habitat.

14. Maintain CRP lands in grass cover to maintain important wildlife habitat.

15. The Idaho Water Resource Board should pursue a minimum streamflow of 1500 cfs during the winter for the main stem South Fork Snake River from Palisades Dam to the confluence with the Henrys Fork to maintain a healthy fishery, and for the benefit of wintering and nesting bald eagles.

16. Ecological integrity will be achieved by implementing actions to maintain water quality and limit development.

17. No development should be allowed in the canyon.

18. Designate canyon as Wild and Scenic River with all land being managed by the Forest Service and BLM.

RECREATION

R - WANTS OR NEEDS:

Maintain quality of the outdoor recreation experience.

Maintain quality of the fishing experience.

Adjust flows from Palisades Dam to be more favorable to the needs of the fishery, wildlife and recreation while accomplishing irrigation, flood control and power generation objectives.

Improve safety at the Big Feeder for boaters.

SUGGESTED STRATEGIES:

1. Maintain the current number of outfitters and legally outfitted trips on the South Fork Snake.

2. Establish zoning to address conflicts between motorized and non-motorized users.

3. Establish horsepower limits for motorized use.

4. Encourage proper boating etiquette.

5. Address law enforcement concerns in the Swan Valley and Irwin areas from increased recreation use.

6. Log dead and downed timber to prevent catastrophic fires in the future, and improve the recreation experience.

7. Prohibit jet skies on the South Fork Snake.

8. Allow outboard motors less than 100 HP

9. Recommend a no wake law for motors. Speed limited to 5 mph.

10. No private homes in the canyon section. The Federal government should make land exchanges for all private land in the canyon.

11. Do not improve the Snake River Road.

12. Restrict certain types of motorized crafts to designated segments of the river and/or to specified days of the week.

13. Legislation needs to be passed allowing heavier fines and strict enforcement of outfitter and guide regulations to prevent illegal outfitting. For example, allow confiscation of property in addition to monetary fines.

14. Restrict access to levees by recreationists. Maintain limited access between Heise and the Henrys Fork confluence at Twin Bridges, Labelle area, and Annis area.

15. Reconstruct bridges located on Rainey Creek washed out in the spring of 1984.

16. Provide additional parking and camping at Palisades Creek Campground.

17. Cress Creek offers one of the most impressive environmental education opportunities for the South Fork Snake River corridor, being a short driving distance from Idaho Falls. Designate Cress Creek as a state protected natural river along its entire reach. The following activities should be prohibited:

1) Construction or expansion of dams or impoundments;
2) Construction of hydro projects;
3) Construction of water diversion works;
4) Dredge or placer mining;
5) Mineral or sand and gravel extraction within the stream bed; and
6) Alterations of the stream bed.

18. The Idaho Water Resource Board should obtain a minimum streamflow for Cress Creek.

19. More enforcement people at the access points on the river.

20. Regulate general public on the river.

21. Limit motorized use to the reservoir. Only non-motorized use below Palisades Dam.

22. State of Idaho to administer a permit system that would give outfitters and guides no more than 50 percent of permits, and requiring limited number of permits for day use floaters.

23. Do not implement a permit system.

24. Limit number of boat launchings each hour during heavy use months (July).

25. Change the Outfitter and Guides Licensing Board rules to limit the use of out-of-state guides by outfitters to minimize illegal guiding.

26. Restrict development to 500 feet from the river bank.

27. Prohibit development in the canyon section (Conant to Black Canyon).

28. Agencies managing recreation should conduct a study to determine the physical and social recreation carrying capacity of the South Fork Snake River corridor.

29. Implement a program to help various recreation users resolve conflicts and learn to respect each other.

30. Determine how Lynn Crandall would impact the cutthroat fishery.

31. Determine if there is enough unappropriated water to justify Lynn Crandall.

32. Determine the demand for reservoir versus free-flowing river recreational experiences.

33. Determine the impacts to summer and wintering habitat for wildlife species if Lynn Crandall were proposed.

34. The entity undertaking measures to improve safety at the Big Feeder needs to consider minimum safety standards, and may assume responsibility for future liability and maintenance or upgrade.

35. Maintain the current number of developed river access points.

36. Maintain the Snake River Road at its current level of development. Allow only minor improvements for safety and maintenance.

DEVELOPMENT & GROWTH

D - WANTS OR NEEDS:

Minimize or prevent adverse effects from development along the river corridor, particularly the canyon.

Protect private property rights.

SUGGESTED STRATEGIES:

1. Limit development in the canyon to maintain wilderness qualities.

2. Do not allow visible development on canyon rim.

3. Place a moratorium on development along the river.

4. Establish a buffer zone several hundred feet from the highwater level.

5. Development should use best available management of its wastes. Eliminate septic/drain fields. All waste water should be transported out of the river valley for treatment. Or new secondary treatment should be required for all new development.

6. Encourage the practice of "conservation development" along the river corridor. Build as far from the river as possible, in the least sensitive areas, and do not remove vegetation along the river.

7. Development should be set back a minimum of 75 to 150 feet to protect aesthetic values. This buffer should include leaving the natural vegetation in place, unaltered.

8. Require subdivision/development applicants to provide a site-specific habitat conservation plan, including a plan to protect nesting and foraging bald eagles.

9. Permit development only if they are at least > ½ mile from bald eagle nests and not in identified principal management parcels.

10. Require developments to retain all trees along shorelines for fish and wildlife, including bald eagle perch and nesting trees.

11. Require sufficient construction setbacks from shorelines to protect visual values.

12. Require developments to retain sufficient native vegetation on shorelines (no mowing, burning, spraying, cutting, etc.) to protect shoreline stability, water quality, fish and wildlife habitat, and visual values.

13. Approve preliminary plats only after approved wetland mapping is complete.

14. Grant building permits only in uplands existing at the time of preliminary plat approval.

15. Permit clustering outside wetland and shoreline areas only.

16. Permit no further subdivision of platted lots.

17. Require developments to retain streams and streambeds (bridges only; no culverts or filling).

18. Permit future development when they are outside of sensitive areas, including river shorelines.

19. The option to build future water development projects should be preserved (for example Lynn Crandall/Burns Creek storage reservoir) .

20. The Palisade and Rainey Creek project placing irrigation water in a pipe, should only be considered if both creeks are developed jointly. There is normally not enough water in Rainey Creek during normal irrigation season to take care of the farmers, even with the reduced requirement, and still leave enough water to keep from drying up the creek. If the systems from both Rainey and Palisade creeks were tied together that would not be a problem.

21. The main stem and important tributaries should be protected from water storage projects and hydropower generation projects.

22. Provide additional storage in the Upper Snake to store water in high water years.

23. Establish cooperative agreements with landowners along the river to help protect resource values.

24. Require public comment for all proposed changes in land and water use associated with the South Fork Snake River corridor.

AGENCY INVOLVEMENT & MANAGEMENT DIRECTION

AM - WANTS OR NEEDS:

Management decisions should use the best available science.

Improve agency coordination in managing the resources in the South Fork Snake River basin.

SUGGESTED STRATEGIES:

1. Manage the river according to the direction established in the *Snake River Activity and Operations Plan.*

2. State agencies should coordinate with the U.S. Bureau of Reclamation, debating state rights versus federal rights will not resolve issues.

3. Support implementation of the Bonneville Power Administration's wildlife mitigation plan.

4. Establish a group to coordinate with landowners and agencies, and to resolve conflicts.

5. Form a watershed council for the South Fork Snake River basin.

6. Based on the evaluation of outstanding resource values identified in the South Fork Snake basin. Designate the following reaches as state protected rivers:

- Bear Creek, headwaters to Palisades Reservoir;
- Big Elk Creek and headwaters, state line to Palisades Reservoir;
- Burns Creek, headwaters to South Fork Snake River;
- Cress Creek, headwaters to its sinks;
- Dry Canyon, mouth of Waterfall Canyon to Palisades Creek (includes Upper Palisades Lake);
- Fall Creek, headwaters to South Fork Snake River;
- Indian Creek (reservoir trib) and headwaters, state line to South Fork Snake River;
- Indian Creek (main stem trib), headwaters to South Fork Snake River;
- McCoy Creek, headwaters to Palisades Reservoir;
- Palisades Creek, headwaters to South Fork Snake River;
- Pine Creek, headwaters to South Fork Snake River;
- Pritchard Creek, headwaters to South Fork Snake River;
- Rainey Creek, headwaters to South Fork Snake River;
- South Fork Snake River, state line to Henrys Fork confluence; and
- Waterfall Canyon, headwaters to Dry Canyon Creek confluence.

7. Evaluate and protect as state protected rivers the following stream reaches:

- Warm Springs (tributary near Burns Creek), headwaters to South Fork Snake River;
- Little Elk Creek, headwaters to Palisades Reservoir;
- Wolverine Creek, headwaters to South Fork Snake River;
- Black Canyon Creek, headwaters to South Fork Snake River
- Trout Creek, headwaters to Palisades Reservoir.

WATER QUANTITY AND ALLOCATION

WA - WANTS OR NEEDS:

Maintain a balance between all water users.

Change water law to allow greater flexibility in allocating water to different uses and address the changing demands for water in the basin and state.

SUGGESTED STRATEGIES:

1. Buy existing water rights from canal companies that have lost farms due to development.

2. Establish policy for water spreading. (Additional water is being supplied to previously irrigated acres because conversion of flood to sprinkler irrigation has made additional water available.)

3. Water from Idaho should not be used for "flow augmentation" to flush salmon smolts. Successful outmigration of salmon smolts requires that conditions in the lower Snake and Columbia Reservoir system be essentially river-like and not lake-like. These conditions cannot be achieved without substantial drawdowns of these reservoirs in the lower Snake and Columbia rivers.

4. Restrict pumping from the aquifer to compensate for reduced irrigation water from the Snake River.

5. Make water available for instream flows by changing water law to encourage water conservation, or allowing changes from consumptive uses (irrigation) to non-consumptive instream uses.

6. Establish priorities for the use of water during low water years between the different uses -- irrigation is first (by law) down to a minimum streamflow; then fisheries and water quality take priority; fisheries have priority over recreation.

7. Investigate current aquifer recharge policy and establish clear objectives for the recharge program. Determine appropriate areas in the Snake River Plan aquifer to apply recharge water to accomplish these objectives.

8. Prevent purchase of water rights where change in use may interfere with current uses.

9. Transfer storage rights from Palisades Reservoir to ground water rights.

10. Water management policy should consider the effects of these policies and protect downstream users of water, including users outside the basin.

11. Increase instream flows by giving incentives to water rights holders to be more efficient, i.e., allow water right holder to keep 50 percent of the water that he saves by using more efficiently his water. The other 50 percent would be required to go to instream use.

12. Recommend that the law be changed to allow transfers on a voluntary basis.

OPERATION OF PALISADES RESERVOIR

PR - WANT OR NEED:

Adjust flows and timing from Palisades Reservoir to meet the needs of irrigators, flood management, private property owners, fisheries, wildlife, cottonwood regeneration, and recreation.

SUGGESTED STRATEGIES:

1. Release water early enough from Palisades and Jackson to keep the flow less than 18,000 cfs during July.

2. Provide high enough flows to regenerate cottonwood in April and May during years when high runoff is expected. The flows could be short in duration and at a safe controlled level -- less than one week at 30,000.

3. Reexamine the flood control curves used to determine releases in the Upper Snake projects. Calculate new flood control curves integrating flows needed for fisheries, recreation, and wildlife and riparian habitat, in addition to irrigation and flood control.

4. Improve communication of current and planned water releases from the Upper Snake to all water users by establishing a prerecorded message accessible to the public.

5. Water accounting response needs to be improved to allow communication and action on weekends.

6. Develop a predictive model that regulates changes in river flows based on precipitation records for the year and biological needs of fish (spawning and winter minimum flows). Regulate the changes to minimize impacts on life cycles of the resident fish population.

7. Adjust flows from the Dam to meet the needs of the fish. Maintain a minimum flow from the Dam established by comparing 10-15 percent of the mean annual flow with minimum streamflow studies conducted by IDFG. Support irrigation needs as long as minimum flow is maintained.

8. Work on any and all compromises to achieve flow rates to better balance wildlife needs.

9. Provide flow releases from Palisades Dam of at least 1,500 cfs during fall and winter for fishery.

10. Establish ramping rate protocols for normal Palisades Dam operation.

11. When sufficient water is available, provide periodic releases from Palisades Dam of sufficient amount and duration to facilitate cottonwood seedling establishment to perpetuate the stands.

12. Manage reservoir levels to avoid large flow increases immediately before, or during, the fishing opener and 4th of July weekends.

13. Manage Palisades flows and Big Feeder diversions to maintain adequate flows in the South Fork below the Big Feeder.

14. Maintain Palisades Reservoir at a level adequate to absorb the 50-100 year flood without increasing the river flow rates above 100-150 percent of the annual mean average flow.

15. Many consider it feasible to develop 75-90 percent of the mean annual flow of a river (Clark, Viessman, and Hammer). The minimum streamflow should be defined as 10-25 percent of the mean annual flow; however, this value needs to be confirmed by actual basin data. The minimum flow should be maintained and not decreased unless severe drought conditions exist for extended periods. The volume of flow may be increased under flood conditions.

16. When sufficient water is available, manage Palisades releases to improve Canada goose nesting success: 8,000 to 16,000 cfs releases during the nesting season (March-May). The recommended flow reduces predator access to nesting islands, while preventing inundation of the important islands. Parker (1973) and DeShon (1976, 1977, 1978) found a significant reduction in nest attempts and success at flows <5,000 cfs; and they found significant nesting island inundation at flows >18,000 cfs. The recommended consistent high flows cause Canada geese to initiate nesting far enough uphill to reduce their vulnerability to nest flooding later during their nesting attempt.

IRRIGATION

I - WANT OR NEED:

Improve irrigation efficiency to make water available for instream flows.

SUGGESTED STRATEGIES:

1. Determine the availability of water from transfer of irrigated land to other uses.

2. Pursue and establish a policy about water spreading.

3. Provide incentives to convert from flood irrigation to sprinkler and/or lining of ditches and canals.

4. Quantify how improved efficiency effects aquifer recharge, and flows at wells and springs.

FLOOD MANAGEMENT

FM - WANT OR NEED:

Address future flood management in the South Fork Snake River basin, including the future of levees below Heise.

SUGGESTED STRATEGIES:

1. Raise levees to accommodate recommended flows for cottonwood regeneration.

2. Areas currently protected by levees should remain free of residential development or significant structures.

3. Reassess the 100-year floodplain and delineate it based on current operation of the Upper Snake projects.

4. Prohibit construction of new or expansion of existing levees and dikes along South Fork Snake River which will constrict the river, reduce the floodplain, lead to more severe flooding downstream, further encroachment on the floodplain by development, and impact wildlife and aesthetic values.

5. Increased flood control will also accelerate the rate of loss of the cottonwood community.

6. Prior to permitting additional dikes, levees, and riprap projects, the situation on the South Fork Snake River in Wyoming should be understood, and it should be avoided on the South Fork in Idaho. (Fish and wildlife habitat, and associated recreational opportunities, may be permanently degraded as a result of dikes, levees, and riprap projects.)

7. Release flood flows from Palisades Dam as necessary to re-establish wetlands in areas that

have been converted to uplands as a result of flood control.

8. Study options to address the high water table and flooding concerns in Ririe and surrounding areas.

9. Survey from the dam to confluence with Henrys Fork to delineate the highwater mark and floodplain.

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COMPREHENSIVE STATE WATER PLAN:

SOUTH FORK BOISE RIVER SUB-BASIN

ADOPTED BY THE

IDAHO WATER RESOURCE BOARD

JUNE 29, 1990

READOPTED
JAN 1996

PREAMBLE

(1988 Idaho Session Laws 1091, c. 370, Section 1)

"The legislature finds and declares that a central component of state sovereignty is the inherent right of the state to regulate and to control the natural resources of this state. In a state such as Idaho, it is essential that the state exercise its full authority to manage its water. To that end, it is the purpose of this act to provide for the full exercise of all the state's rights and responsibilities to manage its water resource."

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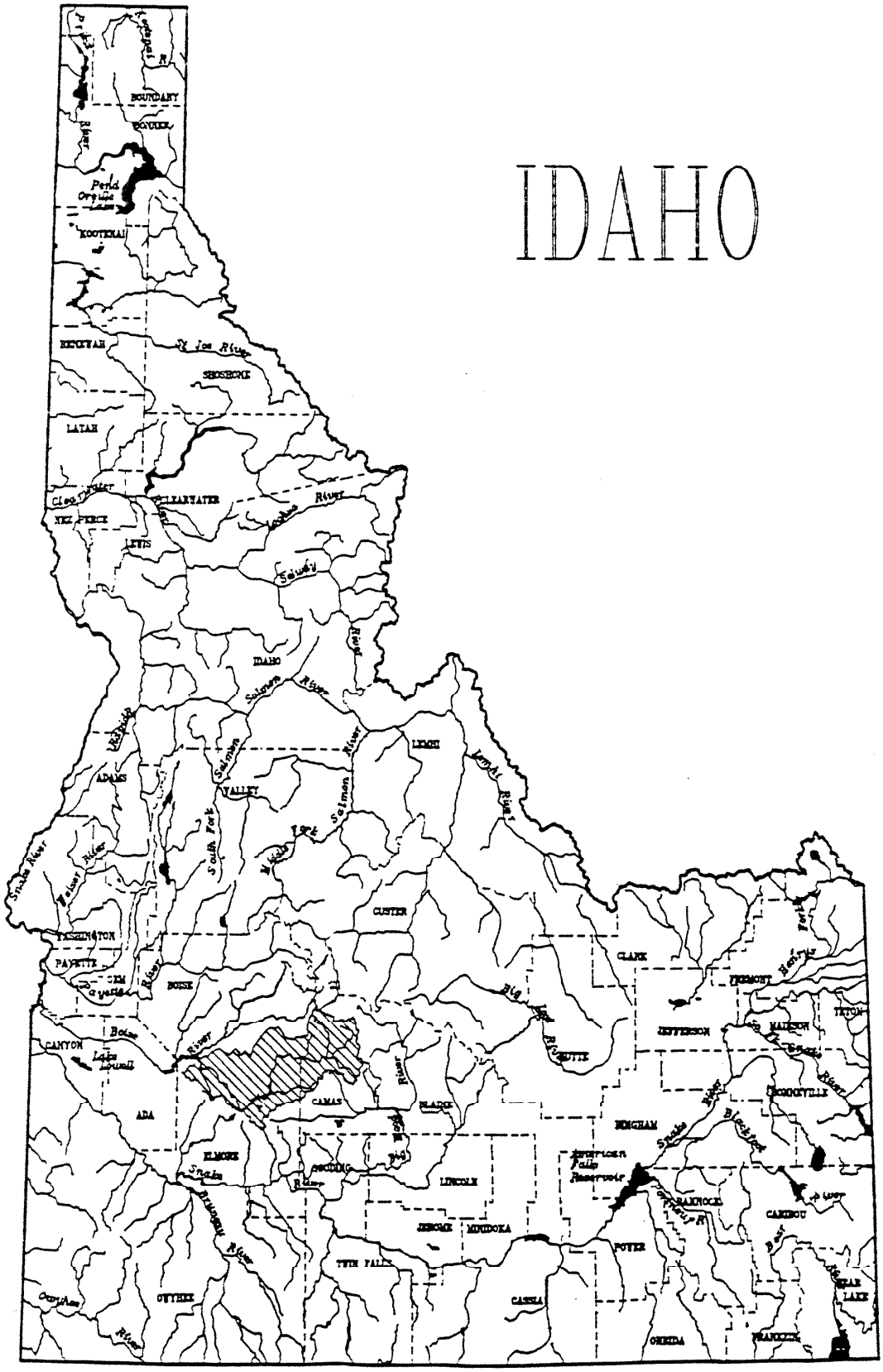


Figure 1. Map of Idaho Showing the Location of the South Fork of the Boise River Basin.

COMPREHENSIVE STATE WATER PLAN: SOUTH FORK BOISE RIVER SUB-BASIN

Executive Summary

The Comprehensive State Water Plan for the South Fork Boise River Sub-Basin, (see Figure 1), was developed in accord with Idaho Code, Chapter 17, Title 42. As directed by the Idaho Water Resource Board Planning Rules and Regulations, an advisory group was formed to provide input relative to local concerns throughout the planning process.

The South Fork Boise River watershed is 1,310 square miles with an average annual yield of 805,600 acre-feet of water (see Appendix G: Figure 2). Major activities in the basin include timber harvest, recreation, and grazing. Two major storage reservoirs exist in the basin. Anderson Ranch and Little Camas reservoirs were constructed to store water of the South Fork Boise River for irrigation. The two reservoirs have a combined total storage capacity of 526,182 acre-feet.

Anderson Ranch Dam has a 40 megawatt (MW) generating plant, consisting of two 20 MW turbines, with provisions for installing a third generator. This is the only hydropower plant in the basin. Anderson Ranch Reservoir is operated in concert with Arrowrock and Lucky Peak Reservoirs to provide for flood control, irrigation, and recreation. This allows for comprehensive use and management of water supplies from the basin.

The confluence of the South Fork with the Boise River is inundated by Arrowrock Reservoir. The reservoir reach extends about ten (10) miles up the South Fork channel. Anderson Ranch Dam is located on the South Fork at river mile 43.5, upstream from its confluence with the Boise River. Summer storage releases from the reservoir sustain popular recreational activities on the South Fork between the Dam and Arrowrock Reservoir backwaters. Summer releases also help maintain the cold water fishery below the Dam. Anderson Ranch Reservoir is one of the more popular kokanee fisheries in southern Idaho, and Little Camas Reservoir provides a good put-and-take rainbow trout fishery.

The South Fork Boise River above Anderson Ranch Dam and all tributary streams (other than Little Camas Creek) are free-flowing streams that provide seasonal fishing and recreational opportunities. The outstanding water quality and natural settings of the Lime Creek and Big Smoky Creek watersheds have been identified in State and federal studies and by local citizens.

The plan acknowledges the existing water rights and uses of the water of the South Fork Boise River sub-basin, and designates various river segments as Natural or Recreational Rivers as follows (see Appendix G: Figure 17):

1. The designation of the South Fork Boise River from Anderson Ranch Dam downstream to Black Canyon Creek as a Recreational River. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

   - Construction or expansion of dams or impoundments
   - Construction of hydropower projects
   - Dredge or placer mining
   - Mineral or sand and gravel extraction within the streambed.

   Stream channel alterations shall be prohibited except for those necessary to maintain existing irrigation facilities, utilities, roadways, stream channel protection, the maintenance of existing access, placement of fishery enhancement structures, or new access for recreational purposes.

   New diversion works shall be limited to pump installations sized to supply water for the standard domestic exemptions or a capacity sufficient for stock water or recreational purposes.

Provision is made for the addition of a third turbine at Anderson Ranch Dam with conditions for protection of fish and recreation values.

2. The designation of the South Fork Boise River from the mouth of Black Canyon Creek downstream to a point 250 yards upstream of Neal Bridge as a Natural River.

Provision is thereby made for the maintenance and future upgrading of Neal Bridge, and the Neal Bridge boat access site.

3. Lime Creek - That Lime Creek from its mouth to its headwaters and all tributaries on the north side of Lime Creek including the North and Middle Forks and all their tributaries from their mouth to their headwaters be designated as Natural Rivers; that all remaining tributaries from their mouth to their headwaters be designated as Recreational Rivers, and pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

   - Construction or expansion of dams or impoundments
   - Construction of hydropower projects
   - Dredge or placer mining
   - Mineral or sand and gravel extraction within the streambed.

   Stream channel alterations shall be prohibited except for those necessary to maintain existing utilities and roadways.

   New diversion works shall be limited to pump installations sized to supply water for the standard domestic exemptions or a capacity sufficient for stock water or recreational purposes.

4. Big Smoky Creek as a Natural River - That Big Smoky Creek from its confluence with Calf Creek to its headwaters and all tributaries of Big Smoky Creek above and including Calf Creek from their mouth to their headwaters be designated as Natural Rivers.

It is recommended that the Department of Water Resources cooperate with the Department of Fish and Game, and with other appropriate natural resource agencies, in reviewing and evaluating the Protected Areas Designations of the Northwest Power Planning Council relative to the Boise River, South Fork Basin.

A major portion of the watershed is national forest land administered by the U.S. Department of Agriculture, Forest Service. Therefore, the plan supports and urges the U.S. Forest Service to expedite land treatment measures that control soil erosion in the watershed, and protect or re-establish riparian areas along streams in the basin.

It is the intent of the Idaho Water Resource Board that all future actions related to the South Fork Boise River be consistent with goals set forth in this basin plan. Amendments to the plan may be made by the Idaho Water Resource Board as needs arise, and if such changes are deemed to be in the public interest. Every five years the Board is required to review the basin plan and may make amendments to the plan, if such are judged to be in the public interest.

A summary of issue analyses and stream classification for the South Fork Boise River Sub-Basin is shown in Appendix A, Tables I and II.

I. INTRODUCTION

In 1988 the Idaho Legislature passed legislation amending state water planning requirements and providing for the development of a Comprehensive State Water Plan. The plan is to be developed in stages by developing comprehensive plans for each river basin, drainage area, river reach, ground-water aquifer, or other geographic consideration in the State. The resources to be described in each plan are:

Navigation
Energy Conservation
Recreational Opportunities
Flood Control
Timber
Livestock Watering
Natural or Cultural Features
Domestic, Municipal, Commercial, and Industrial Uses
Other Aspects of Environmental Quality and Economic Development
Power Development
Fish and Wildlife
Irrigation
Water Supply
Mining
Scenic Values

A description of the various existing and planned uses of these resources, as well as a discussion of goals, objectives, and recommendations for improving, developing, or conserving water and waterways in relation to these resources, are to be included in the plan. Each of these items are addressed in the following pages as they relate to the South Fork Boise River.

The law also provided that the comprehensive state water plan may designate protected rivers based on a determination by the Idaho Water Resource Board (IWRB) that the value of preserving a waterway for particular uses outweighs that of developing the waterway for beneficial uses. The protected designations provided are either a Natural or Recreational River.

In designating a Natural River, the Board shall prohibit the following activities:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alteration of the streambed; and
- mineral or sand and gravel extraction within the streambed.

In designating a Recreational River, the Board shall determine which of the activities listed above shall be prohibited and may specify the terms and conditions under which activities that are not prohibited may go forward.

The Board's prohibitions apply to the waterway. State agencies, however, must exercise their duties in a manner consistent with the Comprehensive State Water Plan, meaning some activities on State land adjacent to the river may be affected (See Appendix B).

Prior to the adoption of a comprehensive plan for a waterway, the Idaho Water Resource Board may designate a waterway as an interim protected river. This designation provides protection of the river while basin studies and a plan are completed. Board prohibitions on a protected river apply only to the waterway. However, State agencies must exercise their duties in a manner consistent with the Comprehensive State Water Plan. The plan therefore may have some impact on State lands within the riparian area (see Appendix B).

Designation of a waterway as an interim protected river shall be based upon a determination that:

-It is probable that the waterway would be designated a protected river in the comprehensive state water plan; and

-Interim protected river status is necessary to protect the values that would support such waterway's designation as a protected river in a comprehensive state water plan.

The legislation directed the Idaho Water Resource Board to designate seven river reaches in the state as interim protected rivers. One of these being the "South Fork of the Boise River, from Anderson Ranch Dam to Neal Bridge" in the South Fork of the Boise River Basin. Designation of this river reach is addressed in this basin plan. Also consideration is given to other waterways in the basin that may merit a protected designation.

An effort was made in this study to also identify known potential development opportunities and various beneficial uses the available water resources of the basin could be developed for which are within the constraints of existing uses, water rights, contracts, etc.

II. PLANNING EFFORT

On February 2, 1989 a public meeting was held in Boise announcing the beginning of a river basin planning effort for the Boise River Basin. This planning effort was in response to Idaho Code, Chapter 17, Title 42, directing the Water Board to complete a comprehensive state water plan. The code also provided that the plan could be developed in individual river basin components.

To provide further direction for the river basin planning effort, the Idaho Water Resource Board established Planning Rules and Regulations. One of the provisions included was, "The board shall seek the involvement of volunteers from the geographic area to be affected by a portion of the comprehensive water plan. These volunteers shall constitute a local advisory group which shall inform the Board of local concerns throughout the planning process."

Members chosen to serve on the Boise River Advisory Group were:

Don Brandt - Nampa, Real Estate Broker
Bob Bruce - Boise, Project Development Manager, Morrison Knudsen
Kristen Cheyney - Boise, System Analyst, Simplot Corporation
Ron Davison - Smith Prairie, Farmer and Rancher
Ralph McAdams - Boise, Retired, U.S. West Communications
Ron Platt - Huston, Farmer
Jeff Swanstrum - Boise, Seasonal Govt. Worker and Carpenter

The advisory group met twice during 1989 and once in 1990 to provide input and assistance in meeting the July 1, 1990 deadline for completion of a basin report.

III. RESOURCE SUMMARY

A. Description of the Basin

The South Fork of the Boise River is a major tributary of the Boise River (see Figure 1). Its confluence with the Boise River is at river mile 80.5 of the Boise River. This location is about 5.1 miles above Arrowrock Dam and is now inundated by the Arrowrock Reservoir. An arm of the Arrowrock Reservoir extends about 10 miles up the South Fork of the Boise River.

The northern boundary of the basin extends easterly from the point of confluence with the Boise River, along the divide between the Middle Fork of the Boise River and the South Fork. This divide runs through the Trinity Mountain Range, Steel Mountain, and Bald Mountain, to the Sawtooth Mountain Range, the divide between the Boise River drainage and the Salmon River drainage. The basin boundary then extends in a southeasterly direction along the crest of the Sawtooth and Smoky Mountain ranges, along the Camas County boundary to a point that separates the South Fork of the Boise River and Camas Creek. The boundary then extends in a southwesterly direction along the divide between the South Fork and Camas Creek to Bennett Mountain. From Bennett Mountain the boundary runs northwest along the divide between the South Fork and the Snake River drainage to a point where the Willow Creek and Indian Creek divide begins. The boundary then runs in a northerly direction along the divide between Willow Creek and other Boise River tributaries, to the point of confluence of the South Fork with the Boise River (see Appendix G: Figure 2).

The sub-basin covers an area of 1,310 square miles, and is mountainous with an extensive network of perennial streams. A major portion of the basin is covered by timber. The USDA Forest Service administers over 669,000 acres of federal land in the basin, or 80% of the total area. A small allotment is managed by the Bureau of Land Management (BLM). Other small holdings are by the State of Idaho and private individuals. Figure 3, in Appendix G, is an Ownership map of the South Fork sub-basin. Figure 4 shows vegetative cover or land use in the basin.

B. Water Supply

Average annual precipitation in the South Fork of the Boise River Basin ranges from 18 to 40 inches. Most of the precipitation falls as snow during the winter season. Snow melts during the spring and early summer cause high runoffs. The annual high-water period begins with a gradual increase in discharge during March, culminates with a peak discharge, usually between April 15 and June 15, and terminates with a gradual recession to base flows during August. Low flows then normally prevail from August through February, see Fig 5.

The average annual runoff from the basin is 805,600 acre-feet. Storage reservoirs are used to catch the spring runoff and release water as needed for irrigation, hydropower, and minimum stream flows. There are two reservoirs (storage exceeding 500 ac-ft) that control runoff in the basin. These are Anderson Ranch and Little Camas. They have a combined total storage capacity

of 526,182 acre-feet. An arm of Arrowrock Reservoir on the Boise River also extends into the basin.

Because of downstream development and existing water rights, little or no opportunity exists within the basin for future development using natural flows. There also appear to be limited opportunities for new storage development above Anderson Ranch Dam.

1. Existing Reservoirs

a. Anderson Ranch Reservoir - Anderson Ranch Dam and Reservoir are a multipurpose project constructed by the U.S. Bureau of Reclamation (BOR) at river mile 43.5 on the South Fork of the Boise River. This is about 28 road miles northeast of Mountain Home, or 75 miles southeast of Boise. The project was authorized by the Secretary of the Interior in August, 1940, with the primary purposes being irrigation, hydroelectric power generation, and flood control. Recreation and fish and wildlife purposes were authorized as incidental benefits tied to a minimum pool. Dam construction began in 1941, reservoir storage commenced in 1945 and the project was completed in 1950.

Anderson Ranch Reservoir controls flows from a 980 square-mile watershed and holds 503,682 acre-feet of water. The dead storage space in the reservoir furnishes the required silt control, and sustains a permanent lake which conserves fish life and provides recreation. Reservoir releases at Anderson Ranch Dam are regulated by the U.S. Bureau of Reclamation in conjunction with Lucky Peak and Arrowrock reservoirs on the Boise River, under terms of a Memorandum of Agreement between the Department of the Army (Corps of Engineers) and the Department of the Interior (Bureau of Reclamation). This Agreement commits Arrowrock and Anderson Ranch to flood control operation with Lucky Peak, protects existing irrigation use of Anderson Ranch and Arrowrock reservoirs during flood control operations, and commits space in Lucky Peak Reservoir to irrigation, stream flow maintenance, and flood control use.

There is no federally authorized release requirement from Anderson Ranch Reservoir to provide minimum stream flows in the South Fork of the Boise below the dam. However, a Bureau of Reclamation administrative action, based upon the Anderson Ranch powerplant Third Unit Study, 1982, maintains minimum release flows of 300 cfs from September 16 through March 31 and 600 cfs from April 1 to September 15. Based on analysis of the run-off over the historical period, beginning in 1928, the 300 and 600 cfs minimum stream flows could be met over 90% of the time. Under unusual circumstances, however, it may be necessary to reduce flow releases below the minimum during years of extremely short water supply. Although efforts are made to not exceed 1600 cfs during the irrigation season, flood flow releases as high as 10,000 cfs have occurred in late spring (April-June). For fish conservation in the South Fork below the dam, it is desirable to avert large spring releases to avoid disturbing spawning beds.

Lucky Peak Dam and Reservoir were authorized primarily as a flood control and irrigation facility, with recreation an authorized secondary purpose. According to the U.S. Bureau of Reclamation, congressional authorizations, therefore, placed a higher priority on recreation at Lucky Peak Reservoir than at Anderson Ranch Reservoir. In years when it is not possible to fill the Boise system, the Bureau moves water first from Arrowrock Reservoir to maintain power head at Anderson Ranch Dam and recreation at Lucky Peak Reservoir. Power head at Lucky Peak is not a consideration in water movement with the reservoir system. Anderson Ranch is kept on minimum fish flows as late as possible, and is then put at maximum powerplant capacity in order to deliver contracted irrigation

water. Having to release more water than the powerplant maximum would constitute a loss in power generation.

The Bureau of Reclamation states that the wholesale value of maximum powerplant capacity at Anderson Ranch Dam is about $20,000 per day. According to the Bureau, use of the hollow jet valves in addition to the powerplant, in order to deliver irrigation water later in the summer, is expensive and to be avoided if at all possible. Loss of power generation in order to provide recreation benefits does not meet project authorization and is not acceptable.

At the end of the irrigation season in a dry year, Arrowrock and Lucky Peak are drawn down to minimum fish pools. All water drawn from Anderson Ranch Reservoir during the summer is used for irrigation. Bureau operation strives to maintain reservoir conservation pools of not less than 41,000 acre-feet at Anderson Ranch Reservoir, and 28,700 acre-feet at both Arrowrock and Lucky Peak reservoirs.

b. Little Camas Reservoir - The Little Camas Reservoir watershed is located in the South Fork of the Boise River drainage and collects runoff from the north slope of Bennett Mountain. This reservoir was completed in 1912 and is owned and operated by the Mountain Home Irrigation District. It is located on Little Camas Creek, one to two miles above where the creek empties into an arm of Anderson Ranch Reservoir. All of the 22,500 acre-feet of storage in Little Camas Reservoir is allocated to irrigation. The water from the reservoir is diverted out of the basin through a canal which runs around the mountain side and tunnels through the ridge into Long Tom Creek in the Snake River drainage. Long Tom Reservoir collects and stores this water to serve irrigated land in the Mountain Home area.

The Little Camas Reservoir provides a good put-and-take rainbow trout fishery and is heavily used for this purpose.

2. Stream Flows

As described above, stream flows follow a general pattern of discharge year after year (Figure 5). However, the intensity of flow varies on a daily, monthly, and annual basis each year. Recording stations established to record flows at various locations on the river are described below. Records of flows at each station are also shown in Appendix C.

No known potential reservoir sites exist in the basin which would alter flow patterns. Only one diversion plan has been proposed that would impact stream flows. This is the inactive Long Tom diversion discussed under Resource Summary for irrigation.

a. Recording Stations - records of flow measurements for many years are available from three major stations on the South Fork of the Boise River. Comparative information on each of these stations is shown in Table III. The map in Appendix G: Figure 2 shows the locations of gaging stations. Other miscellaneous measurements on tributary streams are available but not included in this report (see Appendix D).

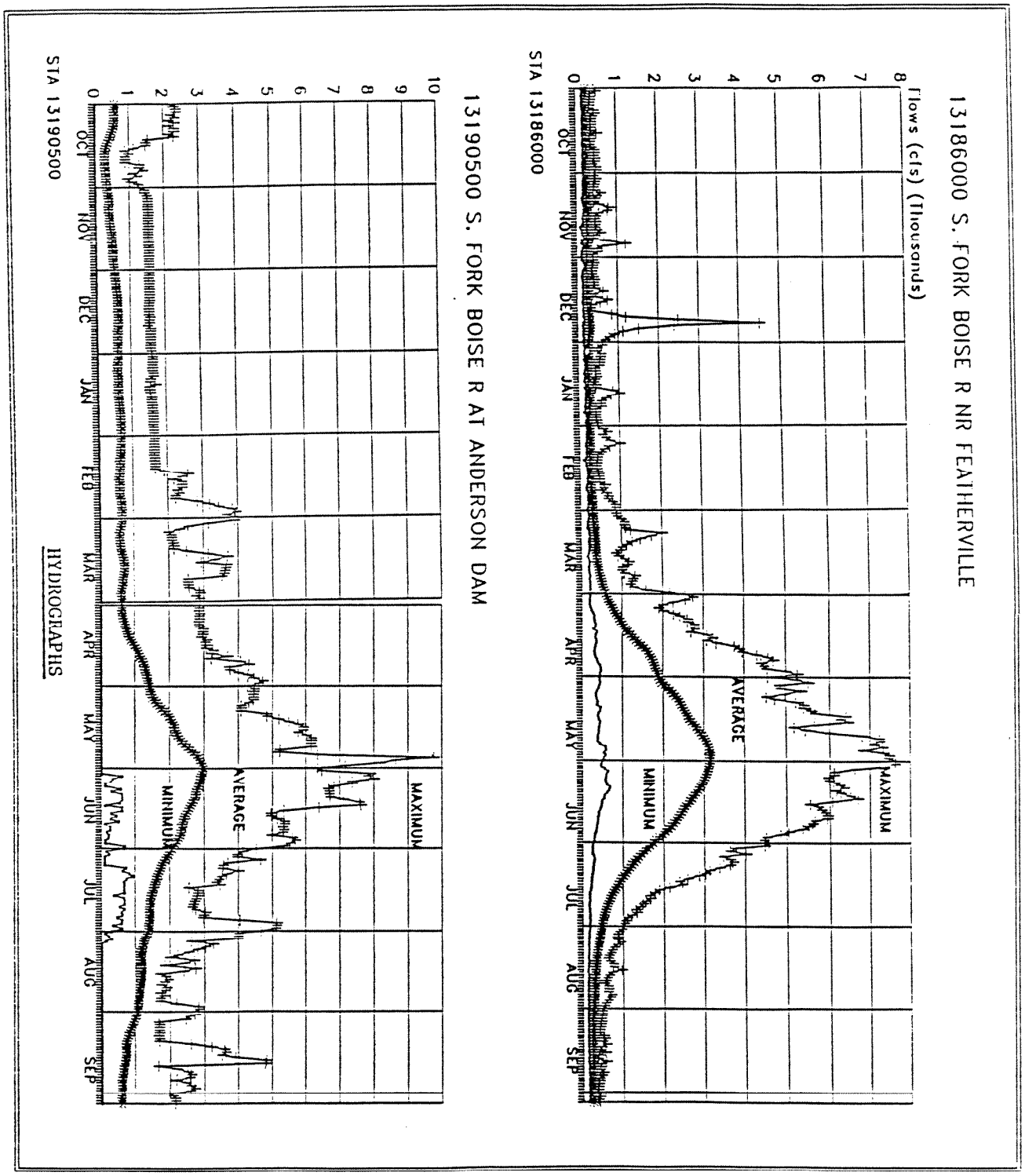
b. Flow Data

(1) Featherville #13186000: South Fork Boise River near Featherville, Elmore County, on right bank 2.5 miles upstream from Deer Creek, 8 miles southwest of Featherville. At the station near Featherville, monthly

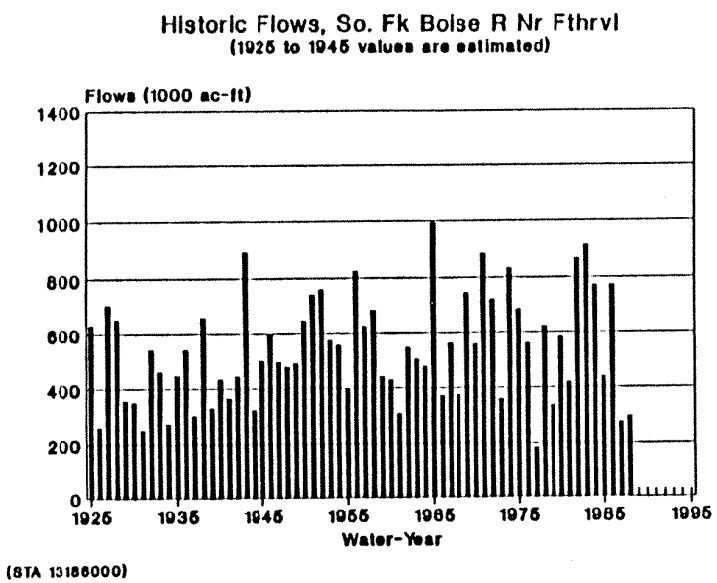
Table III: Key Gaging Stations - South Fork Boise River

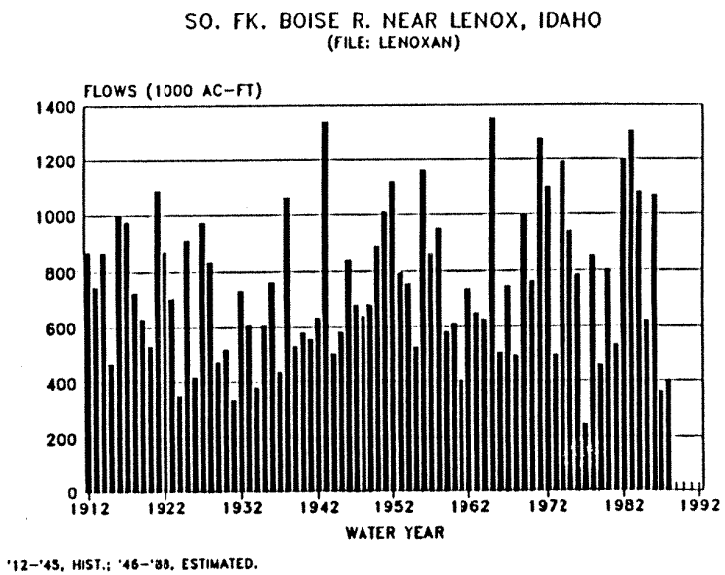
Station	Gage	Period of Record	Average Drainage Area (sq.mi.)	Runoff Volume (ac-ft/yr)	Period of Record (cfs) Avg.	Max.	Min.
#1318600 South Fork Boise River near Featherville	River	Apr. 1945 to Present	635	576,000	795	7,960	30
#13190500 South Fork Boise River below Anderson Ranch Dam	River	Apr. 1943 to Present	982	739,700	1,021	9,850	0.1
#13191500 South Fork Boise River near Lennox, Idaho	River	Mar. 1911 to Nov. 1943	1,090	750,500	1,040	9,550	26

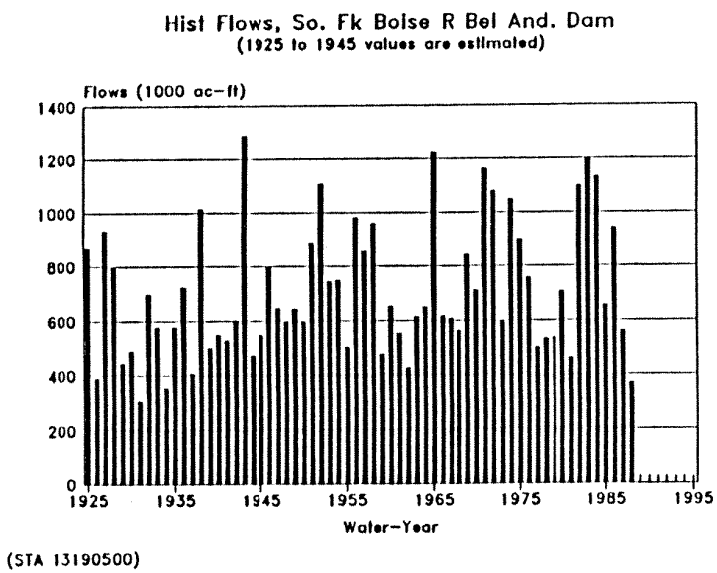
Figure 5


13186000 S. FORK BOISE R NR FEATHERVILLE
flows (cfs) (thousands)
MAXIMUM
AVERAGE
MINIMUM
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
STA 13186000
13190500 S. FORK BOISE R AT ANDERSON DAM
MAXIMUM
AVERAGE
MINIMUM
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
STA 13190500
HYDROGRAPHS

Figures 6-9


Historic Flows, So. Fk Boise R Nr Fthrvl
(1925 to 1945 values are estimated)
Flows (1000 ac-ft)
1400
1200
1000
800
600
400
200
0
1925
1935
1945
1955
1965
1975
1985
1995
Water-Year
(STA 13186000)


SO. FK. BOISE R. NEAR LENOX, IDAHO
(FILE: LENOXAN)
FLOWS (1000 AC-FT)
1400
1200
1000
800
600
400
200
0
1912
1922
1932
1942
1952
1962
1972
1982
1992
WATER YEAR
'12-'45, HIST.; '46-'88, ESTIMATED.


Hist Flows, So. Fk Boise R Bel And. Dam
(1925 to 1945 values are estimated)
Flows (1000 ac-ft)
1400
1200
1000
800
600
400
200
0
1925
1935
1945
1955
1965
1975
1985
1995
Water-Year
(STA 13190500)

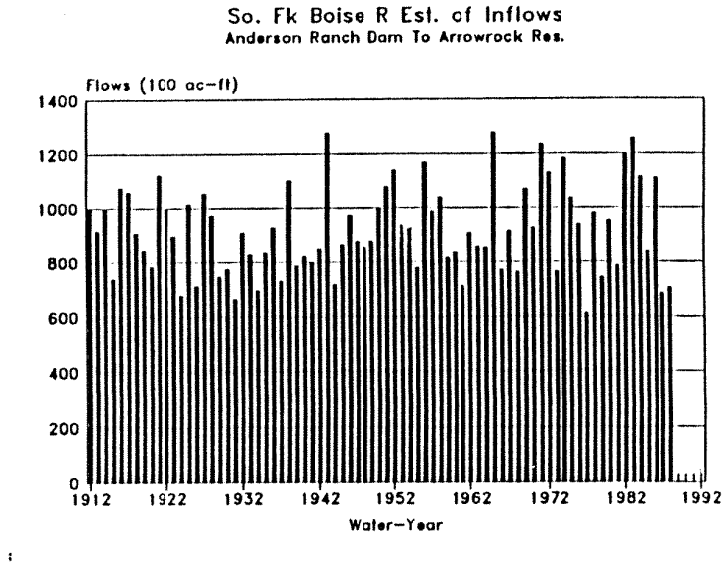

So. Fk Boise R Est. of Inflows
Anderson Ranch Dam To Arrowrock Res.
Flows (100 ac-ft)
1400
1200
1000
800
600
400
200
0
1912
1922
1932
1942
1952
1962
1972
1982
1992
Water-Year

Figure 10

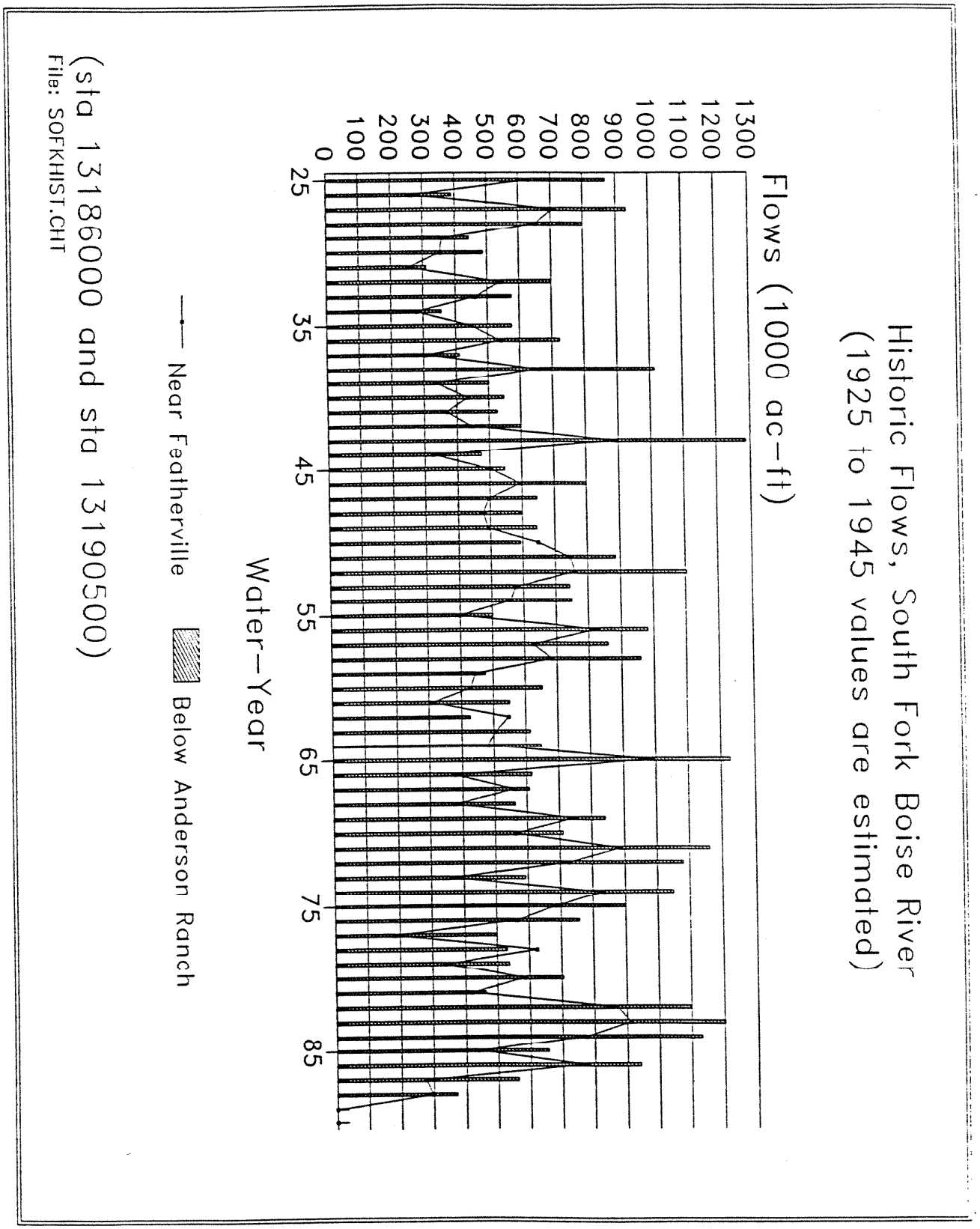
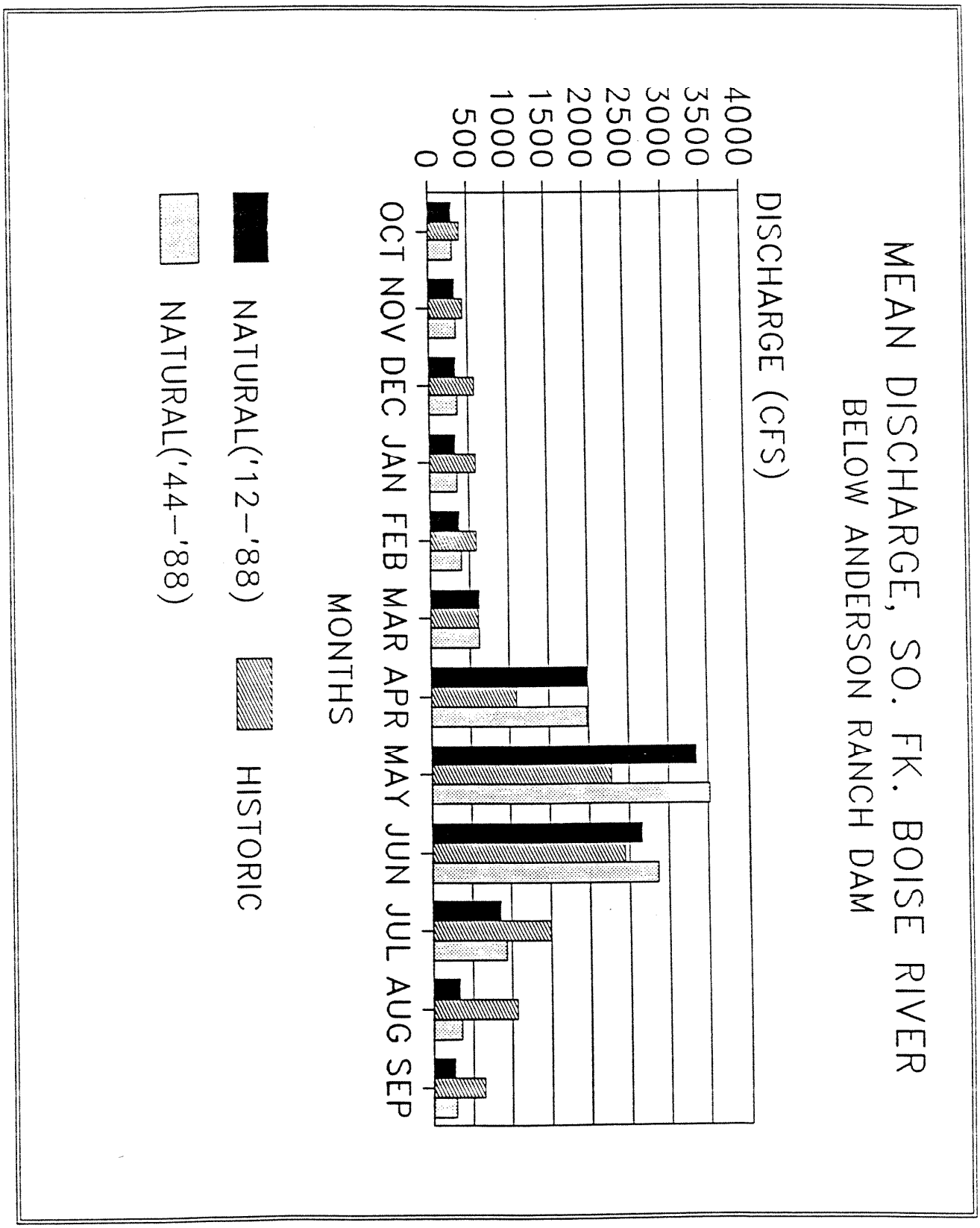

Historic Flows, South Fork Boise River
(1925 to 1945 values are estimated)
Flows (1000 ac-ft)
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
25
35
45
55
65
75
85
Water-Year
Near Featherville
Below Anderson Ranch
(sta 13186000 and sta 13190500)
File: SOFKHIST.CHT

Figure 11


MEAN DISCHARGE, SO. FK. BOISE RIVER
BELOW ANDERSON RANCH DAM
DISCHARGE (CFS)
4000
3500
3000
2500
2000
1500
1000
500
0
OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP
MONTHS
NATURAL('12-'88)
HISTORIC
NATURAL('44-'88)

flows for the period 1946 though 1988 have been recorded, and monthly flows for the 1912 through 1945 period have been calculated. The flows for this combined period, 1912 through 1988 are shown in Table C-1. The annual flows for these years are shown in graph form in Figure 6.

(2) Near Anderson Ranch Dam #13190500: South Fork Boise River at Anderson Ranch Dam, Elmore County, on right bank 600 ft downstream from Dixie Creek, 1.8 miles downstream from Anderson Ranch Dam, 2.2 miles northwest of Bennett. Table C-2 shows estimated natural flows of the South Fork of the Boise River below Anderson Ranch Dam. The 1912 to 1942 period is estimated for a period prior to when the recording station was installed and Anderson Ranch Reservoir began to store water. Estimates were then made for natural flows assuming no influence from Anderson Ranch Reservoir for the 1943 through 1988 period. Figure 7 shows these annual flows for the station in graph form.

Table C-3 lists historic flows below Anderson Ranch Dam for the period 1945 through 1988 with estimate flows from the 1925 to 1945 period. Figure 10 shows the historic and estimated annual flows of Table C-3 in graph form with flows near Featherville super-imposed on the graph for comparison purposes. This shows a high percent of the basin runoff comes from the watershed above Featherville. Figure 11 shows mean monthly discharge flows below Anderson Ranch Dam for both natural and historic conditions. This provides a comparison of natural flows to reservoir releases.

(3) Lenox #13191500: South Fork Boise River Near Lenox, Idaho, on right bank 1.5 miles upstream from Smith Creek, 4 miles upstream from flow line of Arrowrock Reservoir, 4 miles west of discontinued Lenox Post Office, 13 miles from mouth, and 17 miles upstream from Arrowrock Dam. Historic records were kept of the flows at this site from 1911 through 1948. Estimates of the flows for this station have been determined for the 1949 through 1988 period. The historic and estimated flows are given in Table C-4. Figure 8 shows the historic and estimated annual flows in graph form.

(4) Anderson Ranch to Arrowrock Reach Gains - Estimates of reach gains to the South Fork of the Boise River have been made for the river reach from Anderson Ranch Dam to the backwaters of Arrowrock Dam. These estimates cover the period 1912 through 1988 and are shown in Table C-5. The annual flows for the reach and period are also shown in graph form in Figure 9.

3. Ground Water and Geology

The South Fork of the Boise River drainage area is mountainous country. The soil mantle is relatively shallow, and the mountains are steep. Most of the creek and river bottoms where deposition occurs are narrow and provide little opportunity for aquifer formations. One exception is the river bottom in the Pine-Featherville area. The river bottom widens to several hundred feet in this reach and considerable deposition of unconsolidated valley fill material has occurred over time.

This aquifer holds a significant volume of ground water. Specific data on the quality of ground water, and hydrologic and geologic characteristics are unavailable. Major sources of recharge are probably downward percolation of precipitation, snowmelt runoff from surrounding uplands, and seepage from the South Fork Boise River and tributaries. According to Department Well Log records, wells in the area range from 50-250 feet deep producing from 1 to 25 gallons per minute. An estimated 200 people currently rely on this ground-

water system for their domestic and commercial water supply. This number is expected to increase to 280 by the year 2000.

Another area where several domestic wells have been developed is on Smith Prairie. Several domestic wells have been developed at the townsite and also at a number of farmsteads in the area. Wells in this area range from 50 to 300 feet deep and produce up to 40 gallons per minute. Other small ground-water areas exist in the basin such as Dixie and the Little Camas area. These ground-water sources provided a water supply for sparsely located existing and proposed commercial establishments and dwellings in the area.

C. Flood Control

Spring snowmelt and occasional thunderstorm rainfall causes frequent flooding along streams in the basin. The streams beds are steep, resulting in very high run-off velocities. The soil mantle is shallow and most stream channels are armored with rocks and boulders. However, riparian growth along the channels is very important to the control of high runoff flows and the protection of the limited soil mantle. Along reaches where the riparian vegetation has been destroyed, heavy channel erosion occurs causing considerable damage to water quality, and fish and wildlife.

Anderson Ranch Dam controls flooding of the South Fork below the dam. The reservoir is managed in conjunction with Arrowrock and Lucky Peak to control floods in the Lower Boise Basin.

D. Irrigation

Irrigation in the South Fork of the Boise River Basin is very limited. Most irrigation occurs on Smith Prairie where about 1,800 acres are irrigated by diverting water from tributaries of the South Fork. Seven hundred acres in the lower Camas Creek area are irrigated. Other small parcels of land along the river bottom above Anderson Ranch Dam, in the Pine-Featherville reach, are irrigated for pasture, alfalfa hay, and gardens (see Appendix G: Figure 4).

In 1966, a U.S. Bureau of Reclamation "Southwest Idaho Water Development Project" report proposed a project to divert water from the South Fork Boise River to irrigate desert land near Mountain Home under an exchange agreement. The venture involved a diversion dam and tunnel, downstream of Anderson Ranch Dam, to divert 486,000 acre-feet annually out of the basin. The water would irrigate 96,400 acres on the Mountain Home desert. The U.S. Congress did not fund this project and it is inactive. Further consideration of the proposal will not be a part of this sub-basin water plan. However, this does not preclude future consideration of water diversion under an exchange arrangement, should a need for this irrigation project develop.

E. Power Development

There is one hydropower development in the basin, a 40 megawatt (MW) facility at Anderson Ranch Dam. Hydropower generation at this plant is secondary to irrigation and flood control. The powerplant at Anderson Ranch

Dam is owned and operated by the U.S. Bureau of Reclamation, and generates power as releases are made for irrigation and/or flood control. When constructed Anderson Ranch Reservoir had a small, 5,000 acre-feet, exclusive storage right for power operations. However, this storage right has never been used exclusively for that purpose. One-thousand acre-feet of this power right has been marketed to the Boise Water Corporation. Anderson Ranch Dam was designed for a total of three generating units; only two turbines were installed. The two turbines currently have a combined capacity of 40 MW.

Energy generated at the site is added to the federal intertie system and marketed by the Bonneville Power Administration (BPA). Electric power requirements in the basin are supplied through Idaho Power Company (IPC) and the Prairie Power Cooperative. Idaho Power supplies electricity to the area from its private powerplants outside the basin, or through trades with the BPA. The Prairie Power Cooperative buys its power from the BPA.

A number of potential hydro-power sites in the basin have been identified in government and private studies (see Appendix G: Figure 12). There are currently no sites in the South Fork drainage that are actively being studied or developed either through the Federal Energy Regulatory Commission (FERC) or by the federal government.

Installation of a third generating unit at Anderson Ranch Dam is planned. Generation from the third unit would help provide power to meet future energy demands within the region.

F. Energy Conservation

Population in the basin is very sparse. There are no industrial installations, little commercial activity, and limited irrigation development. Therefore, opportunity for extensive energy savings by energy conservation measures in the basin is relatively nonexistent.

G. Fish and Wildlife

The South Fork of the Boise River Basin provides good habitat for a large variety and number of fish and wildlife species, including species of concern. Black bear, mule deer, elk, and mountain goat roam in the forested mountains of the upper South Fork. Native upland game birds: valley quail, mourning doves, and blue, franklin, and ruffed grouse are found throughout the basin. Chukar is prevalent along the drier, lower stretch of the river. The McDonald segment of the Boise River Wildlife Management Area, involving 2,100 acres, is located in the lower end of the basin, roughly along the South Fork between Willow and Rattlesnake creeks.

The South Fork between Anderson Ranch Dam and the backwaters of Arrowrock Reservoir is managed as a quality trout stream by the Idaho Department of Fish and Game. The river below the Dam is famous for its wild rainbow trout. Other game fish found in the reach are bull trout and mountain whitefish. Brook trout may also be found in the lower basin tributaries.

Anderson Ranch Reservoir is a popular kokanee fishery in southern Idaho. Smallmouth bass and rainbow trout also inhabit the reservoir. Fish found in the upper South Fork and tributaries, above Anderson Ranch Reservoir, include:

rainbow, eastern brook, cutthroat, and bull trout, mountain whitefish, and kokanee. Cutthroat trout are found primarily in high mountain lakes, although some migrate into basin streams.

The tributaries of the upper South Fork traverse the Idaho Batholith. These streams exhibit excellent water quality and produce the fine gravels that provide outstanding trout spawning beds. An exception is Feather River, which has a large migration barrier near its mouth and a number of historic mining impacts.

The upper South Fork drainage supplies critical summer habitat for deer, elk, mountain goats and other wildlife species. Most of the elk and goats winter in the area. Forty-three goats were counted during a February 1990 helicopter survey of the South Fork above Bear Creek. A total of 31 goats were counted in the Big Smoky drainage. Deer move to traditional wintering areas along the Boise Front and along the South Fork river corridor. The McDonald segment of the Boise River Wildlife Management Area is managed for 400-600 mule deer as winter range. Bald eagles winter between Anderson Ranch Dam and Featherville. Two active nest sites have been documented along this stretch. Foraging occurs throughout the reach and adjacent tributaries.

Lime Creek and Big Smoky Creek provide excellent fish spawning beds and habitat for wildlife. Public sentiment supports protection of these drainages for their water quality, fishery, and recreation values.

H. Recreation

The South Fork Boise River sub-basin provides abundant recreational opportunities (see Appendix G: Figure 13). There are areas near roads and the river that are developed for picnicking, camping, hunting, fishing, hiking, sight-seeing, or just relaxing. Scenic back country and primitive areas are accessible by foot, horseback, boat, or plane. Opportunities exist in the basin for river rafting, canoeing or boating, fishing, water skiing, and swimming. The U.S. Forest Service estimates recreationists spent 380,000 visitor days in the South Fork basin in 1989, camping, hiking, and participating in water recreation activities. A visitor day is defined as 12 visitor hours, e.g., one visitor spending 12 hours or 12 visitors spending one hour involved in a recreation activity.

Deep water storage releases for irrigation help propagate a celebrated cold water fishery below Anderson Ranch Dam. This lower reach is a nationally recognized fishing stream, rated by Trout magazine as one of the top 100 trout streams in the United States. Sport fishing estimates for 1988 on the South Fork, below the Dam, totaled 100,282 angler hours. This is roughly 2,330 hours per mile for the 43 mile reach.

An Idaho Fish & Game survey conducted in 1988 estimated anglers fished approximately 8200 hours on the South Fork between Featherville and Big Smoky Creek during the late May to mid-October season. This is roughly 370 hours per mile for the 22 mile reach. Wild trout populations on the upper South Fork are supplemented with hatchery trout in over-fished reaches. Fishing effort also occurs on tributary streams, with Little Smoky Creek a popular area because of its accessibility.

Hunting in the basin is estimated at 74,858 hunter days for 1988. Hunting is concentrated in the upper South Fork drainage. Wildlife observation, nature study, and sight-seeing in the basin is estimated at 5,500 visitor hours for 1989.

The South Fork of the Boise River below Anderson Ranch Dam has gained a reputation for whitewater rafting, canoeing, and kayaking. With challenging Class III whitewater and wilderness scenery, the corridor is increasingly used for recreational floating during spring and summer months. Anderson Ranch Reservoir provides for boating, fishing, water skiing, and swimming. Canoeing and tubing are popular water activities on the South Fork above the Reservoir.

Late summer irrigation releases from Anderson Ranch Reservoir extend the boating season on the lower South Fork. Idaho Parks and Recreation (IPR) 1989 surveys on the South Fork, between Anderson Ranch Dam and Neal Bridge, tallied 940 boaters for 23 surveyed days. Summer season (90 day) estimates for the lower South Fork are 3,500 boaters or 1,100 visitor days. The IPR surveys indicate that weekend boating/floating on the South Fork has increased 387 percent over 1983 survey counts. The majority of the launches (87%) occur on weekends or holidays, but weekday use has also grown dramatically, a 289 percent increase over 1983. Boaters responding to the surveys said they chose boating on the South Fork because of its proximity, fishing opportunity, and geologic features or scenery. According to both 1983 and 1989 surveys, 90 percent of the boaters on the South Fork are Idaho residents, and 80 percent of the residents are from the southwest Idaho-Boise-Mountain Home region.

There are many points along the lower South Fork which provide floater access to the river. In response to a perceived increase in recreation demand, the U.S. Forest Service improved boater-launch areas at Reclamation Village, Cow Creek, and Danskin Bridge, and began monitoring site use in 1989. The Forest Service also plans to improve boater access at Neal Bridge. Outfitters have applied for permits for the South Fork below Anderson Ranch Dam, but commercial float trips are currently barred. The U.S. Forest Service, in concert with the Idaho Department of Fish & Game, and through issues identified at public meetings, is developing a management plan for the lower basin stretch due to the dramatically increased recreational pressures in, on, and along the river.

Improved public camping and picnic grounds, administered by the U.S. Forest Service, are concentrated around Anderson Ranch Reservoir and along the South Fork above Anderson Ranch Reservoir. Developed sites are mapped in Appendix G: Figure 13. Some of the more heavily used facilities in the basin and around Anderson Ranch Reservoir are listed in Table IV. Additional use of the basin is made by hikers along 30 trails. Hiking trails frequently follow stream courses in the basin. The Rainbow Basin Trail into the Trinity Mountains, Danskin Mountain, the Big Smoky Trail, and the Lime Creek Trail are particularly popular footpaths for hikers, horseback riders, and hunters.

I. Timber

Timber stands cover 52 percent of the South Fork basin. Most stands are a mix of ponderosa pine and Douglas fir. Stand density and productivity varies with soils and water supply. Along moist stream banks riparian vegetation is prominent, e.g., willows, cottonwood, red alder, and numerous berry-producing bushes. Riparian vegetation slows sediment transport and scouring, helping to modify and alleviate turbidity and bank erosion. In addition, riparian vegetation enhances fishery conditions by providing cover and by shading the water course, thus moderating daytime water temperatures.

Approximately 92 percent of the forest lands of the basin are administered by the federal agencies, 3 percent is under State ownership, and 5 percent is private. Timber harvest has become a complex activity that involves coordination with other resource values. The layout, design, and

Table IV. Anderson Ranch Reservoir Recreational Areas

Area	Facilities	Activities
	CAMPGROUNDS	
Castle Creek	2 units, toilets	Camping, fishing boating
Evans Creek	1 unit, toilets	Camping, fishing
Little Wilson Creek	2 units, toilets	Camping, fishing, boating
	BOATING SITES	
Curlew Creek	Ramp, parking, water, toilet, picnic areas	Boat launching, picnicking un-camping
developed Deer Creek	Ramp, parking, water toilets, picnic areas	Boat launching, picnicking, un-developed camping
Elk Creek	Ramp, parking, toilets	Boat launching
Fall Creek	3 ramps, parking, toilets	Boat launching
Pine Airport	Ramp, parking, toilets	Boat launching, picnicking, un-developed camping
	POINTS OF INTEREST	
Anderson Ranch Dam	Overlook area	Sightseeing

OTHER SOUTH FORK BOISE RIVER BASIN CAMPGROUNDS:

	No. of Sites
Tipton Flat C.G.	10
Curlew Creek	Open Area
Little Wilson Creek	Open Area
Evans Creek	Open Area
Castle Creek	Open Area
Deer Creek	Open Area
Pine Creek	Open Area
Elk Flat	Open Area
Elk Creek	Day Use
Ice Springs C.G.	5
Dog Creek C.G.	13
Big Trinity Lake C.G.	18
Little Trinity C.G.	Day Use
Skeleton Creek C.G.	5
Abbot C.G.	7
Chaparral C.G.	7
Bird Creek C.G.	5
Willow Creek C.G.	5
Baumgartner C.G.	29
Bounds C.G.	12
Canyon C.G.	6

spacing of harvest areas considers the visual impacts on landscape, forage and cover needs of wildlife species, archeological and historical areas, fire hazard, and potential effects on insect and decrease populations. Road construction and harvest activities on steep slopes or highly erosive soils require mitigating measures to reduce erosion and protect water quality. The Idaho Forest Practices Act and Water Quality regulations provide stream and channel protection from erosion and sedimentation associated with timber harvest within the basin.

Timber resources on federal lands are managed by the U.S. Forest Service for a nondeclining yield, i.e., the yield of wood fiber for any decade will not be less than the yield of the previous decade. "Nondeclining yield" also implies that the average annual amount cut cannot exceed the long-term capability of the forest to regenerate wood fiber on a sustained yield basis.

Harvest in the Lime Creek drainage is limited by an agreement between the U.S. Forest Service and the Friends of Lime Creek. In the Big Smoky drainage forest land is managed as semi-primitive.

It is not the intent of the Idaho Water Resource Board that this plan affect harvest of timber or log hauling in the South Fork Boise River sub-basin. The Idaho Forest Practices Act and Water Quality regulations afford protection regarding these activities within the basin.

J. Mining

Portions of the South Fork sub-basin are highly mineralized (see Appendix G: Figure 14). Mining activity in the drainage was at its peak during the 19th century, but has since declined. A number of small mines are presently active. There has been a sharp increase in exploration activities during the past few years due to an increase in gold and silver prices. Most activity has been with placer mining where some gold has been taken out, and a few lead-silver-zinc claims have produced some high-grade ore. Known deposits include: silver, gold, lead, molybdenum, zinc, barite, cooper, tungsten, columbium, tantalum, antimony, tin, and fluorspar. Leasable minerals in the basin include geothermal resources; there is little potential for development of coal, gas, or oil in the basin because no extensive deposits exist.

Mineral resource management is guided primarily by federal laws and regulations. However, several State laws, specific to mining, apply to all lands in Idaho, including federal lands. The Idaho Dredge and Placer Mining Protection Act of 1955 requires reclamation of disturbed areas and adherence to water quality standards. The Idaho Surface Mining Act of 1971 provides measures to reclaim the lands disturbed by surface mining operations.

The State of Idaho Department of Lands administers these two laws with State Land Board direction. A Memorandum of Understanding has been signed by the Department of Lands and the U.S. Forest Service, assuring cooperation in the approval and bonding of mining operations on federal lands. The Idaho State Department of Health and Welfare administers State water quality laws (see also Appendix E).

K. Livestock Water

Livestock grazing began in the South Fork Boise River Basin in 1863 with the coming of the miners to Rocky Bar. The availability of range grasses and water made this an attractive area. By 1905 large numbers of cattle, sheep, and wild horses grazed the area. The mining camps provided a good market for beef. Stages, freight lines, and livery stables were markets for horses. Sheep raising also became big business. In the short span of 40 years, most range suitable for livestock grazing was depleted and soil erosion was common. Due to the extensive number of perennial streams, springs, and lakes, livestock water has not been a limiting resource in the basin. Development and management of the water resources, however, has been found to be of assistance in managing the range resource.

The Forest Service's current livestock management is directed towards resolving three problems: coordination of livestock grazing with reforestation on transitory ranges; preparation and maintenance of Annual Operating Plans for the Forest Service's sheep allotment; and coordination of livestock grazing with the needs of riparian areas, fish habitat, and fish and wildlife indicator species.

L. Scenic Values

The South Fork Boise River sub-basin is 1,310 square miles of scenic mountain ranges and canyons. Elevations range from about 3,200 feet at Arrowrock Reservoir to over 10,000 feet in the jagged Sawtooth and Big Smoky mountains, the northern and eastern boundaries of the basin. Between these extremes in elevation is a wealth of natural resources: timber, forage, minerals, wildlife, recreational opportunity, and splendid vistas of scenery.

The basin is spotted with cascading streams, small sheltered basins near mountain tops, vast rolling high meadows, forested canyons, massive granitic peaks and cliffs, and picturesque hills adjacent to desert valleys. Placid lakes and reservoirs of various shapes and sizes are randomly spotted throughout the basin. Enjoyment of the basin's scenic values is an important component of recreational activity in the basin.

The U.S. Forest Service uses measurable objectives for visual management of federal forest lands. Visual quality objectives include: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. Except for Preservation, which allows for ecological change only, each describes a different degree of acceptable alteration of the natural landscape and is measured in terms of visual contrast with the surrounding natural landscape.

M. Natural and Cultural Features

The South Fork sub-basin, with adjacent areas, has a rich cultural history (Appendix G: Figure 15). Rocky Bar and Featherville were among early mining settlements in the area. Prior to early mining activity, the area was extensively used for hunting and gathering by native American tribes. Research shows that the South Fork sub-basin has been used by native Americans

for the last 10,000 years. The river served as a fishery for the Shoshone and Paiute Tribes and probably their prehistoric ancestors.

Today evidence of these activities is found on the flat, open ground along the river and on the terraces above the drainage. In these sites, ground stone tools and scatters of stone tools and toolmaking debris have been recorded by Forest Service archaeologists. It is possible that fish were dried and processed in this area.

At Danskin Rockshelter, some well preserved pictographs are found inside the shelter. The rockshelter also contains artifacts and burned bones of large mammals as well as a dense accumulation of mussel shells. This site may have functioned as a seasonal camp for Shoshone bands when they were hunting and fishing in this area.

Fur trappers and traders entered the area in the early 1810's. The Northwest's first gold rush occurred near Idaho City in the Moores Creek tributary of the Boise River in 1862. Evidence of early development in the basin includes old mines, pack trails, sheep camps, homesteads, and roads. The old mining area known as Rocky Bar is listed in the National Register of Historic Places.

Active cultural resource management on federal lands is a relatively new program. Lands are being inventoried for archeological resources and historic sites. Cultural resources include: campsites, rock shelters, lithic quarries, mines, town sites, ranches, Forest Service Administration sites, and trails.

The Wild and Scenic River Act, passed by Congress on October 2, 1968, states that ". . . certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreation, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environment shall be protected for the benefit and enjoyment of present and future generations."

After assessing the river qualities in the basin, five river segments have been recommended by the U.S. Forest Service for further study:

Wild - South Fork Boise River, Trail Creek to Neal Bridge (Arrowrock Reservoir).
Wild - Lime Creek, Anderson Ranch Reservoir to BNF boundary.
Scenic - South Fork Boise River, Danskin Bridge to Trail Creek.
Recreational - South Fork Boise River, Anderson Ranch Dam to Danskin Bridge.
Recreational - South Fork Boise River, BNF boundary near Featherville to Anderson Ranch Reservoir.

N. Domestic, Municipal, Commercial and Industrial Uses

At the present time the small communities in the basin rely on ground water for municipal purposes as do residents for their domestic needs. There is no need for domestic, municipal, commercial or industrial allocation of surface water at this time.

O. Navigation

No commercial navigation occurs in the basin. Boating that occurs is recreational. Interest exists in establishing outfitters and guide service on the South Fork Boise River below Anderson Ranch Dam. See the following discussion of constraints on water rights for more pertinent information.

P. Water Quality

Tributaries to the South Fork of the Boise River are reported to be affected by rangeland activities, forest practice activities including road building or maintenance, and dredge mining. Sediment is the primary pollutant in these waters. Cold water biota and salmonid spawning are potentially at risk, except on Wood Creek where they are believed to be only partially supported. Anderson Ranch Reservoir is impacted by rangeland activities, but no pollutants or impacts on beneficial uses are reported. Similarly, the South Fork has non-irrigated crop production and rangeland activities, but no pollutants are reported nor are any beneficial uses considered to be impacted.

IV. CONSTRAINTS AND GOALS

A. Constraints

Goal setting for the future use of water in the basin is limited by a number of existing constraints and rights. These include the following:

1. Water Rights

Early settlers to Idaho were attracted by the abundant water and undeveloped land resource of the State. As water was diverted to irrigate land or used for mining or power generation, a beneficial use was created.

When the State constitution was established, it included in Article 15, Section 3: "The right to divert and appropriate the unappropriated waters of any natural stream to beneficial uses, shall never be denied, except that the state may regulate and limit the use thereof for power purposes. Priority of appropriation shall give the better right as between those using the water; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall (subject to such limitations as may be prescribed by law) have the preference over those claiming for any other purpose; and those using the water for agricultural purpose shall have preference over those using the same for manufacturing purposes. And in any organized mining district those using the water for mining purposes or milling purposes connected with mining have preference over those using the same for manufacturing or agriculture purposes. But the usage by such subsequent appropriators shall be subject to such provisions of law regulating the taking of private property for public

and private use, as referred to in section 14 of article 1 of this Constitution."

Since January 1980, the Idaho Department of Water Resources has issued no water right permits for consumptive use of water during the period June 15 to November 1 on the Boise River and its tributaries above Lucky Peak Reservoir. Water in the affected area has been judged to be fully appropriated, and therefore no additional consumptive uses can be permitted.

Under Idaho Codes, Section 42-1734F, no provision of the statutes or regulations administering formulation and implementation of the Comprehensive State Water Plan shall in any way limit, restrict, or conflict with approved applications for the appropriation of water, or with other existing vested property rights. Other activities not to be limited through the provisions of the planning statutes and regulations include:

(1) Cleaning, maintaining, or replacing a water diversion structure existing on or before the date a river is designated as protected.

(2) Relicensing of existing hydropower projects that have been previously licensed by the FERC, and which have generated electricity.

(3) Expansion of capacity of existing hydropower projects if the existing boundaries or project impoundments are not expanded, and the project was previously licensed by the FERC, and the project generated electricity on or before the date of designation.

Vested property rights are likely established whenever any structure or facility, such as a dam, bridge, road fill, pipeline crossing, dike, boat ramp, float or dock, has been constructed under approved authorities. Similarly, when permits, licenses, claims or leases are issued providing the necessary authorities to construct any of these facilities, or to conduct activities related to mining, or for diversion or storage of water, they may establish vested property rights.

Under these requirements, designations of waterways as protected rivers, cannot interfere with any of these rights or activities that were either approved or in existence prior to the date of designation (see also Appendix B). Within the Boise River, South Fork sub-basin, this could apply to:

(1) Maintenance and replacement of existing water diversion structures.

(2) Construction of new water diversion structures authorized under approved water right permits.

(3) Development of active mine claims or leases, or approved sand and gravel operations.

2. Water Contracts

a. November 20, 1953 Agreement - With the development of reservoirs in the Boise Basin (including Anderson Ranch in the South Fork sub-basin) by the Bureau of Reclamation and the Army Corps of Engineers, it was necessary that an agreement be entered into between these agencies to provide for and control the operation of these reservoirs to maximize the benefits for which they were constructed. This was done after consultation with the State of Idaho. The Agreement was entered into on November 20, 1953. In 1985 a Memorandum of Understanding was also written as a supplement to the Agreement. The primary purpose for the construction of the Anderson Ranch Reservoir is noted in the Bureau of Reclamation water right filing: 493,161

acre-feet for power and irrigation. It lists 275,766 acres of land to be served and a powerplant with a head of 324 feet and 20,000 KW capacity.

Arrowrock Dam, previously constructed, was also built to provide irrigation water to the Boise Valley. The Corps of Engineers then built Lucky Peak Dam as a multipurpose project, authorized primarily for flood control. The water and storage rights within each project have evolved with the projects. Under the agreement entered into, which operates these projects as one, the irrigation reservoirs (Arrowrock and Anderson Ranch) are committed to flood control operation with Lucky Peak Reservoir. However, the agreement also commits Lucky Peak to protection of the existing irrigation use of Anderson Ranch and Arrowrock reservoirs during flood control regulation, and commits space in Lucky Peak to irrigation and stream flow maintenance as well as flood control.

b. Owner and Operator Contract - The Bureau of Reclamation owns and operates the Anderson Ranch, Arrowrock, and Diversion Dam projects and facilities. The Bureau also owns the New York Canal project and facilities. The Boise Project Board of Control operates the three projects under an operation and maintenance contract with the Bureau of Reclamation, that involves flow regulation at Anderson Ranch Dam.

3. Water Quality

The South Fork Boise River has been designated a Special Resource Water from source to mouth by the Idaho Department of Health and Welfare. The water is of outstandingly high quality and meets or exceeds the criteria established for primary contact recreation and cold water biota. No permits for point source discharges to Special Resource Waters are to be issued by the State.

No existing point pollution source is known to occur in the basin. No point-source permits have been issued. Nonpoint source pollution, however, may be a matter of concern. Activities such as road construction and maintenance, skidding or dragging logs, and mechanical brush removal, cause soil disturbance. The application of chemicals to increase growth, to control undesirable growth, or control pests is another potential source of pollution in the basin. In some areas, the removal of shade from streams can increase the water temperature to levels harmful to fish.

The State of Idaho has established regulations aimed at control of nonpoint source pollution. These regulations require:

- application of approved Best Management Practices (BMPs) or, in their absence, knowledgeable and reasonable effort to minimize adverse water quality impacts; and

- protection of designated or protected beneficial uses from serious injury.

Stream-water quality in the basin is monitored by the U.S. Forest Service, U.S. Geological Survey, and Idaho Department of Health and Welfare.

4. Stream Protection

a. State Water Plan

Chapter 17, Section 42-1734A, provides for the state protection of rivers as either a "natural" or a "recreational" river. The Idaho Water Resource Board is to designate those rivers which are to be protected in

the comprehensive state water plan. In designating a Natural River, the Board shall prohibit the following activities:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversions works;
- dredge or placer mining;
- alteration of stream bed; and
- mineral or sand and gravel extraction within the steam bed.

In designating a Recreational River, the Board shall determine which of the activities listed in subsection (5) of this section shall be prohibited and may specify the terms and conditions under which activities that are not prohibited may go forward.

The legislation which authorizes the Idaho Water Resource Board to designate the protective status of rivers as part of a Comprehensive State Water Plan does not grant to the Board any eminent domain powers which would authorize the Board to acquire any property along the rivers. The only property contiguous to rivers which would be affected by this plan is property owned by the State of Idaho.

b. Northwest Power Planning Council

In 1988 the Power Council protected 12,000 miles of streams in Idaho from hydropower development, in an effort to preserve existing fish and/or wildlife habitat. There are 358 miles of streams designated as Protected Areas for resident fish and/or wildlife in the Boise River, South Fork Basin. The Federal Energy Regulatory Commission (FERC) has agreed to consider the Power Council's Protected Areas Designations when evaluating applications for hydro-power development.

The Idaho Legislature recognized in part, that Designations made by the Power Council were based solely on fish and wildlife values. In 1988 the State Comprehensive Water Plan bill (HB 780) directed the Idaho Water Resource Board to develop basin plans that consider a comprehensive list of resource values and criteria to determine the optimum uses of Idaho's water resources. When completed, the Northwest Power Planning Council and FERC will be asked to adopt the actions and recommendations of the Comprehensive State Water Plan.

c. Wild and Scenic Rivers

The Wild and Scenic River Act, passed by Congress on October 2, 1968, states that ". . . certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreation, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environment shall be protected for the benefit and enjoyment of present and future generations."

After assessing the river qualities in the basin, five river segments have been recommended by the U.S. Forest Service for further study:

Wild	- South Fork Boise River, Trail Creek to Neal Bridge (Arrowrock Reservoir).
Wild	- Lime Creek, Anderson Ranch Reservoir to BNF boundary.
Scenic	- South Fork Boise River, Danskin Bridge to Trail Creek.
Recreational	- South Fork Boise River, Anderson Ranch Dam to Danskin Bridge.
Recreational	- South Fork Boise River, BNF boundary near Featherville to Anderson Ranch Reservoir.

5. Forest Service Plan

National forest lands under the management of the USDA Forest Service make up 81 percent of the basin. About 30 percent is in the Boise National Forest and 50 percent in the Sawtooth National Forest. The U.S. Forest Service has completed Land and Resource Management Plans for both Forests. Management practices in the plan apply to the South Fork sub-basin and impact water resources.

B. Goals

The Goals of the Comprehensive State Water Plan seek to ensure that future water resource use will compliment and supplement State goals directed toward achieving "a quality of life" for the citizens of Idaho. The plan recognizes past actions and addresses present conflicts relative to water resources. It also recognizes land ownership and management plans that depend on or impact the water resources. In the Boise River, South Fork basin, the USDA Forest Service manages a major portion of the land area. Their Land and Resource Management Plans apply to the watershed area. Practices applied in the watershed which help protect the water resources and stream flows from degradation, support the goals of the Comprehensive State Water Plan.

1. Supporting Forest Service Land and Resource Management Plans

A major portion of the South Fork sub-basin is national forest land. Private and state lands are scattered through the lower basin area with concentrations in Smith Prairie, Anderson Ranch Reservoir, and around the communities of Pine, Featherville, and Rocky Bar. Land and resource management plans have been developed by the USDA Forest Service for the long-term direction and management of the National Forest lands. The management plans are established to achieve multiple use goals. Goals listed along with a statement that they are "not all inclusive" are as follows:

a. <u>Recreation</u>

- Provide a system of trails necessary to meet expected demand considering user safety, convenience, and resource protection.
- Provide a variety of recreational opportunities in accordance with identified demand.
- Provide protection of most inventoried recreation sites with potential for development.
- Maintain or improve the visual quality of the forest.
- Provide OHV opportunities in areas where such use will not create unacceptable damage or conflict.

b. <u>Wilderness</u>

- Manage to protect wilderness values in designated wildernesses.
- Recommend roadless areas for wilderness that have significant wilderness values.

c. <u>Fish and Wildlife</u>

- Reduce conflicts between wildlife and fish habitat, timber, and livestock resource use, seeking solutions to minimize or eliminate those conflicts.
- Protect and enhance wildlife and fish habitat diversity.

- Manage the forest to maintain or improve aquatic habitats.
- Protect, manage, and improve riparian areas while conducting multiple use activities on them.
- Provide for adequate year-round instream flow in streams associated with Class I Riparian Areas.
- Provide habitat and management access needed to achieve State wildlife agencies' population goals.
- Prevent sensitive plant species becoming threatened or endangered.

d. Range

- Provide for efficient utilization and management of range on a sustained yield basis to meet demand.
- Improve range condition on suitable grazing lands in unsatisfactory condition.

e. Timber

- Enhance the growth and utilization of wood fiber.
- Cooperate with research organizations in trial applications of new practices designed to increase yields, when commensurate with costs.
- Manage the timber resource in a manner that is sensitive to economic efficiency.
- Provide opportunities for firewood cutting and gathering.
- Reduce man-made fuels to acceptable levels.

f. Water, Soil, and Air

- Maintain and/or improve water quality.
- Conserve soil and water resources.
- Maintain and/or improve riparian area vegetation.
- Meet air quality standards.
- Protect, manage, and improve riparian areas while implementing land and resource management activities.

g. Minerals

- Provide opportunities for mineral and energy exploration, development, and extraction consistent with management of surface resources, laws, and regulations.

h. Human and Community Development

- Provide the opportunity for economic growth of industries and communities dependent upon forest outputs.
- Provide for community stability and cohesion through forest programs.
- Encourage the use of volunteers in the National Forest programs to help achieve natural resource goals and to provide opportunities for individuals and groups to become involved in management and protection of the Forest.
- Encourage equal opportunity employment.

i. Lands

- Exchange lands where desirable to block up ownership and increase management efficiency.
- Assure public access to National Forest System lands.

j. Facilities

- Maintain the transportation system necessary to support resource use and protection of forest resources and investments considering user safety, convenience, and user vehicle maintenance costs.
- Provide the administrative facilities necessary for efficient management and public service.

k. Protection

- Provide a cost-effective fire protection and use program.
- Provide for insect and disease considerations to be an integral part of vegetation management activities.
- Prevent or reduce serious long-lasting hazards and damage from pest organisms, utilizing principles of integrated pest management.

l. Other goals

- Provide a program that achieves a high calculated present net value.

2. State Water Plan

Formulation of a Comprehensive State Water Plan is a dynamic process. Every five years a formal review of the plan is made, and the plan is subject to change to reflect citizens desires and to be responsive to new opportunities and needs, which are in keeping with water law. The following goals are established to direct future planning and management of the water resources of the South Fork sub-basin in keeping with that which is determined to be in the greatest public interest.

a. Recreation - Recreation and tourism are expanding rapidly as a major state industry. The goal of the state is to protect the quantity and quality of water where possible to maintain and to enhance recreational experiences and opportunities in the basin.

b. Fish and Wildlife - Where needed and where adequate stream flow exists, it is a goal of the state to provide minimum stream flows sufficient and necessary to meet the minimum requirements for aquatic life, fish, and wildlife in the basin.

Riparian areas along the streams are important to both fish and wildlife. These areas are to be protected. When water projects are developed in the basin, mitigation for fish and wildlife losses must be provided.

c. Irrigation - Irrigation in the basin is limited in magnitude and very little opportunity for future expansion exists. Proposals for inter-basin water diversion for irrigation are inactive at this time. It is the goal of the state to encourage orderly and efficient growth in food and fiber production within the basin and state where possible. This goal will not interfere with, limit, or conflict with vested property and water rights.

d. Power Development - In keeping with the State Energy Plan, it is the goal of the State to encourage development of hydropower sites that are economically feasible and environmentally acceptable.

e. Energy Conservation - The use of electrical energy in the basin is limited primarily to a small amount of commercial and to residential purposes. In keeping with the State Energy Plan, it is the goal of the State to give high priority to the more efficient use of energy in residential and commercial structures in the basin through cost-effective retrofits and new design.

f. Flood Control - Flooding along the South Fork of the Boise River and basin tributaries is not a major problem. However, it is a goal of the State to minimize and further limit damages in the basin by encouraging protection of the riparian areas along all stream reaches.

g. Water Supply - The major water storage facility in the basin is Anderson Ranch Reservoir. Other water supply sources are natural stream diversions for irrigation and ground water pumped for domestic use. It is goal of the state that the quality and quantity of these water supply sources be protected for existing uses and for future expanded uses.

h. Timber - The State supports harvest of an annual sustained yield with protection of riparian areas along the streams and application of best management practices to guard against soil erosion and the entrance of sediment into streams. This goal will not interfere with or regulate timber harvest or log hauling activities within the Basin. These activities are governed by existing Idaho law and regulations.

i. Mining - It is the goal of the State to provide water supply needs for mining enterprises that are environmentally acceptable and that do not degrade water quality in streams with return flows. However, recreational and fishery resources in the Lime Creek and Big Smoky Creek drainages, and the South Fork Boise River, below Anderson Ranch Dam are highly valued and mining opportunities should be limited in these areas.

j. Domestic, Municipal, Commercial, and Industrial Uses - It is the goal of the Water Resource Board to encourage and support economic development in the state. Although domestic, municipal, commercial, and industrial uses are limited in the basin, an adequate supply of good quality water will be maintained for present and planned future uses.

k. Natural and Cultural Features - The State of Idaho has many outstanding natural features that need to be protected and preserved for the enjoyment of present and future generations. It is, therefore, a goal of the State to provide for, where appropriate, the protection of rivers as either Natural or Recreational rivers; to provide for instream flows for the needs of fish and wildlife, power production, and recreation; to protect lake and reservoir shorelands; and to protect the riparian areas of rivers and streams.

   Cultural sites in the state are also significant features that need to be protected for the benefit of present and future generations. It is the goal of the State to identify and preserve these sites where possible and feasible.

l. Scenic - Water provides for and enhances many State scenic attractions. This includes free flowing streams, and placid lakes and reservoirs nestled in canyons, valleys, and mountain basins. It is the goal of the State to support projects and activities that preserve and enhance the scenic values of the State.

m. Livestock Water - Livestock water is a vital component of use and management of the rangelands of the State. It is a goal of the State to support livestock water development and good grazing practices in the South Fork basin in a manner which maintains a high quality range, controls erosion, and provides the greatest long-range economic benefit from range lands in the basin. Idaho law provides that prior vested property and water rights are not affected by any designation of the water resources within the South Fork Boise River sub-basin as protected rivers. It is not a goal of this plan to interfere with, limit or restrain vested property and water rights of any kind which are utilized for stock watering purposes.

n. Environmental Quality and Economic Development - It is the goal of the State to encourage and support projects and activities which protect and enhance environmental quality and provide for economic development. When conflicts occur, those actions which provide the greatest public benefit will be supported.

V. CONCLUSIONS

Based on the Board findings from existing studies, data, and public oral and written input, the following conclusions are made:

1. Streams and river reaches of the South Fork Boise River Basin posses a combination of outstanding fish and wildlife, recreation, geologic or aesthetic values which are worthy of protection.

2. The present qualities of the basin's river and streams could be disrupted by hydropower development, present FERC policies, water diversions, impoundments, dredge and placer mining, alteration of stream beds or sand and gravel extraction within the streambed, and the recent Supreme Court ruling in the Rock Creek vs California case supporting the FERC conclusion that it has exclusive jurisdiction to determine minimum stream flows for FERC licensed projects.

3. A protected river designation will prohibit construction of projects in the streambed, dredge or placer mining, and mineral or sand and gravel extraction or diversion works which would detract from the outstanding qualities of selected streams and river reaches. Future modification or exceptions can be made to this plan if conditions change to where development needs outweigh the protected recreational, biological, aesthetic, and environmental values of these river reaches, or if protection of other streams or river reaches are needed, and if such action is deemed to be in the public interest of the state.

   Amendments to the water plan can be made by the Board whenever it is deemed to be in the public interest and following the public hearing process as required for the adoption of the plan, Section 42-1734A, Idaho Code. Also, "The Board shall review and reevaluate the comprehensive state water plan at least every five (5) years . . . ." (Section 42-1734(B)(7)).

4. Protection of the outstanding features of the streams of the South Fork Boise River Basin are deemed to be in the public interest and can be provided without interfering with existing water rights and agricultural needs; stockwater needs; present and future timber harvest programs on federal, state and private lands; domestic, commercial, municipal and industrial water needs; recreational activities; and other existing multiple river uses in the basin and river corridor areas.

5. Some streams in Idaho have been designated as federal wild and scenic rivers, and others are being considered for federal designation, including reaches of the South Fork Boise River. It is the policy of Idaho that the state has sovereignty over decisions affecting its water resources. In designating protected rivers in Idaho, a state system would be more responsive to the needs and desires of Idahoans. Federal designation should only be made at the request of the state so as to comply with the state water plan.

6. The interim protected reach of the South Fork Boise River from Anderson Ranch Dam to Neal Bridge has outstanding features which warrant protection. Man-made developments in the riparian area of the upper reach of the river limits this protected designation to a Recreational River. The lower reach, however, is free of man-made developments in the riparian area and meets the characteristics of a Natural River.

7. Lime Creek and Big Smoky Creek have been identified as streams which need protection to maintain the existing fish and wildlife, recreation, geologic, and aesthetic values. These streams are free of existing man-made developments within the streambeds and riparian areas which would qualify them as Natural Rivers. However, most of the southern tributaries of Lime Creek enter into or pass through private grazing lands. Designating these streams as Recreational Rivers would provide for needed protection and still allow for future stockwater developments or other future domestic needs for these private grazing lands.

8. A protected designation of the river reaches will not have an economic impact on present or future timber harvest programs, or existing farming operations.

9. The economic trade-off to be considered is returns from development projects versus returns from maintaining and increasing recreational activities resulting from the protected status of selected streams and river reaches. The Idaho Water Resource Board encourages hydropower projects sponsored by State interests.

   The economic benefits to the area from the attraction of a work force who enjoys the recreational opportunities of the area, the increase of jobs from recreational activities, the increase of sales and services due to recreation and tourism, and the potential growth of economic benefits from these attractions have not been measured at this time. It is evident, however, that they are of such magnitude that a comparison to the benefits from limited development opportunities are not required, to arrive at a decision that is in the public interest to protect the present qualities of selected streams and river reaches.

10. The Forest Service Land and Resource Management Plan will have a positive impact on the watershed areas of the basin's stream system. This will reduce erosion, siltation, and destruction of riparian areas, which in turn improves water quality and runoff flow conditions.

11. Water quality standards established by the Department of Health and Welfare have a positive impact on the multiple uses of the water resources in this system.

12. The Fisheries Management Plan of the Idaho Department of Fish and Game improves the recreational quality and quantity of stream use in the planning reaches.

VI. ACTIONS AND RECOMMENDATIONS

The goals of the South Fork sub-basin plan serve as a guide for actions taken by the Idaho Water Resource Board and other land and water management agencies. All local, state, and federal resource agencies are encouraged to assist in achieving the goals of the Comprehensive State Water Plan for the Boise River, South Fork Sub-Basin. Formulation of the Comprehensive State Water Plan is a dynamic process. Every five years a formal review of the plan

is made and the plan is subject to change to reflect citizens desires, and be responsive to new opportunities and needs which are in keeping with water law.

A. Actions

Consistent with the goals and objectives of this plan which recognize that all vested property and water rights in effect as of July 1, 1988 are not affected, limited, or restricted in any manner by this plan, the Idaho Water Resource Board takes the following action regarding protection and management of the water resources within the South Fork Boise River Basin:

1. Designation of Protected Rivers

The South Fork of the Boise River from Anderson Ranch Dam to Neal Bridge has been designated by the Idaho Legislature and Idaho Water Resource Board as an Interim Protected Stream.

2. Federal Wild and Scenic Rivers

The U.S. Forest Service has evaluated eligibility of streams in the South Fork sub-basin, for inclusion in the federal Wild and Scenic Rivers program. Stream segments that meet criteria for study under provisions of the Wild and Scenic Rivers Act are:

Wild - South Fork Boise River, Trail Creek to Neal Bridge (Arrowrock Reservoir).
Wild - Lime Creek, Anderson Ranch Reservoir to BNF boundary.
Scenic - South Fork Boise River, Danskin Bridge to Trail Creek.
Recreational - South Fork Boise River, Anderson Ranch Dam to Danskin Bridge.
Recreational - South Fork Boise River, BNF boundary near Featherville to Anderson Ranch Reservoir.

3. Water Quality Standards

The Department of Health and Welfare have established water quality standards for the State of Idaho.

4. Boise River Reservoirs Water Control Manual

Anderson Ranch is a multipurpose project which provides irrigation water, flood control, power generation, and recreation. Operation of this reservoir is coordinated with Arrowrock and Lucky Peak reservoirs to maximize utility of the available storage for the purposes for which they were constructed.

In May 1974, the Governor of Idaho requested that the Idaho Department of Water Resources review Boise River flood control management, etc., and present recommendations for improved operations. This lead to the preparation of a Water Control Manual for the Boise River Reservoirs. The Bureau of Reclamation and the Army Corps of Engineers jointly regulate the Boise River reservoirs according to the Water Control Manual through a Memorandum of Agreement.

5. U.S. Forest Service Land and Resource Management Plans: Sawtooth and Boise National Forests

The U.S. Forest Service has completed Land and Resource Management Plans for management of the Boise and Sawtooth National Forest lands in the basin. Watersheds on the forest lands provide a continuous supply of high quality water for agriculture, power generation, fish, wildlife, and a variety of recreational activities. The Land and Resource Management Plans provide measures for control of soil and stream channel erosion and improving riparian zones and watershed conditions.

6. Fisheries Management Plan

The Idaho Department of Fish and Game has a Fisheries Management Plan which describes the Department's management program for fish populations and fishing opportunities in the sub-basin (see Appendix F).

B. Protected River Designations and Recommendations

Consistent with the goals and objectives of this plan, the Idaho Water Resource Board makes the following designations regarding protection and management of the water resources within the South Fork Boise River Basin:

1. South Fork Segment - Recreational River

The designation of the South Fork of the Boise River from Anderson Ranch Dam downstream to Black Canyon Creek as a Recreational River. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except for those necessary to maintain existing irrigation facilities, utilities, roadways, stream channel protection, the maintenance of existing access, placement of fishery enhancement structures, or new access for recreational purposes.

New diversion works shall be limited to pump installations sized to supply water for the standard domestic exemption or of a capacity sufficient for stock water or developed recreational purposes.

While not prohibited by law, specific authorization is provided for the eventual addition of a third generating unit at Anderson Ranch Dam with the provision that the fish and recreational values of the river be protected.

2. South Fork Segment - Natural River

The designation of the South Fork Boise River from the mouth of Black Canyon Creek downstream to a point of 250 yards upstream of Neal Bridge as a Natural River. Provision is made, thereby, for the maintenance and future upgrading of Neal Bridge, and the Neal Bridge Float Boat Access site.

3. Lime Creek Drainage - Natural Rivers and Recreational Rivers

That Lime Creek from its mouth to its confluence with the North and Middle Forks and all tributaries on the north side of Lime Creek including the North and Middle Forks and all their tributaries from their mouth to their headwaters, be designated as Natural Rivers.

The term headwaters, as used in this plan, means a natural water course in perceptible extent with definite beds and banks which confines and conducts continuously and intermittently flowing waters (from Rules and Regulations Pertaining to the Idaho Forest Practices Act, IDL, 1988).

All remaining tributaries of Lime Creek, from their mouths to their headwaters be designated as Recreational Rivers. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- Construction or expansion of dams or impoundments
- Construction of hydropower projects
- Dredge or placer mining
- Mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except for those necessary to maintain existing access, utilities, and roadways, the placement of fishery enhancement structures, or new access for recreational purposes.

New diversion works shall be limited to pump installations sized to supply water for the standard domestic exemption or of a capacity sufficient for stock water or developed recreational purposes.

4. Big Smoky Creek Drainage - Natural Rivers

That Big Smoky Creek from its confluence with Calf Creek to its headwaters and all tributaries to Big Smoky Creek above and including Calf Creek from their mouth to their headwaters be designated as Natural Rivers.

The term headwaters, as used in this plan, means a natural water course in perceptible extent with definite beds and banks which confines and conducts continuously and intermittently flowing waters (from Rules and Regulations Pertaining to the Idaho Forest Practices Act, IDL, 1988).

C. Recommendations

1. Northwest Power Planning Council Protected Areas Designations

It is recommended that the Department of Water Resources cooperate with the Department of Fish and Game, and with other appropriate natural resource agencies, in reviewing and evaluating the Protected Areas Designations of the

Northwest Power Planning Council relative to the South Fork Boise River Sub-Basin.

2. Forest Service Action

It is recommended that the Forest Service expedite land treatment measures that control soil erosion on the watershed area and protects and/or re-establishes riparian areas along the streams in the basin.

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Appendix A

Issue Analyses and Stream Classification Summaries

Table I: ISSUE ANALYSIS

**Recreational River:* South Fork Boise, Anderson Ranch Dam to Black Canyon

	RESOURCES	*POTENTIAL IMPACT ON:*	*RECREATIONAL CLASSIFICATION*
Navigation	——	——	——
Hydropower	Add turbine at Anderson Dam; One identified hydropower site	——	Exempted
		Fish and wildlife; boating	Prohibits
Energy Conservation	——	——	——
Fish & Wildlife	Quality trout fishery; mule deer winter range; game birds	Impoundments; major diversions; dredge mining	Stream channel conditionally protected
Recreation	Fishing; boating; sight-seeing	Major diversions; impoundments	Stream channel conditionally protected
Irrigation	Local potential limited; diversion to Mtn. Home	Diversion may impact fishery and recreation	Prohibits new diversions
Flood Control	Regulated by Anderson Ranch Dam	Structural controls may impact fishery and sight-seeing	Prohibits new structural controls
Timber	Area not harvested	Channel alteration may impact fishery	Channel alteration allowed with conditions
Dredge Mining	No commercial operations	Fish and wildlife; recreation; cultural features	Prohibits
Livestock Water	Seasonal use	Fish and wildlife	Pumping exempted
Scenic Values	River canyon; sight-seeing	Impoundments; major diversions	Stream channel conditionally protected
Nat or Cult Features	River canyon; Archeological sites; Historical sites	Impoundments; dredge mining	Stream channel conditionally protected
Do, Com, Ind Uses	Minimal use	Fish and wildlife; recreation	Domestic exempted Prohibits new Comm, Indus diversions

*The designation of any river as having a protective status as part of a Comprehensive State Water Plan is subject to all prior vested property and water rights and does not affect any activities which occurred prior to July 1, 1988 and which were based on vested property and water rights.

Table I : ISSUE ANALYSIS (Cont.)

*Natural River: South Fork of the Boise River - Black Canyon to Neal Bridge

	RESOURCES	POTENTIAL IMPACT ON:	NATURAL CLASSIFICATION
Navigation	——	——	——
Hydropower	Two identified sites	Fish and wildlife; boating	Prohibits
Energy Conservation	——	——	——
Fish & Wildlife	Quality trout fishery; mule deer winter range; game birds	Impoundments; major diversions; dredge mining	Protects
Recreation	Fishing; boating	Major diversions; impoundments	Protects
Irrigation	Limited potential;	Fish and wildlife; recreation	Prohibits new diversions
Flood Control	Regulated by Anderson Ranch Dam	Structural control may impact fishery	Prohibits new structural controls
Timber	Area not harvested	Channel alteration may impact fishery	Prohibits stream channel alteration
Dredge Mining	No commercial operations	Fish and wildlife; recreation	Prohibits
Livestock Water	——	Fish and wildlife	Prohibits new diversions
Scenic Values	Isolated river canyon	Impoundments; major diversions	Protects
Nat or Cult Features	River canyon; Archeological sites;	Impoundments; dredge mining	Protects
Do, Com, Ind Uses	——	Fish and wildlife; recreation	Prohibits diversions

*The designation of any river as having a protective status as part of a Comprehensive State Water Plan is subject to all prior vested property and water rights and does not affect any activities which occurred prior to July 1, 1988 and which were based on vested property and water rights.

Table I: ISSUE ANALYSIS (Cont.)

**Natural River:* Lime Creek and North and Middle Fork Tributaries

	RESOURCES	*POTENTIAL IMPACT ON:*	*NATURAL CLASSIFICATION*
Navigation	——	——	——
Power	Two identified sites	Fish and wildlife, boating	Prohibits
Energy Conservation	——	——	——
Fish & Wildlife	Trout fishery; spawning beds; wildlife habitat	Impoundments; major diversions; dredge mining	Protects
Recreation	Trails/Hunting	Major diversions; impoundments	Protects
Irrigation	Limited potential	Fish and wildlife; recreation	Prohibits new diversions
Flood Control	Not a problem locally	Structural control may impact fishery	Prohibits new structural controls
Timber	Limited harvest	Channel alteration may impact fishery	Prohibits stream channel alteration
Dredge Mining	No commercial operations	Fish and wildlife; recreation	Prohibits
Livestock Water	——	Fish and wildlife	Prohibits new diversions
Scenic Values	Proposed wilderness	Impoundments; major diversions	Protects
Nat or Cult Features	Proposed wilderness; pristine watershed	Impoundments; dredge mining	Protects
Do, Com, Ind Uses	——	Fish and wildlife; recreation	Prohibits new diversions

*The designation of any river as having a protective status as part of a Comprehensive State Water Plan is subject to all prior vested property and water rights and does not affect any activities which occurred prior to July 1, 1988 and which were based on vested property and water rights.

Table I: ISSUE ANALYSIS (Cont.)

*Recreational River: Southern Tributaries to Lime Creek

	RESOURCES	POTENTIAL IMPACT ON:	RECREATIONAL CLASSIFICATION
Navigation	—	—	—
Power	No identified sites	Fish and wildlife, boating	Prohibits
Energy Conservation	—	—	—
Fish & Wildlife	Trout fishery; spawning beds; wildlife habitat	Impoundments; major diversions; dredge mining	Stream channel conditionally protected
Recreation	Trails/Hunting	Major diversions; impoundments	Stream channel conditionally protected
Irrigation	Limited potential	Fish and wildlife; recreation	Prohibits new diversions
Flood Control	Not a problem locally	Structural control may impact fishery	Prohibits new structural controls
Timber	Limited harvest	Channel alteration may impact fishery	Channel alterations allowed with conditions
Dredge Mining	No commercial operations	Fish and wildlife; recreation	Prohibits
Livestock Water	—	Fish and wildlife	Pumping exempted
Scenic Values	Proposed wilderness	Impoundments; major diversions	Stream channel conditionally protected
Nat or Cult Features	Proposed wilderness; pristine watershed	Impoundments; dredge mining	Stream channel conditionally protected
Do, Com, Ind Uses	—	Fish and wildlife; recreation	Prohibits new diversions

*The designation of any river as having a protective status as part of a Comprehensive State Water Plan is subject to all prior vested property and water rights and does not affect any activities which occurred prior to July 1, 1988 and which were based on vested property and water rights.

Table I: ISSUE ANALYSIS (Cont.)

**Natural River:* Big Smoky Creek and Tributaries above Calf Creek

	RESOURCES	*POTENTIAL IMPACT ON:*	*NATURAL CLASSIFICATION*
Navigation	——	——	——
Power	No identified sites	Fish and wildlife habitat	Prohibits
Energy Conservation	——	——	——
Fish & Wildlife	Excellent spawning beds; wildlife habitat	Impoundments; major diversions; dredge mining	Protects
Recreation	Trails/Camping; fishing	Major diversions; impoundments	Protects
Irrigation	Limited potential;	Fish and wildlife; recreation	Prohibits new diversions
Flood Control	Not a problem locally	Structural control may impact fish and wildlife	Prohibits new structural controls
Timber	Semi-Primitive Mngt designation, no sales proposed	Channel alterations may impact fishery	Prohibits stream channel alteration
Dredge Mining	No commercial operations	Fish and wildlife; recreation	Prohibits
Livestock Water	——	Fish and wildlife habitat	Prohibits new diversions
Scenic Values	Intermontaine meadows	Impoundments; major diversions	Protects
Nat or Cult Features	Vegetation zones, watershed	Impoundments; dredge mining	Protects
Do, Com, Ind Uses	——	Fish and wildlife; recreation	Prohibits new diversions

*The designation of any river as having a protective status as part of a Comprehensive State Water Plan is subject to all prior vested property and water rights and does not affect any activities which occurred prior to July 1, 1988 and which were based on vested property and water rights.

Table II: RIVER CLASSIFICATION SUMMARY
South Fork Boise River Sub-Basin

	Recreational	*Natural*	*Natural*
	S. F. from Anderson Ranch Dam to Black Canyon	**S.F. from Black Canyon to Neal Bridge**	**Lime Creek and Northern Tributaries**
Values to be Protected			
Fish & Wildlife	Quality Trout Stream	Quality Trout Stream	Quality Fishery/Spawning
Recreation	Heavy Fishing/Boater Use	Heavy Fishing/Boater Use	Trailhead/Hunting
Aesthetic	Desert Hills-River Canyon	Isolated River Canyon	Prop Wildns/Pristine Wshd
Historic	Mining/Archeol Sites	Mining/Archeol Sites	None Identified
Natural Geologic	None	Deep Basalt Canyon	None Identified Spngs
Riparian Area			
Man Made Structures	Roads, Utilities, Fences	None	None
Access/Trail or Road	Two Roads, Side Trails	Side Trails	Trails
Prohibited Activities			
Const./Exp. Dams	Prohibited	Prohibited	Prohibited
Const. of Hydro	Prohibited	Prohibited	Prohibited
Const. of Diversions	Domestic & Recreation Pumps Allowed	Prohibited	Prohibited
Dredge/Placer Mining	Prohibited	Prohibited	Prohibited
Stream Bed Alterations	Exist Util, Road, Project Maintenance Allowed	Prohibited	Prohibited
Min/Sand/Gravel Ext.	Prohibited	Prohibited	Prohibited

Table II: RIVER CLASSIFICATION SUMMARY
South Fork Boise River Sub-Basin

	Recreational	*Natural*
	Southern Tributaries to Lime Creek	**Big Smoky Creek Drainage from Calf Creek**
Values to be Protected		
Fish & Wildlife	Trout Spawning/Wildlife	Excellent Spawning Stream
Recreation	Trails/Hunting	Trails/Camping
Aesthetic	Pristine Watershed	Intermontaine Meadows
Historic	None Identified	None Identified
Natural Geologic	None Identified	Hot Springs
Riparian Area		
Man Made Structures	None	None
Access/Trail or Road	Trails	Trails
Prohibited Activities		
Const./Exp. Dams	Prohibited	Prohibited
Const. of Hydro	Prohibited	Prohibited
Const. of Diversions	Domestic & Recreation Pumps Allowed	Prohibited
Dredge/Placer Mining	Prohibited	Prohibited
Stream Bed Alterations	Exist Util, Road, Project Maintenance Allowed	Prohibited
Min/Sand/Gravel Ext.	Prohibited	Prohibited

Appendix B
Idaho Water Resource Board Authority

The Idaho Code (42-1731) defines Natural River, Recreational River, and riparian area. The essential difference between Natural and Recreational rivers is the degree of man-made development within the waterway and riparian zone.

Riparian area is defined as the area within 100 feet of the mean highwater mark on either side of the waterway. State agencies must exercise their duties in a manner consistent with the Comprehensive State Water Plan. The plan therefore may have some impact on State lands within the riparian area.

Other governmental or private landowners are under no requirement to modify existing or future practices, nor are they required to recognize the plan in any other way. If the construction of diversion works is prohibited or conditioned, or if the alteration of the streambed is prohibited or conditioned, future development along the waterway will be limited to activities not restricted by such conditions.

The Idaho Code (42-1734) provides the Water Resource Board with eminent domain authority for the construction of projects, both land and water. HB 780, the legislation which created the State protected rivers system, and provided for comprehensive state water planning, does not include eminent domain language. Since protected river status can not be construed as a land or water project, the eminent domain authorities of the Board do not apply.

Appendix C
Stream Flow Records

Table C-1

18600G DISCH., BOISE RIVER NEAR FEATHERVILLE, IDAHO (1912-45 GNRTD)(1000 AC-FT)

W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
12	14.7	13.7	13.6	15.5	13.1	16.0	64.5	188.5	233.2	57.5	24.9	18.4	673.6
13	16.2	15.7	12.8	12.9	12.4	16.6	85.0	182.2	142.4	50.0	25.0	15.9	587.1
14	17.1	18.5	13.9	14.5	13.6	32.1	106.8	174.4	106.1	36.2	14.9	15.2	563.3
15	19.1	14.6	11.5	12.2	11.9	16.9	47.8	72.9	51.9	25.2	12.5	11.7	308.2
16	12.5	12.1	13.1	12.2	11.6	27.6	111.5	162.7	209.5	105.0	26.2	16.5	720.5
17	16.1	12.2	12.0	11.7	11.2	13.4	44.3	186.2	223.0	84.0	18.7	12.3	645.1
18	12.5	12.2	21.6	18.0	13.7	28.3	92.3	134.6	193.8	32.8	16.4	13.2	589.4
19	15.1	13.1	12.0	11.5	10.9	17.9	87.0	169.0	72.1	18.1	10.5	9.3	446.5
20	12.7	14.1	11.8	14.3	11.1	13.6	32.9	163.5	130.6	36.7	15.3	15.1	471.7
21	17.5	18.1	15.8	16.7	15.5	34.4	83.0	271.3	254.6	52.9	19.7	16.2	815.7
22	14.8	17.1	16.7	13.3	12.0	17.3	51.3	195.5	221.4	42.9	17.5	11.8	631.6
23	12.5	12.7	13.2	13.3	11.9	16.3	52.1	140.9	118.7	58.3	17.0	12.0	478.9
24	14.4	13.0	12.7	12.5	13.6	12.8	30.1	76.0	12.1	8.0	7.6	7.8	220.6
25	12.0	14.3	12.1	12.5	17.0	27.4	111.5	226.8	120.3	47.1	17.4	13.6	632.0
26	14.7	13.0	13.6	13.4	12.4	21.4	55.7	70.6	20.6	9.8	8.7	8.5	262.4
27	10.9	16.4	17.0	13.9	14.8	24.1	74.4	179.1	244.3	73.8	21.0	16.6	706.3
28	17.2	30.1	19.2	17.4	15.1	35.6	64.5	290.8	100.6	33.5	15.4	11.9	651.3
29	13.5	12.7	12.3	12.0	11.1	17.4	31.3	104.9	95.8	27.3	11.4	9.7	359.4
30	11.7	10.9	15.2	12.0	14.1	18.5	71.7	83.1	74.5	19.0	11.9	10.2	352.8
31	15.0	11.9	11.4	12.0	11.3	16.9	43.9	79.9	27.5	8.3	7.1	7.6	252.8
32	10.8	10.9	11.4	11.9	11.2	19.7	65.1	183.0	150.3	40.4	14.8	10.8	540.3
33	12.3	12.9	11.5	12.4	11.2	13.6	47.4	92.4	193.8	30.1	12.5	9.8	459.9
34	12.2	12.3	13.2	14.9	14.5	31.0	75.5	64.6	15.7	8.4	7.1	7.2	276.6
35	11.9	13.9	13.0	13.2	12.8	15.6	67.3	131.5	121.3	27.2	11.5	8.6	447.8
36	11.0	11.3	11.3	11.9	11.3	15.8	128.7	197.4	97.5	21.2	12.0	10.2	539.6
37	11.2	10.7	11.8	11.6	11.0	15.2	36.0	116.5	50.3	14.6	8.5	7.6	305.0
38	11.1	12.7	20.9	14.8	13.2	24.2	95.4	196.5	181.4	56.9	18.8	12.8	658.7
39	15.0	14.5	14.0	13.0	11.8	25.6	73.2	101.8	31.1	15.2	8.7	8.6	332.5
40	12.0	11.0	13.0	13.3	14.3	33.4	86.5	144.0	70.3	16.9	9.3	11.2	435.2
41	14.4	14.6	13.3	13.1	12.9	19.0	39.0	106.9	82.7	23.0	15.3	12.8	367.0
42	13.4	17.0	20.7	14.5	13.0	16.1	78.0	90.8	115.7	41.8	14.0	10.4	445.4
43	11.7	15.6	15.4	20.2	16.6	30.8	213.2	206.0	199.2	118.4	31.4	16.7	895.2
44	16.8	16.9	13.5	13.1	12.3	13.8	34.1	83.2	69.5	28.8	12.6	10.1	324.7
45	11.7	14.0	12.2	13.3	13.4	17.2	42.8	150.6	148.0	49.5	16.8	12.3	501.8
46	12.2	13.2	14.8	14.4	11.8	24.5	131.6	185.5	120.8	38.3	16.2	12.6	595.9
47	17.1	15.8	17.1	13.3	14.2	32.0	77.9	163.5	88.0	32.2	13.5	11.1	495.7
48	15.5	13.7	12.2	13.7	11.9	13.2	50.0	142.0	145.1	33.7	14.9	11.9	477.8
49	13.7	13.6	13.0	12.8	11.1	19.3	88.9	174.1	95.4	27.7	12.6	10.3	492.5
50	13.1	14.8	12.5	13.9	12.9	18.2	83.1	171.6	189.7	77.5	22.6	17.9	647.8
51	19.1	23.9	19.0	16.3	18.6	22.1	139.9	230.7	151.0	65.2	24.8	15.1	745.7
52	19.4	16.7	18.2	17.1	15.0	17.5	125.0	271.0	175.6	52.8	20.9	13.6	762.8
53	13.6	12.6	14.1	16.4	13.5	23.8	80.7	109.3	179.9	78.2	20.1	13.0	575.2
54	12.6	14.0	12.7	14.2	15.1	23.1	87.0	193.2	106.2	50.8	17.1	12.4	558.4
55	13.0	12.8	11.3	11.8	9.8	11.8	24.3	101.9	137.5	37.4	13.1	10.2	394.9
56	12.7	15.6	27.4	21.8	15.5	28.5	150.3	269.2	195.9	54.7	20.2	13.6	825.4
57	16.2	14.9	15.3	13.4	14.5	22.5	63.2	212.8	178.0	46.4	16.5	12.7	626.4
58	15.0	13.1	14.3	14.1	14.9	17.7	53.0	299.7	167.8	43.2	19.3	13.8	685.9
59	14.1	16.0	18.6	15.7	12.9	17.7	72.0	98.2	118.8	29.0	13.9	16.9	443.8
60	21.4	15.6	12.5	13.6	11.6	24.3	75.5	107.5	101.3	22.2	12.3	11.3	429.1
61	11.9	12.6	11.0	11.6	13.0	17.6	41.3	90.4	65.8	14.6	9.6	10.4	309.8
62	12.2	12.3	11.9	12.0	13.0	14.3	98.8	130.2	160.7	48.6	19.4	13.1	546.5
63	16.6	15.0	14.6	12.4	24.2	20.5	39.0	149.8	136.5	45.2	17.2	14.5	505.5
64	14.0	16.2	13.7	13.2	12.2	14.6	54.7	132.4	134.9	45.4	15.6	12.3	479.2
65	12.4	12.8	42.0	27.3	23.2	28.2	128.4	248.2	285.7	119.6	39.5	23.6	990.9
66	19.2	17.3	14.6	14.8	12.2	20.4	67.4	113.0	57.5	19.2	10.3	8.9	374.8
67	10.5	11.3	10.8	12.9	11.4	17.7	32.3	163.4	197.9	61.0	19.1	13.7	562.0
68	15.9	14.3	13.4	12.9	16.1	25.8	41.1	81.2	94.2	25.4	20.5	14.8	375.6
69	16.9	18.6	15.8	20.0	16.0	24.8	154.4	267.6	143.6	40.1	16.7	13.7	748.2
70	14.6	12.3	12.7	15.5	14.8	24.3	41.2	159.1	181.3	51.7	18.4	14.6	560.5
71	14.7	19.9	17.2	21.0	22.0	25.2	97.2	275.1	249.2	98.2	28.5	19.4	887.6
72	19.1	17.3	16.7	17.5	15.7	46.2	70.3	194.0	227.2	61.6	23.0	16.7	725.3
73	17.8	16.1	15.4	14.7	12.7	18.1	43.7	107.3	68.5	24.6	11.5	11.2	361.6
74	12.2	21.4	16.8	23.4	15.9	40.8	129.7	217.5	247.9	70.3	22.9	14.6	833.4
75	15.4	14.7	13.4	14.9	15.1	26.6	29.1	159.4	233.8	120.0	27.7	16.7	686.8
76	18.0	18.2	19.3	16.8	15.8	18.5	75.4	191.7	109.5	36.8	22.5	19.5	562.0
77	16.9	13.5	12.3	11.8	11.2	12.5	20.6	25.8	29.3	13.2	8.5	8.4	184.0
78	9.9	10.6	15.7	12.5	12.0	35.2	83.8	155.8	171.7	74.8	22.4	18.9	623.3
79	14.8	13.4	13.1	12.7	12.6	19.7	32.4	111.9	65.3	19.3	13.3	10.3	338.8
80	12.8	11.5	11.8	13.9	13.7	18.8	91.2	174.0	138.0	61.6	20.3	17.3	584.9
81	14.9	14.6	16.7	15.0	15.5	23.9	58.2	114.9	96.5	25.7	13.6	10.6	420.1
82	13.5	17.3	19.8	16.3	19.7	28.8	72.2	263.3	263.1	108.7	27.1	18.8	868.6
83	20.0	17.9	17.3	19.0	16.6	35.9	80.9	259.3	277.2	114.1	33.8	20.8	912.8
84	22.5	25.8	20.7	18.9	18.7	29.6	84.5	216.4	208.7	80.9	26.8	19.3	772.8
85	17.9	16.8	15.0	13.8	12.9	17.8	84.1	137.3	71.3	21.6	14.4	16.9	439.8
86	17.7	16.9	14.9	16.6	24.6	76.5	143.6	186.3	192.6	43.9	20.7	19.2	773.5
87	19.2	17.4	13.6	12.7	12.8	21.7	48.2	68.6	27.2	15.4	10.3	8.8	275.8
88	9.7	9.9	11.4	10.4	10.7	18.8	54.7	82.0	56.6	16.1	8.7	8.1	297.0
AVE 1912-88:	14.6	14.9	15.0	14.5	14.0	22.8	74.3	158.8	136.7	45.3	17.0	13.2	541.0

Table C-2

NATFLO EST.- NAT. FLOWS, SO. FK. BOISE R NR ANDERSON RANCH DAMSITE (1000 AC-FT)

W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
12	21.0	23.4	21.8	24.4	22.0	27.4	105.8	233.6	237.5	61.5	29.0	24.0	831.4
13	23.9	22.5	17.5	15.7	17.4	26.3	116.5	207.3	159.5	60.2	28.6	19.6	715.0
14	23.5	26.8	20.5	22.7	22.4	66.3	194.6	240.4	120.4	48.5	23.0	20.6	829.7
15	26.4	21.9	17.6	17.8	19.9	34.6	77.4	94.5	69.3	30.3	14.7	14.5	438.9
16	15.9	16.0	18.4	19.1	21.2	59.0	202.4	231.7	225.8	100.9	29.0	19.8	959.2
17	22.8	19.7	21.6	17.7	15.7	25.7	75.6	287.3	297.0	104.8	27.3	19.1	934.3
18	18.7	19.8	32.0	29.6	20.9	48.5	120.4	148.7	171.2	40.2	21.4	21.0	692.4
19	25.5	19.6	16.7	17.7	17.3	31.2	139.0	201.4	76.8	23.2	14.7	13.7	596.8
20	17.6	19.4	15.9	21.6	19.2	25.4	57.7	152.6	109.7	34.2	15.0	14.0	502.3
21	18.4	22.7	21.0	27.2	23.2	66.3	141.9	339.0	265.8	72.8	24.7	18.7	1041.7
22	18.6	22.8	23.3	18.2	15.6	27.0	97.0	273.6	234.6	58.0	27.3	17.3	833.3
23	18.7	19.1	19.9	19.7	17.0	29.7	100.9	187.7	143.8	72.2	25.7	17.6	672.0
24	23.7	19.4	19.0	17.6	23.0	22.5	52.5	90.9	29.1	12.4	8.1	8.3	326.5
25	13.3	16.0	13.8	15.8	27.1	54.2	188.7	295.1	146.8	57.9	23.7	17.9	870.3
26	21.3	18.5	18.5	16.6	17.7	49.2	87.8	90.9	37.1	14.8	9.0	9.7	391.1
27	12.6	18.6	23.2	18.3	20.7	42.0	122.4	256.1	277.5	91.4	28.4	21.0	932.2
28	23.8	41.4	31.5	29.7	22.3	63.2	97.0	309.7	109.7	36.5	17.6	13.7	796.1
29	16.3	15.1	13.5	13.5	13.9	30.8	59.4	125.3	102.9	29.3	12.4	11.3	443.7
30	13.7	13.2	21.7	12.1	18.2	30.9	98.0	117.5	102.9	28.4	16.8	13.1	486.5
31	19.5	15.6	13.5	15.0	14.7	24.7	54.6	90.9	36.8	11.0	7.3	7.3	310.9
32	10.6	10.8	11.7	13.2	11.8	31.0	102.9	224.8	189.7	57.5	18.5	14.2	696.7
33	16.8	18.4	13.6	16.0	14.0	20.0	80.3	138.0	195.6	36.7	14.6	12.6	576.6
34	14.7	17.5	17.6	20.4	24.2	52.3	85.4	71.0	28.4	11.3	6.2	7.2	356.2
35	12.2	15.1	15.9	15.9	16.9	24.5	99.8	172.3	145.8	35.2	12.4	9.7	575.7
36	12.3	13.4	12.3	14.0	13.8	28.4	200.2	256.7	115.3	29.4	15.6	13.2	724.6
37	13.9	13.9	15.3	13.5	13.6	26.7	69.8	141.8	64.4	20.4	8.6	8.0	409.9
38	12.6	16.0	39.9	21.7	19.3	44.9	198.0	315.1	231.4	74.9	24.2	17.2	1015.2
39	23.8	23.6	22.5	20.4	17.1	51.1	125.1	128.3	47.8	20.0	10.3	10.4	500.4
40	13.8	13.3	15.3	15.7	17.3	53.0	125.7	169.8	80.4	20.0	9.7	13.4	547.4
41	18.0	19.4	18.6	17.4	17.9	38.6	70.3	155.7	102.7	31.1	21.2	15.6	526.5
42	17.1	19.9	29.5	20.1	18.2	26.8	133.6	127.2	133.4	45.8	16.6	12.5	600.7
43	15.0	20.5	23.2	34.8	26.0	55.7	367.7	308.5	249.4	134.5	34.3	18.4	1288.0
44	21.5	24.2	19.6	21.0	17.8	23.1	59.6	121.7	97.7	38.6	16.4	13.2	474.4
45	15.1	18.6	15.4	17.3	18.4	26.1	67.8	152.7	135.2	49.4	17.5	14.2	547.7
46	16.2	17.9	9.2	3.0	17.6	46.5	211.8	253.6	143.7	44.8	20.5	17.6	802.4
47	23.3	21.9	26.0	20.0	23.1	50.6	106.1	205.4	104.7	39.3	13.4	14.0	647.8
48	19.7	18.1	18.0	18.8	17.4	19.2	77.3	179.8	166.5	42.2	16.4	12.8	606.2
49	17.0	18.8	17.2	16.8	19.2	24.3	139.4	221.7	111.7	33.7	14.1	13.3	647.2
50	17.5	20.0	17.0	19.6	18.5	28.9	130.5	236.6	220.7	94.5	22.4	23.3	849.5
51	20.8	30.0	27.4	22.9	29.3	31.6	216.0	292.0	175.9	72.7	28.1	20.4	967.1
52	24.7	21.4	24.8	24.7	20.4	24.0	207.7	402.9	207.9	66.6	26.4	20.3	1071.8
53	16.2	18.7	19.2	26.7	20.0	35.4	121.5	147.9	210.2	91.1	28.6	18.1	753.6
54	15.0	21.3	19.5	19.2	21.7	37.2	127.7	235.1	125.4	60.4	23.0	16.0	721.5
55	13.2	17.8	15.6	15.1	16.2	17.6	37.5	136.6	153.9	45.5	16.1	10.0	495.1
56	14.4	21.5	50.4	36.5	26.7	50.6	230.9	349.3	226.9	65.0	26.8	15.0	1114.0
57	21.7	23.9	24.9	22.2	22.5	39.7	100.9	273.9	204.5	56.7	20.8	13.1	824.8
58	20.2	17.9	23.0	20.0	25.4	28.3	91.4	392.2	193.7	53.4	26.7	18.0	910.2
59	15.7	21.8	26.2	22.7	18.6	27.8	98.0	118.5	131.9	36.0	14.8	21.0	553.0
60	25.9	20.9	15.7	17.8	18.0	36.9	121.4	141.3	120.0	30.7	15.1	14.1	577.8
61	13.6	17.5	15.2	16.5	19.0	26.0	58.4	102.4	72.7	15.9	10.0	11.9	379.1
62	17.5	17.0	15.1	18.1	20.5	22.8	150.0	166.0	179.6	57.8	22.2	14.6	701.2
63	17.8	18.5	17.3	14.2	43.1	28.1	54.5	177.4	161.4	51.1	18.6	15.4	617.4
64	15.3	21.5	18.1	19.1	17.1	21.2	83.4	168.3	152.4	49.7	16.4	13.6	596.1
65	14.1	17.8	64.3	32.4	26.4	38.7	211.1	334.9	341.2	138.7	46.5	33.7	1299.8
66	23.5	23.8	19.4	20.4	15.6	30.4	93.1	140.8	65.1	22.3	13.4	9.4	477.2
67	12.1	15.0	17.0	22.3	18.6	29.5	53.4	209.0	233.2	66.6	19.7	14.5	710.9
68	18.0	19.3	19.1	17.4	26.4	38.8	53.8	97.2	105.5	28.9	25.3	15.6	465.3
69	21.2	27.0	22.4	31.0	21.4	34.0	236.8	323.2	157.8	43.1	18.1	16.3	952.3
70	18.0	16.1	19.0	24.8	20.6	37.5	66.9	218.1	211.4	62.1	19.5	16.1	730.1
71	19.2	31.4	26.2	32.3	38.5	46.2	190.0	388.4	292.3	111.4	29.9	21.1	1226.9
72	24.2	23.7	24.2	28.1	28.7	90.2	131.2	282.3	298.1	73.5	26.4	22.3	1052.9
73	24.5	20.8	23.1	21.6	19.4	28.9	69.8	131.8	76.8	25.5	12.7	13.4	468.3
74	16.1	29.4	23.8	28.4	21.8	66.8	217.3	312.0	308.6	77.0	24.3	15.1	1140.6
75	19.9	19.7	19.9	19.5	19.5	29.5	49.3	244.4	291.2	133.4	32.7	19.9	898.9
76	24.1	23.8	27.2	25.9	24.3	30.6	122.6	241.8	125.5	47.5	30.5	24.5	748.3
77	20.8	17.5	15.7	15.7	14.2	16.6	25.9	32.9	35.0	13.7	7.0	9.1	224.1
78	13.5	15.1	25.3	19.3	17.9	57.5	136.5	192.7	199.3	84.9	28.1	23.5	813.6
79	18.3	16.3	17.2	19.7	16.2	31.0	47.6	131.7	76.3	27.4	19.7	8.9	430.3
80	14.2	14.8	16.9	21.8	23.2	31.4	138.5	228.7	165.3	69.6	22.5	19.7	766.6
81	17.3	17.7	23.0	19.3	22.2	35.3	69.5	140.3	108.3	28.1	13.5	10.0	504.5
82	15.8	23.2	29.4	22.0	27.0	48.3	121.9	382.3	299.2	123.0	34.9	25.8	1152.8
83	27.9	26.4	27.1	30.9	26.8	73.9	142.2	369.6	331.6	124.4	45.6	26.8	1253.2
84	25.4	30.5	28.7	25.1	26.2	50.1	146.7	302.1	245.1	94.7	34.2	25.8	1034.6
85	25.7	27.1	23.4	20.2	18.8	30.3	130.7	165.4	81.7	28.5	16.9	22.6	591.3
86	23.9	23.0	19.2	22.1	46.6	134.6	214.7	229.4	216.4	48.9	21.0	21.7	1021.5
87	24.1	20.8	19.3	19.3	18.4	34.4	59.6	75.3	31.5	16.2	9.6	9.7	338.2
88	11.6	13.3	16.3	15.0	15.3	29.8	77.9	98.4	65.9	11.9	10.1	9.8	375.3
AVE 1912-88:	18.6	20.2	21.3	20.5	20.8	38.4	118.8	206.9	158.4	53.3	20.4	16.1	713.7

Table C-3

13190500 HIST & EST(1928-43) DISCH S F BOISE R AT ANDERSON R DAM (1000 AC-FT)

W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
28	23.4	39.6	30.5	28.8	22.0	59.8	97.0	306.2	109.4	37.4	17.6	14.0	785.7
29	16.5	15.4	13.9	13.9	14.2	29.8	60.0	124.8	102.7	30.3	12.9	11.9	446.3
30	14.0	13.6	21.4	12.6	18.2	30.0	97.9	117.1	102.7	29.5	16.9	13.5	487.4
31	19.4	15.8	13.9	15.3	15.0	24.2	55.2	90.9	37.7	12.4	8.2	8.1	316.1
32	11.2	11.4	12.2	13.6	12.3	30.1	102.7	222.7	188.2	58.1	18.4	14.5	695.4
33	16.9	18.4	14.0	16.2	14.3	19.9	80.5	137.3	193.9	37.6	14.8	13.0	576.8
34	15.0	17.6	17.6	20.2	23.8	49.7	85.5	71.4	29.5	12.6	7.1	8.1	358.1
35	12.7	15.4	16.1	16.0	17.0	24.1	99.7	171.1	145.0	36.2	12.9	10.4	576.6
36	12.9	13.8	12.8	14.3	14.2	27.6	198.5	254.1	115.0	30.4	15.8	13.7	723.1
37	14.2	14.3	15.6	13.9	14.0	26.0	70.2	141.0	64.9	21.6	9.4	8.8	413.9
38	13.0	16.2	38.2	21.4	19.2	42.8	196.3	311.5	229.2	75.3	23.8	17.3	1004.2
39	23.3	23.2	22.1	20.2	17.2	48.6	124.6	127.8	48.6	21.2	11.0	11.0	498.8
40	14.2	13.8	15.6	15.9	17.5	50.3	125.2	168.6	80.6	21.2	10.4	13.8	547.1
41	18.0	19.4	18.5	17.5	18.0	37.0	70.7	154.8	102.5	32.2	21.0	15.8	525.4
42	17.2	19.8	28.6	20.0	18.2	26.2	133.0	126.6	132.8	46.6	16.7	13.0	598.7
43	15.3	20.3	22.8	33.6	25.4	52.8	363.3	296.4	241.4	129.0	33.3	17.9	1251.5
44	21.5	24.2	19.7	21.0	17.8	23.1	59.6	121.7	97.7	38.6	16.4	13.2	474.5
45	15.1	18.6	15.5	17.3	18.4	26.2	67.8	152.7	135.2	49.4	17.5	14.2	547.9
46	16.1	17.9	9.2	0.3	0.3	33.5	225.8	236.4	105.0	115.7	21.0	17.6	798.8
47	22.8	21.5	24.2	0.2	0.1	0.5	130.9	148.6	96.5	96.0	90.7	14.0	646.0
48	19.0	3.7	0.1	0.2	0.2	14.0	72.6	130.8	154.5	77.0	114.5	7.7	594.3
49	0.1	0.1	0.1	0.1	65.4	46.5	88.9	163.8	91.8	126.5	58.9	2.5	644.7
50	0.1	0.1	0.1	0.1	0.1	0.2	0.4	255.0	159.2	156.6	3.9	16.7	592.5
51	29.3	0.9	15.2	20.4	18.5	14.7	118.5	281.9	146.0	88.9	63.9	88.2	886.4
52	56.3	72.0	72.1	68.5	42.6	102.7	41.1	184.4	193.3	89.8	80.0	103.6	1106.4
53	72.7	23.8	45.4	35.1	6.6	7.8	24.6	81.2	160.6	113.2	99.0	73.4	743.4
54	42.3	20.1	61.8	41.3	13.1	11.8	45.5	108.1	122.9	88.3	96.1	98.0	749.8
55	63.8	8.4	20.2	20.6	23.8	7.5	7.4	80.6	34.1	73.2	93.5	69.3	502.4
56	35.0	22.7	52.2	60.9	76.7	70.4	76.1	186.6	233.7	71.8	65.3	30.7	982.1
57	9.9	54.7	87.0	93.4	46.9	17.0	47.9	135.8	178.4	92.1	91.7	3.2	858.0
58	11.1	58.7	53.5	85.5	30.0	54.7	43.8	201.3	173.8	91.2	95.5	60.8	959.9
59	6.5	6.1	28.9	23.4	9.9	39.3	55.7	37.9	122.9	91.6	36.8	16.3	475.3
60	15.1	14.6	35.0	38.0	34.1	22.3	26.2	135.2	128.3	78.7	76.8	49.5	653.8
61	36.0	36.8	35.6	37.8	45.4	39.0	3.2	33.7	91.2	85.0	42.2	65.8	551.7
62	37.2	49.2	33.0	13.9	9.6	0.7	0.3	0.2	129.7	75.4	47.6	29.3	426.1
63	20.4	68.8	28.0	33.3	20.8	17.3	14.2	105.6	163.0	66.6	50.3	26.2	614.5
64	32.0	27.2	54.5	65.7	34.5	15.4	2.5	87.1	138.3	81.5	84.0	26.9	649.6
65	12.2	12.9	14.3	39.2	105.1	133.3	134.6	275.7	236.7	141.3	48.6	72.2	1226.1
66	2.0	16.0	26.6	45.5	38.6	30.2	47.3	116.8	86.2	92.8	82.6	31.7	616.3
67	23.8	34.4	44.5	34.0	31.3	35.6	9.8	80.2	129.3	76.6	67.1	42.0	608.6
68	33.1	24.2	39.7	20.5	43.2	31.0	25.5	64.2	82.5	95.3	61.4	42.6	563.2
69	63.3	30.8	27.8	28.0	22.2	39.3	137.0	203.0	136.0	63.1	67.0	24.3	841.8
70	26.8	23.4	32.9	33.9	47.1	51.4	67.6	112.8	154.4	73.7	36.6	51.8	712.4
71	22.8	14.9	51.1	67.2	83.7	109.4	180.3	259.7	204.8	122.5	32.3	13.4	1162.1
72	35.5	52.1	56.6	83.3	96.3	33.0	159.5	227.1	182.3	79.3	44.8	30.9	1080.7
73	13.1	37.6	85.9	46.0	25.6	18.0	56.3	42.0	64.3	78.9	92.4	31.9	592.0
74	14.8	14.9	65.6	52.5	57.7	69.1	93.9	263.1	232.4	96.8	61.9	26.0	1048.7
75	17.4	23.8	77.4	32.3	28.6	45.4	55.7	185.3	209.5	111.4	83.5	28.7	899.0
76	16.2	30.9	50.5	75.1	42.8	43.0	43.1	163.7	107.2	96.1	66.2	23.3	758.1
77	16.0	14.3	15.1	29.4	15.3	14.9	16.1	81.6	90.4	91.7	84.2	30.9	499.9
78	12.9	12.3	13.7	16.3	13.7	26.2	14.3	70.7	129.9	104.6	93.0	23.6	531.2
79	12.8	13.7	16.6	26.4	35.5	23.6	31.9	50.6	94.7	95.7	101.2	33.9	536.6
80	24.4	19.5	20.5	20.8	19.8	21.2	36.2	130.9	164.6	97.5	91.3	60.0	706.7
81	17.7	17.4	19.0	19.6	17.3	7.8	6.9	95.1	117.4	56.7	58.6	29.0	462.5
82	17.6	19.1	20.4	37.7	82.6	99.8	94.1	210.5	279.1	135.1	63.6	40.1	1099.7
83	21.1	33.6	48.8	55.7	63.1	128.0	161.3	187.2	307.7	123.9	44.4	28.0	1202.8
84	24.2	89.5	95.7	94.1	33.2	20.1	120.5	181.7	213.6	98.0	62.6	99.4	1132.6
85	52.6	21.1	32.4	42.2	21.8	21.3	54.4	93.0	103.2	101.8	85.3	28.3	657.4
86	19.6	18.6	18.7	19.5	17.3	73.3	161.5	213.2	217.3	52.4	62.0	67.3	940.7
87	23.8	21.3	19.3	19.6	17.8	19.7	27.3	96.1	99.9	102.8	87.2	26.9	561.7
88	18.8	17.9	18.9	18.7	17.5	18.5	32.2	36.9	40.3	90.5	37.1	24.1	371.5
MEAN	22.3	23.8	31.4	31.6	29.1	37.0	80.0	149.7	138.8	78.0	52.6	31.8	706.2

Table C-4

HIST. DISCH., SO. FK. BOISE RIVER NEAR LENOX, IDAHO (1000 AC-FT)

191500 W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
12	23.1	25.6	23.9	26.6	24.2	29.7	110.0	241.0	245.0	64.6	31.3	26.2	871.2
13	26.1	24.6	19.5	17.7	19.4	28.5	121.0	214.0	165.0	63.3	30.9	21.7	751.7
14	25.7	29.1	22.6	24.8	24.5	69.5	201.0	248.0	125.0	51.3	25.2	22.7	869.4
15	28.6	24.0	19.6	19.8	22.0	37.0	80.9	98.4	72.6	32.6	16.7	16.4	468.6
16	17.9	18.0	20.4	21.2	23.4	62.1	209.0	239.0	233.0	105.0	31.3	21.9	1002.2
17	25.0	21.8	23.7	19.7	17.7	27.9	79.1	296.0	306.0	109.0	29.6	21.2	976.7
18	20.8	21.9	34.4	31.9	23.0	51.3	125.0	154.0	177.0	42.8	23.5	23.1	728.7
19	27.7	21.7	18.7	19.7	19.3	33.6	144.0	208.0	80.3	25.4	16.6	15.6	630.6
20	19.6	21.5	17.9	23.7	21.3	27.6	60.7	158.0	114.0	36.6	17.0	15.9	533.3
21	20.4	24.8	23.1	29.5	25.4	69.5	147.0	349.0	274.0	76.2	26.9	20.8	1086.6
22	20.6	25.0	25.5	20.2	17.6	29.3	101.0	282.0	242.0	61.0	29.6	19.3	873.1
23	20.8	21.2	22.0	21.8	19.0	32.0	105.0	194.0	149.0	75.6	27.9	19.6	707.9
24	25.9	21.5	21.1	19.6	25.2	24.6	55.4	94.7	31.4	14.3	9.9	10.1	353.7
25	15.2	18.0	15.7	17.8	29.4	57.1	195.0	304.0	152.0	60.9	25.9	19.9	910.9
26	23.4	20.5	20.5	18.6	19.7	52.0	91.6	94.7	39.6	16.8	10.8	11.5	419.7
27	14.5	20.6	25.4	20.3	22.8	44.6	127.0	264.0	286.0	95.3	30.7	23.1	974.3
28	26.0	44.0	33.9	32.0	24.5	66.4	101.0	319.0	114.0	39.0	19.6	15.6	835.0
29	18.3	17.1	15.4	15.4	15.8	33.1	62.5	130.0	107.0	31.6	14.3	13.2	473.7
30	15.6	15.1	23.8	14.0	20.2	33.3	102.0	122.0	107.0	30.7	18.8	15.0	517.5
31	21.6	17.6	15.4	17.0	16.7	26.9	57.5	94.7	39.3	12.9	9.0	9.0	337.7
32	12.4	12.7	13.6	15.1	13.7	33.4	107.0	232.0	196.0	60.5	20.5	16.1	733.0
33	18.8	20.4	15.5	18.0	15.9	22.1	83.9	143.0	202.0	39.2	16.5	14.5	609.8
34	16.7	19.5	19.6	22.5	26.4	55.2	89.1	74.4	30.6	13.1	7.9	9.0	384.1
35	14.1	17.1	17.9	17.8	18.9	26.7	103.9	178.2	151.0	37.7	14.3	11.5	609.2
36	14.2	15.3	14.2	15.9	15.8	30.7	206.8	264.7	119.8	31.7	17.6	15.1	762.0
37	15.9	15.9	17.3	15.4	15.6	28.9	73.1	146.9	67.6	22.5	10.4	9.8	439.1
38	14.4	18.0	42.5	23.8	21.3	47.6	204.5	324.5	238.7	78.4	26.4	19.2	1059.4
39	26.0	25.8	24.6	22.5	19.1	54.0	129.8	133.1	50.6	22.1	12.2	12.2	531.9
40	15.8	15.3	17.3	17.7	19.4	55.9	130.4	175.6	84.0	22.1	11.5	15.4	580.3
41	20.0	21.5	20.6	19.4	20.0	41.1	73.7	161.2	106.8	33.5	23.3	17.6	558.6
42	19.1	22.0	31.8	22.2	20.2	29.0	138.5	131.9	138.3	48.5	18.6	14.4	634.6
43	17.0	22.5	25.3	37.3	28.2	58.7	378.4	317.8	257.2	139.4	36.7	20.5	1339.0
44	25.4	27.1	21.4	22.0	20.1	26.7	62.4	125.8	99.7	41.3	17.6	13.6	503.2
45	16.0	19.6	16.4	19.2	22.8	31.5	72.9	158.4	140.7	51.0	18.9	14.9	582.4
46	18.2	19.9	11.0	4.7	19.6	49.2	218.6	261.5	148.9	47.5	22.6	19.6	841.3
47	25.5	24.0	28.2	22.1	25.3	53.4	110.3	212.1	108.9	41.9	15.3	15.9	682.9
48	21.8	20.1	20.0	20.9	19.5	21.3	80.8	185.9	172.2	44.8	18.4	14.7	640.4
49	19.0	20.9	19.2	18.8	21.3	26.5	144.4	228.8	116.1	36.1	16.0	15.2	682.3
50	19.5	22.1	19.0	21.7	20.5	31.2	135.3	244.1	227.8	98.4	24.5	25.5	889.6
51	22.9	32.3	29.7	25.1	31.6	34.0	223.0	300.8	181.9	76.1	30.4	22.5	1010.3
52	26.9	23.5	27.0	26.9	22.5	26.2	214.4	414.5	214.7	69.8	28.6	22.4	1117.4
53	18.2	20.7	21.3	28.9	22.1	37.9	126.1	153.2	217.0	94.9	30.9	20.1	791.3
54	17.0	23.4	21.6	21.3	23.8	39.7	132.5	242.5	130.1	63.5	25.2	18.0	758.6
55	15.1	19.8	17.6	17.1	18.2	19.6	40.0	141.6	159.3	48.2	18.1	11.8	526.4
56	16.3	23.6	53.2	39.0	29.0	53.4	238.2	359.6	234.1	68.2	29.1	17.0	1160.7
57	23.8	26.1	27.1	24.3	24.6	42.3	105.0	282.3	211.2	59.7	22.9	15.0	864.3
58	22.3	19.9	25.2	22.1	27.6	30.6	95.3	403.5	200.1	56.3	28.9	20.0	951.8
59	17.7	23.9	28.4	24.8	20.6	30.1	102.0	123.0	136.8	38.5	16.8	23.1	585.7
60	28.1	23.0	17.7	19.8	20.1	39.4	126.0	146.4	124.6	33.0	17.1	16.0	611.2
61	15.5	19.5	17.2	18.5	21.1	28.2	61.4	106.5	76.1	17.9	11.8	13.8	407.5
62	19.5	19.0	17.1	20.1	22.6	25.0	155.3	171.7	185.6	60.8	24.3	16.5	737.5
63	19.8	20.5	19.3	16.1	45.8	30.4	57.4	183.4	167.0	54.0	20.6	17.4	651.7
64	17.3	23.6	20.1	21.2	19.2	23.3	87.1	174.1	157.8	52.5	18.4	15.5	630.1
65	16.0	19.8	67.5	34.8	28.6	41.2	217.9	344.8	351.3	143.7	49.2	36.1	1350.9
66	25.7	26.0	21.5	22.5	17.6	32.7	97.0	145.9	68.3	24.4	15.3	11.2	508.1
67	14.0	17.0	19.0	24.4	20.6	31.8	56.3	215.8	240.6	69.8	21.8	16.4	747.5
68	20.0	21.4	21.2	19.4	28.7	41.3	56.7	101.2	109.7	31.2	27.5	17.6	495.9
69	23.3	29.3	24.5	33.4	23.5	36.4	244.3	332.8	163.3	45.8	20.1	18.3	995.0
70	20.0	18.1	21.1	27.0	22.7	40.0	70.1	225.1	218.2	65.2	21.6	18.1	767.2
71	21.3	33.8	28.4	34.7	41.0	48.9	196.3	399.6	301.1	115.8	32.2	23.2	1276.3
72	26.4	25.9	26.4	30.4	31.1	94.0	136.0	290.9	307.1	76.9	28.6	24.4	1098.1
73	26.7	22.9	25.3	23.7	21.5	31.2	73.1	136.7	80.3	27.7	14.6	15.3	499.0
74	18.1	31.7	26.0	30.7	23.9	70.0	224.3	321.3	317.9	80.5	26.5	17.1	1188.0
75	22.0	21.8	22.0	21.6	21.6	31.8	52.1	252.1	300.0	138.3	35.1	22.0	940.4
76	26.3	26.0	29.5	28.1	26.5	32.9	127.2	249.4	130.2	50.3	32.8	26.7	785.9
77	22.9	19.5	17.7	17.7	16.1	18.6	28.1	35.3	37.5	15.6	8.8	10.9	248.7
78	15.4	17.1	27.5	21.4	19.9	60.5	141.5	199.1	205.8	88.6	30.4	25.7	852.9
79	20.3	18.3	19.2	21.8	18.2	33.4	50.4	136.6	79.8	29.7	21.8	10.7	460.2
80	16.1	16.8	18.9	23.9	25.4	33.8	143.5	236.0	171.0	72.9	24.6	21.8	804.7
81	19.3	19.7	25.2	21.4	24.3	37.8	72.8	145.4	112.6	30.4	15.4	11.8	536.1
82	17.8	25.4	31.7	24.1	29.3	51.1	126.5	393.4	308.2	127.6	37.4	28.0	1200.5
83	30.2	28.6	29.4	33.3	29.1	77.3	147.3	380.4	341.4	129.1	48.3	29.1	1303.5
84	27.6	32.8	31.0	27.3	28.5	52.9	151.9	311.2	252.8	98.6	36.6	28.0	1079.2
85	27.9	29.4	25.6	22.3	20.9	32.6	135.5	171.1	85.3	30.8	18.9	24.7	625.0
86	26.1	25.2	21.3	24.2	49.3	139.5	221.6	236.7	223.4	51.7	23.1	23.8	1065.9
87	26.3	22.9	21.4	21.4	20.4	36.8	62.7	78.8	33.9	18.2	11.4	11.5	365.7
88	13.5	15.2	18.3	17.0	17.3	32.1	81.4	102.4	69.1	13.8	11.9	11.6	403.6
AVE 1912-88:	20.7	22.3	23.4	22.6	23.0	41.0	123.3	213.6	163.9	56.2	22.5	18.0	750.5

Table C-5

RGNEST EST. OF REACH GAINS, S. F. BOISE R. ANDERSON R TO ARROWROCK (1000 AC-FT)

W-YR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
12	5.3	5.5	5.3	5.5	5.5	5.8	10.5	18.5	18.8	7.8	5.8	5.5	99.8
13	5.5	5.3	5.0	5.0	5.0	5.5	11.3	16.8	13.8	7.8	5.8	5.3	92.1
14	5.5	5.8	5.3	5.3	5.3	8.0	16.0	19.0	11.5	7.0	5.5	5.3	99.5
15	5.5	5.3	5.0	5.0	5.3	6.0	8.8	9.8	8.3	5.8	5.0	4.8	74.6
16	5.0	5.0	5.0	5.3	5.5	7.8	16.5	18.3	18.0	10.3	5.8	5.3	107.8
17	5.5	5.3	5.3	5.0	5.0	5.5	8.8	21.8	22.5	10.5	5.8	5.3	106.3
18	5.3	5.3	6.0	5.8	5.3	7.0	11.5	13.3	14.5	6.5	5.3	5.3	91.1
19	5.5	5.3	5.0	5.0	5.0	6.0	12.5	16.5	8.8	5.5	4.8	4.8	84.7
20	5.0	5.3	5.0	5.3	5.3	5.5	7.5	13.5	10.8	6.0	5.0	4.8	79.0
21	5.0	5.3	5.3	5.8	5.5	8.0	12.8	25.0	20.5	8.5	5.5	5.3	112.5
22	5.0	5.5	5.5	5.0	5.0	5.8	10.0	21.0	18.5	7.5	5.8	5.0	99.6
23	5.3	5.3	5.3	5.3	5.0	5.8	10.3	15.8	13.0	8.5	5.5	5.0	90.1
24	5.5	5.3	5.3	5.0	5.5	5.3	7.3	9.5	5.8	4.8	4.5	4.5	68.3
25	4.8	5.0	4.8	5.0	5.8	7.3	15.8	22.3	13.0	7.5	5.5	5.0	101.8
26	5.3	5.0	5.0	5.0	5.0	7.0	9.5	9.5	6.3	5.0	4.5	4.5	71.6
27	4.8	5.0	5.5	5.0	5.3	6.5	11.5	19.8	21.3	9.8	5.8	5.3	105.6
28	5.5	6.5	6.0	5.8	5.5	8.0	10.0	23.3	10.8	6.3	5.0	4.8	97.5
29	5.0	5.0	4.8	4.8	4.8	5.8	7.8	11.8	10.3	5.8	4.8	4.8	75.5
30	4.8	4.8	5.3	4.8	5.0	6.0	10.0	11.3	10.3	5.8	5.0	4.8	77.9
31	5.3	5.0	4.8	5.0	5.0	5.5	7.3	9.5	6.3	4.8	4.3	4.3	67.1
32	4.5	4.8	4.8	4.8	4.8	6.0	10.3	18.0	15.8	7.5	5.0	4.8	91.1
33	5.0	5.0	4.8	5.0	4.8	5.3	9.0	12.5	16.0	6.3	4.8	4.8	83.3
34	5.0	5.0	5.0	5.3	5.5	7.3	9.3	8.5	5.8	4.5	4.3	4.5	70.0
35	4.8	5.0	5.0	4.8	5.0	5.5	10.3	14.8	13.0	6.3	4.8	4.5	83.8
36	4.8	4.8	4.8	4.8	5.0	5.8	16.5	20.0	11.3	5.8	5.0	4.8	93.4
37	5.0	5.0	5.0	4.8	4.8	5.5	8.3	12.8	8.0	5.3	4.5	4.5	73.5
38	4.5	5.0	6.5	5.3	5.0	6.8	16.3	23.5	18.3	8.8	5.5	5.0	110.5
39	5.5	5.5	5.3	5.3	5.0	7.3	11.8	12.0	7.0	5.3	4.8	4.5	79.3
40	4.8	5.0	5.0	5.0	5.3	7.3	11.8	14.5	9.0	5.3	4.5	5.0	82.5
41	5.0	5.3	5.0	5.0	5.3	6.3	8.3	13.8	10.3	6.0	5.3	5.0	80.6
42	5.0	5.3	5.8	5.3	5.0	5.8	12.3	11.8	12.3	6.8	5.0	4.8	85.2
43	5.0	5.0	5.3	6.3	5.5	7.5	26.8	23.3	19.5	12.3	6.0	5.3	127.8
44	9.8	7.3	4.5	2.5	5.8	9.0	7.0	10.3	5.0	6.8	3.3	1.0	72.3
45	2.5	2.5	2.3	4.8	11.0	13.3	13.0	14.3	13.8	4.0	3.5	1.8	86.8
46	5.0	5.0	4.5	4.3	5.0	6.8	17.0	19.8	13.0	6.8	5.3	5.0	97.5
47	5.5	5.3	5.5	5.3	5.5	7.0	10.5	16.8	10.5	6.5	4.8	4.8	88.0
48	5.3	5.0	5.0	5.3	5.3	5.3	8.8	15.3	14.3	6.5	5.0	4.8	85.9
49	5.0	5.3	5.0	5.0	5.3	5.5	12.5	17.8	11.0	6.0	4.8	4.8	88.0
50	5.0	5.3	5.0	5.3	5.0	5.8	12.0	18.8	17.8	9.8	5.3	5.5	100.6
51	5.3	5.8	5.8	5.5	5.8	6.0	17.5	22.0	15.0	8.5	5.8	5.3	108.3
52	5.5	5.3	5.5	5.5	5.3	5.5	16.8	29.0	17.0	8.0	5.5	5.3	114.2
53	5.0	5.0	5.3	5.5	5.3	6.3	11.5	13.3	17.0	9.5	5.8	5.0	94.5
54	5.0	5.3	5.3	5.3	5.3	6.3	12.0	18.5	11.8	7.8	5.5	5.0	93.1
55	4.8	5.0	5.0	5.0	5.0	5.0	6.3	12.5	13.5	6.8	5.0	4.5	78.4
56	4.8	5.3	7.0	6.3	5.8	7.0	18.3	25.8	18.0	8.0	5.8	5.0	117.1
57	5.3	5.5	5.5	5.3	5.3	6.5	10.3	21.0	16.8	7.5	5.3	4.8	99.1
58	5.3	5.0	5.5	5.3	5.5	5.8	9.8	28.3	16.0	7.3	5.5	5.0	104.3
59	5.0	5.3	5.5	5.3	5.0	5.8	10.0	11.3	12.3	6.3	5.0	5.3	82.1
60	5.5	5.3	5.0	5.0	5.3	6.3	11.5	12.8	11.5	5.8	5.0	4.8	83.8
61	4.8	5.0	5.0	5.0	5.3	5.5	7.5	10.3	8.5	5.0	4.5	4.8	71.2
62	5.0	5.0	5.0	5.0	5.3	5.5	13.3	14.3	15.0	7.5	5.3	4.8	91.0
63	5.0	5.0	5.0	4.8	6.8	5.8	7.3	15.0	14.0	7.3	5.0	5.0	86.0
64	5.0	5.3	5.0	5.3	5.3	5.3	9.3	14.5	13.5	7.0	5.0	4.8	85.3
65	4.8	5.0	8.0	6.0	5.5	6.3	17.0	24.8	25.3	12.5	6.8	6.0	128.0
66	5.5	5.5	5.3	5.3	5.0	5.8	9.8	12.8	8.0	5.3	4.8	4.5	77.6
67	4.8	5.0	5.0	5.3	5.0	5.8	7.3	17.0	18.5	8.0	5.3	4.8	91.8
68	5.0	5.3	5.3	5.0	5.8	6.3	7.3	10.0	10.5	5.8	5.5	5.0	76.8
69	5.3	5.8	5.3	6.0	5.3	6.0	18.8	24.0	13.8	6.8	5.0	5.0	107.1
70	5.0	5.0	5.3	5.5	5.3	6.3	8.0	17.5	17.0	7.8	5.3	5.0	93.0
71	5.3	6.0	5.5	6.0	6.3	6.8	15.8	28.0	22.0	11.0	5.8	5.3	123.8
72	5.5	5.5	5.5	5.8	6.0	9.5	12.0	21.5	22.5	8.5	5.5	5.3	113.1
73	5.5	5.3	5.5	5.3	5.3	5.8	8.3	12.3	8.8	5.5	4.8	4.8	77.2
74	5.0	5.8	5.5	5.8	5.3	8.0	17.5	23.3	23.3	8.8	5.5	5.0	118.8
75	5.3	5.3	5.3	5.3	5.3	5.8	7.0	19.3	22.0	12.3	6.0	5.3	104.2
76	5.5	5.5	5.8	5.5	5.5	5.8	11.5	19.0	11.8	7.0	5.8	5.5	94.2
77	5.3	5.0	5.0	5.0	4.8	5.0	5.5	6.0	6.3	4.8	4.5	4.5	61.7
78	4.8	5.0	5.5	5.3	5.0	7.5	12.5	16.0	16.3	9.3	5.8	5.5	98.5
79	5.0	5.0	5.0	5.3	5.0	6.0	7.0	12.3	8.8	5.8	5.3	4.5	75.0
80	4.8	5.0	5.0	5.3	5.5	6.0	12.5	18.3	14.3	8.3	5.3	5.3	95.6
81	5.0	5.0	5.5	5.3	5.3	6.3	8.3	12.8	10.8	5.8	4.8	4.5	79.4
82	5.0	5.5	5.8	5.3	5.8	7.0	11.5	27.8	22.5	11.5	6.3	5.5	119.5
83	5.8	5.5	5.8	6.0	5.8	8.5	12.8	27.0	24.5	11.8	6.8	5.8	126.1
84	5.5	5.8	5.8	5.5	5.8	7.0	13.0	22.8	19.3	9.8	6.0	5.5	111.8
85	5.5	5.8	5.5	5.3	5.3	5.8	12.0	14.3	9.0	5.8	5.0	5.3	84.6
86	5.5	5.5	5.3	5.3	6.8	12.3	17.3	18.3	17.5	7.0	5.3	5.3	111.4
87	5.5	5.3	5.3	5.3	5.0	6.0	7.8	8.8	6.0	5.0	4.5	4.5	69.0
88	4.8	4.8	5.0	5.0	5.0	5.8	8.8	10.0	8.0	4.8	4.5	4.5	71.0
AVE 1912-88:	5.2	5.2	5.3	5.2	5.4	6.5	11.4	16.8	13.8	7.3	5.2	4.9	92.2

Appendix D
Miscellaneous Gaging Stations

(a) Smith Creek near Lenox, Idaho
Sec. 12, T. 2 N., R. 6 E.
1916 to 1917.
Drainage area. - 50.3 square miles.

(b) Long Gulch Creek near Lenox, Idaho
Sec. 2, T. 2 N., R. 6 E.
1916.
Drainage area. - 10.5 square miles.

(c) Rattlesnake Creek near Lenox, Idaho
Sec. 27, T. 3 N., R. E.
1916 to 1917.
Drainage area. - 46.0 square miles.

(d) Willow Creek near Lenox, Idaho
Sec. 1. T. 2 N., R. 5 E.
1916 to 1917.
Drainage area. - 55.1 square miles

(e) Grouse Creek near Arrowrock, Idaho
Sec. 19, T. 3 N., R. 5 E.
1939 to 1942
Drainage area. - 8.0 square miles.

Appendix E
Mining

The General Mining Law of 1872, as amended, gives citizens the right to enter public lands to locate and claim valuable minerals, and upon discovery, to receive title to the land. The major distinction between the mineral resource and other resources on public land is that valuable mineral discovery conveys a property right to the mineral and, through the patent process, to the surface. The minerals managed under this law are called "locatables." Locatable minerals primarily include gold and silver.

The 1872 Surface Use Act regulations provide for federal land management that minimizes mining-related environmental impacts to surface resources. The 1897 Organic Act specifies that these mining regulations apply to National Forests. These laws authorize the present surface management program for mining claims which requires written operating plans, reasonable environmental protection measures, reclamation plans, and bonds.

The Mineral Leasing Act of 1920 authorizes the Secretary of the Interior to lease land for oil, gas, and certain other nonlocatable minerals. These minerals are called "leasables." Federal agencies have considerable discretion whether or not to lease and whether to attach special stipulations, on federal lands to assure protection of other resources.

The Mineral Materials Act of 1947 states that common variety minerals on National Forests are subject to disposal by the Secretary of Agriculture, and are not subject to mining and leasing laws. These mineral materials are commonly called "saleable." The U.S. Forest Service has discretion whether and how common variety mineral materials should be developed on National Forest land. Stone, clay, and road materials account for most of the mineral materials reported each year. Most of this material was supplied to the Federal Highway Administration for road construction projects.

Although most of the South Fork basin is capable of energy/mineral exploration and development, not all areas are suitable. In areas that are very sensitive to surface disturbance, protective stipulations/constraints can be made to insure that unnecessary surface disturbance does not take place. Constraints are generally based on wildlife, fisheries, soils, water, or visual resource considerations. Mining may be restricted or prohibited during elk calving seasons, or reclamation activities may be modified to meet a suggested visual quality objective. The type and extent of mining constraints are different for each situation.

Appendix F
Idaho Fisheries Draft Management Plan 1990-1995

The Boise River basin lies in southwestern Idaho and contains about 4,100 square miles of land. The headwaters of the Boise River originate in the Sawtooth Mountains at elevations in excess of 10,000 ft. It flows in a westerly direction for about 200 miles before emptying into the Snake River near Parma at an elevation of 2,100 ft. Major tributaries to the Boise River include the North Fork Boise River (382 square miles), the South Fork Boise River (1,314 square miles) and Mores Creek (426 square miles). This basin has an average annual runoff of 2,005,000 acre-feet of water.

The Boise River has three major instream impoundments. Anderson Ranch, Arrowrock and Lucky Peak Reservoirs, and one large off-stream impoundment, Lake Lowell. The four large reservoirs have a combined storage capacity of 2,276,940 acre-feet of water. The Boise River reservoirs supply water storage for irrigation flood control, recreation, hydropower and instream flows.

Because of the wide range in elevations, geographic features and water uses, the Boise River has a great variety of habitat types and fish species. The drainage includes the major population center in the state, has over 250,000 acres of irrigated cropland and some of Idaho's earliest mining, logging and hydroelectric developments. Man caused impacts have severely degraded most habitats over a long period of time creating severe limitation on fishery productivities.

From the mouth of the Boise River upstream to Star, low summer flows and poor water quality limit fishery production. This section of river supports a fair fishery for largemouth bass, smallmouth bass and channel catfish. From Star upstream to Lucky Peak Dam, the river changes from a warmwater to a coldwater fishery. Mountain whitefish make up the bulk of the game fish biomass, with hatchery reared rainbow trout, wild rainbow trout and fingerling brown trout plants supporting the bulk of the fishing pressure. Upstream from Lucky Peak and Arrowrock reservoirs, rivers and streams contain excellent populations of wild rainbow trout, mountain whitefish and bull trout. Brook trout, redband trout and cutthroat trout occur in some tributary streams. Due to the heavy angling pressure exerted on these streams, catchable-size hatchery rainbow trout supplement wild populations in selected heavy use areas of the streams except for the South Fork Boise River between Arrowrock Reservoir and Anderson Ranch Dam.

The South Fork Boise River between Arrowrock Reservoir and Anderson Ranch Dam was the first designated quality trout stream segment in southwestern Idaho. Wild rainbow trout and mountain whitefish make up the majority of the fish caught in the South Fork. The rainbow trout fishery there is managed with limit, size, and tackle restrictions. In 1978, anglers caught an estimated 19,150 rainbow trout and released 18,059

(94 percent). In 1988, anglers caught an estimated 18,400 rainbow trout and released 99 percent.

A 1988 creel survey of the South Fork Boise River between Featherville and Big Smokey Creek estimated effort at 228 hours/km. Hatchery rainbow trout made up over 80% of fish checked in anglers creels but the overall return total creel rate was only 21%, indicating hatchery fish need to be more efficiently utilized.

Popular reservoir fishing within the Boise River drainage exists at Lake Lowell, Lucky Peak, Arrowrock, Anderson Ranch and Little Camas. The Lake Lowell fishery consists primarily of largemouth bass, smallmouth bass, yellow perch, black crappie, bullhead, bluegill, and channel catfish. Lucky Peak and Anderson Ranch reservoirs provide "two-story" fisheries with smallmouth bass occupying the warm, inshore waters and rainbow trout and kokanee dominating the cold, mid-water fishery. The rainbow trout fishery in these reservoirs depends heavily on stocked catchable or fingerling size fish. Little Camas and Arrowrock reservoirs also provide excellent fishing for rainbow trout stocked as catchables and/or fingerlings. Neither of these two reservoirs has a conservation pool and both have a history of total water evacuation.

Good spawning conditions in tributary streams provide a continuous supply of kokanee in Anderson Ranch Reservoir, but maintenance stocking is required in Lucky Peak and Arrowrock. At Anderson Ranch Reservoir, one of the more popular kokanee fisheries in southern Idaho, anglers harvested an estimated 40,000+ kokanee in 1979 and 34,000 in 1985. Kokanee populations in the reservoir have fluctuated significantly from 1983 through 1989 due to extreme high and low water conditions in the drainage. Ongoing studies of kokanee populations are being used to develop models to reduce population fluctuations through stocking in low number years. Fall chinook salmon will be used to crop excess kokanee numbers and to provide a trophy fishery.

Alpine lakes within the Boise River drainage provide anglers with a variety of fishing opportunity. Rainbow, cutthroat and brook trout are abundant with lesser numbers of golden trout. There are 224 alpine lakes in the Boise drainage. Most of these lakes are too small to support a fishery. The Department presently stocks 68 of the alpine lakes in the Boise River system.

Objectives and Programs

1. Objective: Provide a diversity of fishing opportunities within the Boise River drainage.

   Program: Zone the stream areas to concentrate hatchery catchable stocking in the locations where the highest return to the creel will occur.

   Program: Manage for wild trout where habitat and fish populations will sustain acceptable fisheries.

Program: Manage for increase catch rates and fish size in selected stream reaches with quality and trophy trout regulations.

Program: Stock appropriate strains of trout in natural production areas to better utilize the rearing capacity and provide larger and more desirable fish.

Program: Manage warmwater fisheries to provide a wide variety of sizes and species readily available to the large population of the Treasure Valley area.

2. Objective: Seek better land management practices that significantly improve fishery habitats.

Program: Provide sediment objectives/standards to land management agencies where sediment is the limiting factor in aquatic habitats.

Program: Provide riparian vegetation objectives to land management agencies where grazing, development, or other activities have degraded riparian zones.

3. Objective: Monitor effects of land management activities, fishery regulations, and other fishery management activities on fish habitat and fish populations.

Program: Collect common data base information on habitat and fish populations throughout the Boise River drainage.

Program: Examine changes and trends in common data base information and attempt to determine causes for any changes that are noted.

4. Objective: Seek improved reservoir management and stream flows.

Program: Pursue development of a minimum pool in Arrowrock Reservoir.

Program: Study water management at Lake Lowell to determine the relationship between fish production and water levels.

DRAINAGE: Boise River

Water	Miles/acre	Fishery: Type	Fishery: Species present	Management	Management Direction
Mouth to Star	34/510	Mixed		General	Work with state and federal regulatory agencies to improve water quality and habitat condition. Evaluate and stock with fingerling brown trout and catchable rainbows (vicinity of Caldwell, fall and winter).
Star to Eagle Road		Coldwater	Rainbow trout Whitefish Brown trout	Put-and-take trout	Work with state and federal regulatory agencies to improve water quality and habitat condition. Stock with fingerling brown trout catchables (year-round) to supply.
Eagle Road to Head of of Eagle Island		Coldwater	Rainbow trout Whitefish Brown trout	Trophy	Manage both channels for high catch rates (3/hr) on large fish. Stock with large trout that are salvaged from other waters. Improve access to both channels.
Head of Eagle Island to Barber Dam		Coldwater	Rainbow trout Steelhead Brown trout Whitefish	Put-and-take trout	Work with regulatory agencies to enhance habitat. Stock with fingerling brown and adult steelhead seasonally. Stock catchable rainbow year-round. Screen diversions to prevent loss of large fish. Manage for high density of anglers.
Barber Dam to Lucky Peak		Coldwater	Rainbow trout Brown trout Whitefish	General	Evaluate potential trophy trout management. Stock with predatory trout, bull trout, brown trout, and rainbow trout that would be collected from other waters. Work with Bureau of Reclamation to screen large diversions.

Rabbit Creek to Deer Park		Coldwater	Rainbow trout Bull trout Whitefish	Put-and-take trout	Manage for high yield and moderate angler densities.
Deer Park to headwaters all tributaries		Coldwater	Rainbow trout Bull trout Whitefish	Wild trout	Manage for high catch rates (3/h) and low angler densities
Lucky Peak Reservoir	/2,850	Mixed	Smallmouth bass Perch	General	Evaluate status of smallmouth bass fishery. Provide an attractive kokanee fishery for large fish by managing spawning escapement at Mores Creek weir to select four (4) four-year-old spawners and by stocking fingerling kokanee in Mores Creek arm at levels that will return spawners to the weir at a mean length of sixteen (16) inches or greater.
			Rainbow trout Kokanee Bull trout Whitefish		Investigate feasibility of providing a trout fishery by stocking large numbers of fingerling rainbow in Lucky Peak Reservoir to avoid excessive competition for plankton and jeopardizing quality of kokanee fishery. Continue to stock catchable rainbow.
Arrowrock Reservoir	/4,000	Mixed	Smallmouth bass Perch Rainbow trout Bull trout Whitefish	General	Seek minimum pool through Federal Government. Stock annually with fingerling rainbow.

Boise River Drains	92/70	Coldwater	Rainbow trout Brown trout	General	Work with communities and regulatory to improve water quality and habitat conditions. Improve angler access. Stock with fingerling brown trout and catchable rainbow.
Middle Fork Boise River from Arrowrock Reservoir to North Fork Boise River		Coldwater	Rainbow trout Bull trout Whitefish	Put and Take	Stock with catchable rainbow following high water period until Labor Day.
From North Fork to Atlanta Power Dam	32	Coldwater	Rainbow trout Bull trout Cutthroat trout Whitefish Brook trout	General	Manage for high catch rates on wild fish.
From Atlanta Power Dam to Sawtooth Wilderness Boundary		Coldwater	Rainbow trout Bull trout Cutthroat trout Whitefish Brook trout	Hatchery Supported	Stock with catchable rainbow following high water period until Labor Day.
Upstream of Sawtooth Wilderness boundary and all tributaries		Coldwater	Rainbow trout Bull trout Cutthroat trout Whitefish Brook trout	Wild Trout	Manage for high catch rates and low angler densities. Manage for wild fish.
South Fork Boise River from Arrowrock Reservoir to Danskin Bridge		Coldwater	Rainbow trout Whitefish Bull trout	Trophy	Work with Forest Service to preserve low density angling experience. Manage for high catch rates for large fish.
South Fork Boise River from Danskin to Anderson Dam		Coldwater	Rainbow trout Whitefish Bull trout	Trophy	Work with Forest Service to restrict boating at lower flows. Manage for high catch rates for large fish.

So. Fork Boise - Anderson Ranch Reservoir to Pine Bridge	0.6/3.0	Coldwater	Fall chinook salmon Rainbow trout Kokanee Bull trout Mountain whitefish	General	Annual river closure to protect spawning kokanee to trap site. Monitor fall chinook runs, target fish for harvest. 0.5 fish/hr.
So. Fork Boise - Pine Bridge to headwaters	50/242	Coldwater	Rainbow trout Bull trout Mountain whitefish Kokanee	Put-and-take trout General	Good quality habitat with wild trout potential. High accessability and campgrounds give potential for hatchery return rates of >30%. Consider use of regulation allowing harvest of adipose fin-clipped fish only. Evaluate to allow wild stocks to rebuild and maintain harvest opportunity on catchable rainbow. Maintain catch rates of 0.5 fish/hr.
Big Smoky Creek - mouth to Barlow Creek	5/12	Coldwater	Rainbow trout Bull trout mountain whitefish kokanee	Put-and-take trout General	Good quality habitat with wild trout potential. High accessability gives potential for >30% return on fish. Consider evaluation of adipose fin regulation to allow wild stocks to rebuild and maintain harvest opportunity on catchable rainbow. 0.5 fish/hr.
Big Smoky Creek - Barlow Creek to headwaters	14/34	Coldwater	Rainbow trout Bull trout Mountain whitefish	Wild trout	Evaluate social and biological potential for quality management. Emphasize bull trout, self-sustaining rainbow populations. Maintain limited harvest opportunity. 1.0 fish/hr.
All other streams in South Fork Boise River drainage upstream from Anderson Ranch Reservoir	297/324	Coldwater	Rainbow trout Bull trout Mountain whitefish	Wild trout	Investigate potentially unique redband trout and ensure survival. Maintain naturally reproducing populations and harvest opportunity. 0.7 fish/hr.
North Fork Boise River Mouth to Rabbit Creek		Coldwater	Rainbow trout Bull trout Whitefish	Wild Trout	Manage for high catch rates (3/hr) and low angler densities.

Other alpine lakes	/801	Coldwater	Rainbow trout Cutthroat trout Golden trout Brook trout	General	Put-and-grow for trout and char. Consider use of bull trout to develop trophy aspect in some waters. 0.5-1.0 fish/hr.

IDAHO COMPREHENSIVE STATE WATER PLAN

Payette River Basin

PLAN SUMMARY

Prepared by: Idaho Department of Water Resources
Water Planning Bureau

Prepared for: Idaho Water Resource Board

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Adopted February 5, 1999

PLAN SUMMARY

BACKGROUND

In February 1991 the Idaho Water Resource Board adopted the *Comprehensive State Water Plan: Payette River Reaches* that was approved by the Idaho Legislature in April 1991. The Payette River Reaches Plan examined segments of the North Fork Payette River from Cabarton Bridge to Banks, the South Fork Payette River from the Sawtooth National Recreation Area boundary to Banks, and the main Payette River from Banks to Black Canyon Dam. Segments of the North Fork, South Fork and main Payette rivers were designated as state recreational rivers.

The Board began a review of the Payette River Reaches Plan in 1995, but decided to prepare a comprehensive state water plan for the entire Payette River Basin instead of updating the Payette River Reaches Plan. The Payette River Basin Plan describes and evaluates water resources and related economic, cultural, and natural resources in the basin. The plan takes actions and recommends water policy and water resource management options to improve, develop, and conserve the water resources of the Payette River Basin. Goals, objectives, actions, and recommendations contained in the plan were developed with the help of a Payette River Citizens Group, comprised of individuals representing various water users in the basin.

BASIN OVERVIEW

The Payette River is a major tributary to the Snake River, draining a 3,320 square mile watershed in west-central Idaho. Approximately 4,000 stream miles delineate the basin. Three major branches, the North, Middle, and South forks, conveying water from the mountainous headwaters, converge at the southwestern edge of the Idaho batholith to form the Payette River. The confluence of the South and Middle forks in Garden Valley, 80.7 miles upstream from the mouth, forms the Payette River proper. However, the eight-mile stretch from the Middle Fork Payette confluence to Banks is locally known as part of the South Fork Payette, and is referred to as such in the plan.

About 60 percent of the basin is public land. The estimated amount of water entering the basin each year as precipitation is about 5.3 million acre-feet. The amount leaving the basin as the annual flow volume of the Payette River at Payette is 2.2 million acre-feet. The remaining 3.1 million acre-feet are diverted or lost through evapotranspiration by native vegetation and crops, through evaporation from open water and bare ground, or ground water recharge. An unknown volume leaves the basin as ground water discharge into the Snake River.

The Payette River Basin is rural, with an estimated population of 37,000 people in 1996. Major population centers include Payette, Emmett, Fruitland, McCall, New Plymouth, Cascade, Horseshoe Bend, Donnelly, and Crouch. Average annual population growth rates for the basin exceed the state average for the period from 1970 to 1996.

Major industries are agriculture (farming and ranching), timber, and recreation. Irrigated agriculture mainly occurs in two areas of the basin: the lower Payette Valley below Emmett, and Long Valley between McCall and Cabarton. Smaller valleys have some irrigated agriculture as well. Approximately 33 percent of the basin is considered

tentatively suitable for timber harvest. The basin is characterized by 60,000 surface acres of boatable rivers, lakes, and reservoirs, comprising 9.1 percent of the state total. Five of the sixteen lakes in the state managed for a trophy or quality trout angling experience occur in the Payette River Basin. Winter sports are an important sector of the economy for upper basin communities.

PLANNING APPROACH

The planning process encompassed six steps which are described below. Not all steps occurred in the order presented. Some occurred throughout the planning process and/or simultaneously with others.

1) ***Inventory resource attributes*** - The resource attribute inventory is contained in the Payette River Basin Plan. Resource information, figures, and statistics for this plan were obtained through in-house analysis, literature review, field reconnaissance, contact with state and federal agency personnel, and citizen input. Maps of resource data were prepared at a scale of 1:24,000 using a geographic information system (GIS). Resource data were reviewed for accuracy by government agencies, a local citizens group, and interested public.

2) ***Identify local issues, concerns, and goals*** - Issues, concerns, and goals related to water use and management framed the scope of the Payette River Basin Plan. These were identified through meetings with the public, management agencies, local officials, and a citizens group.

3) ***Assess current and potential water uses and constraints*** - An assessment of current and potential water uses and constraints is contained in the Payette River Basin Plan. This information was obtained by review of water right files, pertinent literature, regulations and law, and discussion with agency personnel.

4) ***Assess and identify river segments with outstanding resource values*** - Waterways possessing outstanding fish and wildlife, recreation, scenic, or geologic values are eligible for state designation as natural or recreational waterways (Idaho Code, Sec. 42-1731). Outstanding resources are indicated by unique or rare features regionally or nationally, and/or legal protection or special agency management designation to protect important resource values. Specific criteria for defining outstanding fish and wildlife, recreation, and scenic resources are described in the Payette River Basin Plan.

5) ***Develop alternatives or strategies*** - Strategies may be actions, recommendations, or policies responding to the issues and concerns identified, and intended to achieve the selected goals. They represent alternatives proposed by the public and agencies, and considered by the Board.

6) ***Determine actions and recommendations*** - After considering alternatives and the public interest, actions and recommendations relative to improving, developing, and conserving water resources were identified by the Board. Many actions and recommendations were the result of consensus achieved at Payette River Citizens Group workshops.

PUBLIC PARTICIPATION

Public involvement is an important part of the planning process. Input from local citizens is necessary in assessing viewpoints and conditions in the basin. Information meetings, agency consultation, and citizens group workshops provided opportunity for public critique and suggestions for the Payette River Basin Plan. Public information meetings were conducted April through May 1997 in McCall, Donnelly, Cascade, Lowman, Crouch, Horseshoe Bend, Sweet, Ola, Emmett, New Plymouth, Payette, and Boise to inform the public about preparation of a Payette River Basin Plan, and to ask the public to identify issues and concerns. In

1998 another public information meeting was held in Horseshoe Bend, announcing the formation of a citizens group and summarizing the issues identified at the Spring 1997 meetings.

The Payette River Citizens Group was formed in March 1998 to inform the Board and its staff about local concerns, review information used in the development of the plan, and provide feedback and suggestions for the Board's consideration. The group consisted of individuals representing various water users in the basin, including, but not limited to, irrigators, local government, property owners, fishermen, boaters, other recreationists, ranchers, timber industry, and hydropower. People representing these users were invited to participate to ensure all interests were represented and heard. However, membership and participation on the Citizens Group was open; any interested individual could be a member by attending the workshops.

The Board held a series of five Payette River Citizens Group workshops in April through June 1998. During these workshops, the Citizens Group ranked issues, developed goals, and identified actions and recommendations to submit to the Board. About eighty individuals attended one or more of these workshops. Newsletters were circulated through the U. S. Postal Service or Internet to an additional 312 individuals that summarized the development of the Payette River Basin Plan, announced Citizens Group workshops, and requested comment on key pieces of information

Summary of Public Comment on Draft Payette River Basin Plan

The Board circulated a Draft Comprehensive State Water Plan for the Payette River Basin on November 9, 1998 for a sixty-day comment period. Information meetings and hearings occurred in Cascade, Horseshoe Bend, and Boise in November and December 1998 to discuss and receive comment on the draft plan. Thirty-four people testified at the public hearings and sixty-eight written comments were received prior to the close of the comment period on January 8, 1999.

The majority (72 percent) of comments supported the actions and recommendations contained in the Draft Payette River Basin Plan. Fourteen percent of the comments received did not support the Draft Plan. Most of these comments concerned three main areas, including 1) designation of about 193 miles of bull trout focal habitat as state recreational rivers; 2) a proposal to process a water right application for a minimum stream flow below Payette Lake; and 3) a request to amend recreational river designations on the South Fork and main Payette rivers to allow recreational mining. The Board reexamined these actions and reviewed some additional information.

Actions and recommendations contained in the Draft Payette River Basin Plan were revised or expanded in response to these concerns. The Board adopted a *Final Comprehensive State Water Plan for the Payette River Basin* on February 5, 1999. The Final Plan was then presented to the Legislature for its consideration as required by Section 42-1734B of the Idaho Code. A summary of the public review schedule follows:

- Public Comment Period - *November 9, 1998 to January 8, 1999*
- Public Information Meetings in Cascade, Horseshoe Bend, and Boise - *November 1998*
- Public Hearings in Horseshoe Bend and Boise - *December 1998*
- Board Adoption of Final Plan - *February 5, 1999*
- Submit to Legislature for Approval - *February 8, 1999*
- Signed by Governor - *March 26, 1999*

GOALS AND OBJECTIVES

The statute provides some guiding criteria for the Board in developing a comprehensive state water plan. These are found at Idaho Code 42-1734A and include:

1. Existing rights, established duties, and the relative priorities of water established in the Idaho Constitution will be protected and preserved.

2. Optimum economic development in the interest of and for the benefit of the state as a whole will be achieved by integration and coordination of the use of water, the augmentation of existing supplies, and the protection of designated waterways for all beneficial purposes.

3. Adequate and safe water supplies for human consumption and maximum supplies for other beneficial uses will be preserved and protected.

4. Minimum stream flows for aquatic life, recreation, aesthetics, water quality, and the protection and preservation of waterways will be fostered and encouraged. Consideration will be given to the development and protection of water recreation facilities.

5. Watershed conservation practices consistent with sound engineering and economic principles will be encouraged.

Additional goals and objectives contained in the Payette River Basin Comprehensive State Water Plan reflect local concerns, current and future uses of water, and the resource values of the basin. Discussions about priority issues by the Payette River Citizens Group identified some general wants and needs, or desired outcomes, falling into ten categories. Goals were developed to address these desires. Goals are general statements about citizens' desired future for the basin. The Payette River Citizens Group developed, discussed, and reviewed goals at workshops conducted in May and June 1998. The following lists the goals developed and supported by the Citizens Group for each issue category.

State Protected Rivers Designations

1. Recognize and maintain the outstanding fish and wildlife, aesthetic, recreation, and geologic values of waterways in the Payette River Basin.

Water Allocation

2. Work toward cooperation among all water users for optimum use of the Payette River Basin's water resources.

3. Maintain flexibility when providing water for different uses to address changing demands, while recognizing existing water rights and contracts in accordance with state law.

4. Support the management of the water delivery system to meet irrigation water rights and contracts, and other objectives such as water quality, flood management, private property, fisheries, wildlife, energy, and recreation needs.

Water Storage and Delivery

5. Improve the efficiency of surface water delivery systems where cost effective and beneficial.

6. Identify and protect potential water storage opportunities in the basin for the purposes of municipal water supply, irrigation, and flood management.

Municipal Water Supply

7. Maintain or develop an adequate supply of

good quality water to meet present and future municipal needs.

Water Quality

8. Maintain, improve, and protect water quality of all surface and ground water within the Payette River Basin.

9. Improve coordination between the Idaho Division of Environmental Quality, Idaho Department of Water Resources, Health Districts, and local governments to manage, maintain, or enhance the basin water quality.

Flood Management

10. Minimize potential flood damage by managing riparian zones and open space along streams and rivers.

11. Repair damage from the 1997 flood.

12. Improve maintenance and management of the levee system along the Payette River from Horseshoe Bend to its mouth.

13. Update floodplain mapping in the Payette River Basin.

Resource Development

14. Recognize and consider the importance of industrial resources in the basin, such as timber, minerals, and agriculture, in maintaining a viable economy.

15. Consider the economic feasibility of hydropower projects that maintain or enhance environmental quality, and provide economic benefits to the basin.

16. Encourage energy conservation and development of hydropower at existing structures where feasible.

Fisheries

17. Improve the quality of fisheries in the basin.

Agency Planning and Coordination

18. Improve the efficiency of the permitting process for stream channel alterations, particularly during emergencies.

19. Encourage or improve coordination among the agencies, private landowners, and public in managing the resources in the Payette River Basin.

Recreation

20. Recognize and consider the positive economic and social values of recreation and tourism in the basin.

21. Maintain the diversity and quality of recreation opportunities on the Payette River system.

22. Minimize water-related recreation user impacts in the basin, such as environmental damage, adverse social impacts, and the cost of public services, while maintaining aesthetic, recreational, and environmental qualities.

ACTIONS AND RECOMMENDATIONS

Actions and recommendations of the Board are consistent with Idaho law, the *Idaho State Water Plan*, private property rights, and local and state management plans. Actions and recommendations were developed after considering the desires of local citizens of the basin and region. They recognize public consensus achieved at Payette River Citizens Group workshops conducted in May and June 1998, and public comment received on the Draft Payette River Basin Plan in November 1998 through January 1999.

The Board has constitutional and statutory authority to formulate and implement the State Water Plan, including designating state protected rivers, filing applications to appropriate water for instream flows or other uses beneficial to the public, providing funds for water projects, undertaking

special water projects, administering the water supply bank, and when requested by the Governor, representing the State in water right negotiations with the federal government and tribes. Other state agencies are required to “exercise their duties in a manner consistent with the comprehensive state water plan” [Idaho Code 42-1734B(4)]. All local and federal agencies are encouraged to administer their activities to help achieve the actions and recommendations contained in the *Comprehensive State Water Plan for the Payette River Basin.*

Actions

The Payette River Basin Plan comprises a review and analysis of present needs, and future needs, and opportunities for fifteen resource categories specified by the Idaho Legislature. Resource categories include navigation; power development; energy conservation; fish and wildlife; recreational opportunities; irrigation; flood control; water supply; timber; mining; livestock watering; scenic values; natural or cultural features; domestic, municipal, commercial, and industrial water use; and other aspects of environmental or economic development [Idaho Code 42-1734A(3)]. A need was identified to designate certain river reaches as state protected rivers to preserve current values for Idaho.

STATE PROTECTED RIVER DESIGNATIONS

A comprehensive state water plan may designate waterways as "natural" or "recreational." As defined by the Idaho Code, a recreational or natural river is “a waterway that possesses outstanding fish and wildlife, recreation, geologic, or aesthetic values” [Idaho Code 42-1731 (7) and (9)]. A “natural” or “recreational” designation refers to the level of development in the river corridor. Natural rivers are free of substantial man-made development in the waterway, and the riparian area is largely undeveloped. Recreational rivers may include man-made development in the waterway or the riparian area. A designation is made only if the Board determines the value of preserving the waterway is in the public interest and outweighs developing the river for other beneficial uses.

The Board believes state protected river designations are preferable to federal protection, and are in the best interests of Idaho residents. Federal protection limits the flexibility of planning for the reach, and removes the option of amending the designation by action of the Board and Legislature. Federal agencies are encouraged to manage lands to compliment state protection designations.

Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited within the stream channel or below the high water mark on the reaches designated “natural” rivers:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the stream bed; and
- mineral or sand and gravel extraction within the stream bed.

The Board determines which of the above prohibitions apply to rivers designated "recreational." Prohibitions for natural or recreational designations do not interfere with activities necessary to maintain and improve existing utilities, roadways, managed stream access facilities, and diversion works, and for the maintenance of real (private or public) property. State designation does not change or infringe upon existing water rights or other vested property rights. It does not restrict the maintenance of existing uses. Recreational dredge mining (defined as the use of suction dredges with

an intake diameter of 5 inches or less, and equipment rated at 15 horsepower or less) falls under the stream channel alteration category and not dredge or placer mining.

The Board considered the impact of protected river designations on the social, economic, and environmental livelihood of the region. To protect the public interest, current resource uses, and the multiple-use character of the basin, the Board designates river/stream reaches as indicated below. Each river reach in this plan has been found to qualify for the level of protection identified.

Existing Designations

The *Comprehensive State Water Plan: Payette River Reaches* adopted by the Board in February 1991 designated state protected rivers to preserve outstanding resource values. The Payette River Basin Plan retains those state protected river designations as listed below and depicted in Map 1.

North Fork Payette River *(9.6 miles): Cabarton Bridge to Rainbow Bridge - recreational*
South Fork Payette River *(7.9 miles): Deadwood River confluence to Big Pine Creek confluence - recreational*

The following activities are prohibited on these reaches:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the stream bed; and
- stream channel alterations.

Exceptions to the above prohibitions include:

- New diversion works shall be limited to pump installations that do not create an obstruction in the river, and are sized to supply water for the standard domestic definition or a capacity sufficient for stock water or developed rest areas, picnic, and campground purposes (not to exceed a diversion rate of 0.04 cubic feet per second) .
- Stream channel alterations necessary to maintain and improve existing utilities, roadways, managed stream access facilities, and diversion works, and for the maintenance of real (private or public) property.

North Fork Payette River *(18.4 miles): Rainbow Bridge to Banks - recreational*
South Fork Payette River *(7.6 miles): Middle Fork confluence to Banks - recreational*
Payette River *(7.2 miles): Banks to Beehive Bend boat access - recreational*

The following activities are prohibited on these reaches:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the stream bed; and
- stream channel alterations.

Exceptions to the above prohibitions include:

- New diversion works shall be limited to pump installations for the following purposes that do not create an obstruction in the river: irrigation of basin lands; stock water; developed rest area, picnic and campground areas; and for domestic, commercial, municipal and industrial needs.
- Stream channel alterations necessary to maintain and improve existing utilities, roadways, managed stream access facilities, and diversion works, and for the maintenance of real

(private and public) property.

South Fork Payette River *(20.3 miles): Sawtooth National Recreation Area boundary to Deadwood River confluence - recreational*
South Fork Payette River *(16.0 miles): Big Pine Creek confluence to Middle Fork confluence - recreational*

The following activities are prohibited on these reaches:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the stream bed; and
- stream channel alterations.

Exceptions to the above prohibitions include:

- New diversion works shall be limited to pump installations for the following purposes that do not create an obstruction in the river: irrigation of basin lands; stock water; developed rest area, picnic and campground areas; and for domestic, commercial, municipal and industrial needs.
- Stream channel alterations necessary to maintain and improve existing utilities, roadways, managed stream access facilities, and diversion works, and for the maintenance of real (private and public) property.
- Recreational dredge mining is permitted as regulated by the Idaho Department of Water Resources and Idaho Department of Lands.

Alteration of the streambed, except for maintenance and repair of existing diversion works, must comply with the Idaho Stream Channel Alteration Rules and Minimum Standards.

Additional State Protected Designations

The Board considered the impacts of additional protected river designations, and determined it is in the public interest to designate the additional stream reach listed below and depicted in Map 1.

North Fork Payette *(23.6 miles): Headwaters (including Cloochman and Trail creeks) to Payette Lake Inlet - recreational*

The following activities are prohibited on this reach:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the stream bed; and
- stream channel alterations.

Exceptions to the above prohibitions include:

- Stream channel alterations necessary to maintain and improve existing utilities, roadways, managed stream access facilities, and diversion works, and for the maintenance of real (private and public) property.
- Alterations of the stream channel for installation of fisheries enhancement structures and other activities necessary for fishery management.
- This designation is not intended to restrict current and future operations at Upper Payette Lake by the Lake Reservoir Company, including enlargement of the dam or lake.

Alteration of the streambed, except for maintenance and repair of existing diversion works, must comply with the Idaho Stream Channel Alterations Rules and Minimum Standards.

NORTH FORK PAYETTE HYDROPOWER

PROJECT PROPOSAL

The Board retains the current state protected designation on the North Fork Payette River that prohibits hydropower projects. Gem Irrigation District requested an amendment to this designation to construct a hydropower project in the Smiths Ferry to Banks reach. The project proposal is described in the Payette River Basin Plan.

When deciding whether to amend the designation, the Board was guided by the hydropower siting policy (Policy 4E) in the *Idaho State Water Plan* (Idaho Water Resource Board, 1996). This policy states:

> The Idaho Water Resource Board believes energy conservation and efficiency improvements are the most desirable methods to provide for additional power requirements. The state will be best served through conservation and the upgrading of existing energy systems. The Board prefers that new hydropower resources be developed at dams having hydropower potential that do not currently generate power or do not generate at their maximum potential. New structures should be carefully evaluated to insure that benefits to the state outweigh any negative consequences associated with the proposed development" (Idaho Water Resource Board, 1996).

Public and agency comment about the project identified many concerns, and the need for additional information and studies. The Board requested additional specific information from the project applicant by letter during this planning effort. The applicant did not provide any information in response to the Board's request, including demonstrating that the project is financially feasible.

Adequate information has not been presented to justify changes to the existing state recreational river designation. Based on the information that is available, the Board concludes that it is not in the public interest to modify the existing state recreational river designation to allow the proposed North Fork Payette hydropower project by Gem Irrigation District. This action is consistent with the Payette River Citizens Group's recommendations concerning the North Fork Payette hydropower project.

MINIMUM STREAM FLOWS

It is the policy of Idaho that the Board should seek to appropriate waters in the state for instream flow purposes when it is in the public interest. Idaho Code, Title 42, Chapter 15 provides the authority and spells out procedures for the Board to file applications to appropriate water for instream flows. A minimum stream flow is the minimum instream flow or lake level required to protect fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, navigation, transportation, or water quality in the public interest. By law, a minimum stream flow is not an ideal flow, but the minimum necessary to achieve the objectives. The water right is held by the Board and is junior to all earlier water rights. It is not a guaranteed minimum flow, but is only achieved after senior water rights are satisfied.

In order for the Board to acquire a minimum stream flow, a process separate from the development of a comprehensive state water plan occurs. Studies to determine the quantity and timing of the minimum stream flow may need to be conducted. The Director of the Idaho Department of Water Resources determines whether the minimum stream flow right is granted based on guidance in the Idaho Code. Legislative review of minimum stream flow rights granted by the Idaho Department of Water Resources is then required.

The Idaho Water Resource Board will take

action to obtain a minimum stream flow on the North Fork Payette River at Fisher Creek above Payette Lake. The reach location is depicted on Map 1.

The Big Payette Lake Management Plan, established by the Big Payette Lake Water Quality Council and adopted by the Idaho Legislature in 1998 recommends the Board obtain a minimum stream flow for the North Fork Payette River below Upper Payette Lake to protect kokanee spawning and resident trout species. The Idaho Department of Fish and Game conducted a modeling study, using the Riverine Habitat Simulation program, to model the relationship between flow and availability of fish habitat (Apperson, 1998). The suggested minimum stream flow is 60 cubic feet per second at the gage below Fisher Creek from July 1 to September 7.

The available period of record for the gage at Fisher Creek is October 1994 to April 1998, a period of above average streamflows. The calculated flow duration was adjusted using a longer record station at Lake Fork above Jumbo Creek (USGS 13240000) to produce a duration curve that reflects a long-term average (1946-97). Based on this adjusted flow duration, the suggested minimum stream flow of 60 cubic feet per second for July through September would be met or exceeded about 59 percent of the time. The Board will file an application for this water right with the Idaho Department of Water Resources.

Recommendations

The Board has the authority to establish water policy for the state of Idaho, and to plan for the improvement, development, and conservation of water resources through development and implementation of the State Water Plan [Idaho Constitution, Article 15, Section 7]. The Board requests that federal, state, and local agencies, and the entities referenced work with the Board to implement the recommendations contained in the plan. State agencies are asked to "exercise their duties in a manner consistent with the comprehensive state water plan" [Idaho Code 42-1734B (4)]. Federal agencies are required to consider a comprehensive state water plan, and are encouraged to manage their lands in a manner consistent with the recommendations contained in this plan.

Recommendations contained in the Payette River Basin Plan reflect input received from citizens and agencies. The Payette River Citizens Group submitted recommendations to the Board for their consideration. After considering Citizens Group agency input, and public comment on a Draft Payette River Basin Plan, the Board makes the following recommendations.

PROTECTED RIVER DESIGNATIONS

Federal Wild and Scenic River System

The Forest Service and Bureau of Land Management have found reaches within the Payette River Basin eligible for further study as potential federal wild and scenic rivers. Additionally, three national forests (Boise, Payette and Sawtooth) within the Payette River Basin are reexamining the eligibility of rivers and streams for possible wild and scenic designation during the forest plan revision process. Suitability studies to determine whether to recommend designation to Congress would occur after forest plan revisions are complete.

The Board recommends that the revised forest plans recognize state protected river designations as the best option for managing and protecting the outstanding resource values of waterways in the basin. The Forest Service and Bureau of Land Management are reminded that state designations should not be the basis for seeking inclusion of such waterway in the National Wild and

Scenic Rivers System [Idaho Code 42-1736]. The Board does not support federal wild and scenic river designation of any waterway in the Payette River Basin, believing state designation serves the general public equally well and best addresses local concerns. Because of the comprehensive scope of state water planning, the Board encourages the Bureau of Land Management and Forest Service to work within the state water planning process, and to support state protected river designations.

Northwest Power Planning Council Protected Area Designations

The Board designates the rivers shown on Map 1 as state protected rivers. The Board recommends that the Northwest Power Planning Council protected area designations reflect the state protected river designations.

WATER ALLOCATION

The Payette River Citizens Group was unable to reach consensus on many issues that concern water allocation. A Payette River Watershed Council was formed in 1996 to improve communication, cooperation, and sharing of information about the Payette River and its watershed. In past years the Watershed Council has worked towards consensus about releases from Cascade and Deadwood reservoirs. Changing water needs and additional demands will highlight the importance of this group to resolve water issues. The Board supports the continued efforts of the Watershed Council as a forum to discuss and resolve water allocation and other water-related issues at the local level. The Board encourages the Payette River Watershed Council to expand its forum to respond to issues identified in this plan.

Flow Augmentation

Flow augmentation involves using water stored in the Snake River Basin reservoirs in Idaho to flush smolts to, and in some cases through, the reservoirs behind the lower four Snake River Dams (located outside Idaho) as a means to aid salmon recovery. The Idaho Department of Water Resources recently examined the effectiveness of flow augmentation in improving velocity to assist migrating juvenile chinook salmon (Dreher, 1998). The Department demonstrated that flow augmentation provides minimal improvements in average flow velocities in the lower reach of the Snake River, and does not come close to achieving velocities that occurred before construction of the four dams below Lewiston. It is also important to note that the Snake River Basin in Idaho (which includes the Payette River Basin) has insufficient water quantities in dry years to achieve the seasonal average flow objectives identified by the National Marine Fisheries Service.

Using Payette River Basin water for flow augmentation jeopardizes the economic and environmental health of the basin. Out-of-basin use precludes the availability of water to meet present and future demands such as irrigation in drought years, reservoir and river recreation, and future municipal supply. Flow augmentation also limits the capability to manage releases to protect water quality and resident fisheries.

The evidence and conclusions presented by Dreher (1998), and the potential economic and environmental impacts in the Payette River Basin and to the State, point out that continued use of water from the Snake River Basin to flush smolts in the lower reach of the Snake River is not justified. There is no evidence that temperature control and velocity can be improved by using Payette River Basin water for flow augmentation.

Water Conservation

Water conservation in irrigation practices was identified as an issue for further study. There is concern that conservation may result in forfeiture or

partial forfeiture of water rights, and may reduce ground water recharge. The Board recommends further study of irrigation water conservation.

WATER STORAGE AND DELIVERY

Irrigation Water Measurement, Delivery and Management

To promote optimum and efficient water use, continued improvements in water delivery and measurement are necessary. To better track water supply and availability, the Board recommends that the U.S. Geological Survey, U.S. Bureau of Reclamation, Idaho Department of Water Resources, Water District 65, or some partnership of these entities pursue installing and funding additional automated gages in the following order of priority:

1) Middle Fork Payette just upstream of the confluence with the South Fork Payette River
2) South Fork Payette (main Payette River) just upstream of Banks

Currently, installation and maintenance of gages in the basin are funded by the U.S. Geological Survey, Idaho Department of Water Resources, U.S. Bureau of Reclamation, Water District 65, and Idaho Power Company. Other sources to fund the installation and maintenance of gages should be explored.

Continued improvements in water measurement and tracking by the automated accounting system for Water District 65 are desirable. Improvement is needed in the tracking method for pump diversions, possibly through installation of flow meters or use of power consumption coefficients. Additional water measurements are needed to track diversions more closely, including measurement of smaller diversions (30 cubic feet per second or less) on a weekly basis, and larger diversions on a daily basis. Additional investments in automating Water District 65's water delivery system is encouraged.

The desire to insure efficient and optimal use of the basin's water, coupled with the need to improve or protect water quality, has led to an examination of the many diversions and water delivery systems in the basin. Diversion upgrades have been recommended to improve water quality, fisheries habitat, and water delivery efficiency. Some recommendations are listed in Tables 1 and 2. Funding priority should reflect projects that accomplish multiple objectives, and that meet the objectives, goals, and recommendations contained in Payette River Basin Plan and the *Idaho State Water Plan.*

Water District 65 is the largest water district in the Payette River Basin. There are four additional water districts active in the basin. Improved communication and coordination between these water districts will maximize the benefits of water management.

J Ditch Irrigation Pipeline Project

The J Ditch irrigation pipeline, designed to improve water quality in Cascade Reservoir, will eliminate the discharge of McCall's treated wastewater effluent into the North Fork Payette River. The J Ditch pipeline mixes treated effluent with irrigation water, and transports both irrigation water and enriched irrigation water through a paired pipeline to downstream irrigators within the Mud Creek watershed. A Lake Fork Irrigation District canal system serving those same irrigators will be replaced.

Table 1. Recommendations for Cascade Reservoir Watershed Diversions.

Diversion	Study Recommendations
Lake Fork Watershed	
Westside Lake Fork Ditch	Catch point: Install weir flow measurement device, inlet box should be raised to mitigate backwater problems Replace corroding 24" steel outlet pipes with PVC; Cipolletti weir blade needs sharpened or replaced; scheduled maintenance and program to clear vegetation and other obstructions
Lake Irrigation District Canal	Install a measuring device - a ramp flume structure suggested
Spink-Barker Ditch	Replace diversion with more permanent structure; requires headwall and attachment to corrugated metal pipe; install stage recorder and stilling well with stage recording equipment at weir
Ditch F	Install 24" slide gate on ditch with a check structure; install small ramp flume structure; invert at head should be lowered slightly
Pump F	Install flow meter
Mud Creek Watershed	
Ditch B	Install 36" headgate structure at diversion and replace existing culvert; install 36" headgate at wasteway with turnout to farm ditch; install ramp flume structure with staff gage at both; replace check structure in creek
Ditch C	Install 36" headgate structure at the diversion point and replace existing culvert; install 36" headgate structure at wasteway with turnout to farm ditch; install ramp flume structure and staff gage at both; replace check structure serving farm ditch
Ditch D	Install 12" headgate structure; install weir flow measurement device on headgate; can remove check/waste box; install fencing to keep livestock out
Ditch L	Replace 60" corrugated metal pipe with 2 -36" gated culverts and bulkheads; install ramp flume structure and staff gate
Stock Pond B	Remove structure as it has been abandoned
Boulder Creek	
Pump B	Clean or replace trash rack; install flow meter for each pipe
Stock Pond D/ Ditch A	Install staff gage and 3' Cipolletti weir structure; rehabilitate eroded rock chute spillway with concrete design; clear head of spillway
Upper Jug Reservoir	Clear dead timber from reservoir
Ditch K	Install riprap bank protection, sharpen or replace weir blade
Gold Fork	
Pump C	Replace sediment diversion dam with more permanent structure; install flow meter; clean oil and diesel fuel contaminated area
Pump D	Replace sediment diversion dam with more permanent structure; install flow meter on pump
Center/Gold Fork Canal	Install Cipolletti weir in canal above Gold Fork flume crossing; reconstruct north wingwall at diversion; repair several canal sections
Ditch E	Install 12" gated turnout; install staff gage and 2.5' Cipolletti weir or flume structure; require new outlet facility
Ditch G	Install 36" gate and headwall structure; install 6' Cipolletti weir structure; extend ditch to river; install wasteway structure at confluence with side channel
Ditch H	Install 15" gate and headwall structure; install 2.5' Cipolletti weir or flume and staff gage
Ditch I	Install Cipolletti weir and gage staff; install headwall; install 4" Cipolletti weir o flume structure and staff gage; recommend regular clearing
Stock Pond C	Install flume structure in farm ditch and staff gage; raise contour ditch around meadow; install drop structure in wasteway
Willow Creek	
Diversion 701	Install flow meter
Diversion 702	Install 15" gate and headworks structure; install 1" Cipolletti weir

Sources: Natural Resources Consulting Engineers, Inc., 1996

Table 2. Lower Payette Diversion Inventory Recommendations.

Diversion	Recommendations
Bilbrey Enterprise Diversion	Signage to inform recreationists about diversion
Boise Cascade- Emmett	Construction of a permanent structure proposed
Eagle Island Diversion	Signage to inform recreationists about diversion
Farmers Cooperative Diversion	Possibility of additional signage upstream to inform recreationists
Last Chance Diversion	Culverts installed for Plaza Road are undersized, eventually county will replace with clear span structure, might want to consider Parshnall measuring flume; signage to inform recreationists of diversion dam and portage route
Lower Payette Diversion	Possible consolidation with Simplot pumps; signage to inform recreationists of diversion and possible portage
Seven Mile Slough Diversion	Possibility of improving diversion to make the structure more permanent; install trash rack in front of headworks for safety; signage to inform recreationists about diversion and possible portage
Washoe Diversion	Headgate may need rebuilt; repair needed to check structure; signage to inform recreationists about diversion and recommending portage route
Acord Diversion	Possible permanent structure

Source: Quadrant Consulting, Inc., et al., 1997.

The project replaces diverted waters from Mud Creek and Lake Fork, with the desired benefit of improving instream flows in these waterways. The Board recommends that the Idaho Department of Water Resources work with the Lake Fork Water District to develop an automated accounting program to more efficiently track rental pool, natural flow, and storage water rights. This will improve the watermaster's ability to deliver and manage water.

Water Storage

The Payette River Citizens Group identified the need for additional water storage for municipal water supply, irrigation, and flood control. Several options for meeting municipal water supply are listed in the next section. The need, feasibility, and opportunities to provide additional storage for these uses should be further explored. Small and large reservoir sites should be considered. The Board will consider reserving additional sites in the basin if warranted.

MUNICIPAL WATER SUPPLY

Basin population growth exceeds the state average, and is projected to continue to do so. Planning for and securing adequate water supplies to meet the demands of this growth needs to be a priority. Some municipalities need to acquire additional water supplies, or build infrastructure to provide for growth. These needs are summarized in the Payette River Basin Plan.

Idaho law [Idaho Code 42-202] provides that municipalities can appropriate water for reasonably anticipated future needs as determined through comprehensive plans or other supporting data. All communities are encouraged to pursue long-term planning, projecting future growth and reviewing water systems, to determine if current municipal water supply is adequate to meet projected growth. Water applications may be filed with the Idaho Department of Water Resources if a need is determined by a comprehensive plan or other supporting data.

Numerous options are available for meeting future water demands. The Board supports making water conservation a priority strategy. Other options that can be considered in long-term planning include:

- Measuring delivery to user and structuring municipal water rates to reflect the quantity of water used, instead of a flat rate. This measure can result in reduced water use.
- Purchasing a senior water right from a willing seller.
- Requiring land use developers to demonstrate that adequate water supplies are available for projects before local governments authorize them. The developer should work with the Idaho Department of Water Resources to identify water sources to serve the needs of the development. If the development will rely on a community water supply, water rights associated with the developed land should be gifted to the municipality by the developer.
- Obtaining contracts from the State Water Supply Bank.
- Obtaining storage contracts from the U.S. Bureau of Reclamation storage facilities.
- Condemning senior water rights with compensation.
- Building water storage projects that are consistent with the *Idaho State Water Plan*. The Payette River Citizens Group has supported building storage reservoirs to supply future needs. The Board supports this recommendation only if it may be accomplished with minimal environmental and social impact, and if adequate attention has been given to meeting demand through water conservation efforts. Off-channel reservoirs which provide flood control and fishery enhancements may provide a reasonable alternative.

In the *Idaho State Water Plan*, the Board identified a potential reservoir site on the Gold Fork River for 80,000 acre-feet of irrigation storage (Idaho Water Resource Board, 1996). The Board will continue to reserve this potential reservoir site and include municipal water supply as a project purpose.

The City of Horseshoe Bend needs to identify a secure water supply. The Board encourages the City to initiate a study of various alternatives. Additional alternatives for the City may include rehabilitating the wells abandoned in the 1970s and treating the water.

Other basin communities will need funding to replace aging infrastructure, or upgrade infrastructure to meet water quality standards and increased demands. A number of funding options were suggested by the Payette River Citizens Group, including revenue bonds through the Idaho Water Resource Board, user fees to generate funds allocated specifically to a water treatment facility, and federal funding.

WATER QUALITY

Planning and administration of water quantity and water quality are divided between two state agencies. The Idaho Department of Water Resources is primarily responsible for programs relating to water quantity, and the Idaho Division of Environmental Quality is primarily responsible for protecting the quality of the state's water. The Board has the authority to "study and examine" water quality issues, and "advise, cooperate and counsel" the Idaho Division of Environmental Quality about these issues [Idaho Code 42-1734(15)].

The Board will coordinate with the Idaho

Division of Environmental Quality on water quality concerns in the basin when it is consistent with the Board's authority. The Board recommends local citizens participate in the activities of the Southwest Basin Advisory Group and the several Watershed Advisory Groups active in the basin in preparing water quality management plans. The Board will address at a later date actions and recommendations contained in the Idaho Division of Environmental Quality's water quality plans for which they have responsibility or authority.

Coordination of Well and Septic System Installation

The Idaho Department of Water Resources is responsible for permitting the construction of wells. The Health District establishes guidelines for septic tank and leachfield locations and design. This current system can result in wells being permitted and constructed without specific knowledge of local septic tank or field locations, risking well contamination. The Payette River Citizens Group has expressed a desire to see improved coordination in well and septic system permitting. The Board recommends that the Idaho Department of Water Resources and Health District examine additional opportunities to improve coordination between their permitting responsibilities.

Increased urbanization, soil characteristics, and the hydrologic conditions in the basin indicate conventional septic systems will not be adequate to protect the resource. Development in rural areas with individual septic systems and domestic wells increases the potential for water quality and health problems. The Board recommends that subdivisions exceeding specified sizes or densities should be required to construct community waste treatment systems or hook-up with existing systems. This should be a high priority for development in Long Valley, Garden Valley, along the Middle Fork Payette River, and the lower Payette Valley.

In areas where individual septic tanks continue to be used, the Board recommends that counties and communities require lot sizes reflect the assimilative capacity of soils to safely site leachfields and wells. Where individual septic tanks prove acceptable, the density should be based on the assimilative capacity of the soils for the developed area. It may be necessary to establish a community well away from the influences of septic systems to protect drinking water supplies.

Minimum Stream Flows

Minimum Stream Flow - North Fork Payette Below Payette Lake Outlet to Cascade Reservoir

In May 1994 the Board filed an application with the Idaho Department of Water Resources for a minimum stream flow on the North Fork Payette River from Payette Lake Outlet to Cascade Reservoir for the protection of water quality, wildlife habitat, aquatic life, and recreation values. The Board has not asked the Director of the Department of Water Resources to process the application, because they wanted to first consider public response provided during the development of the Payette River Basin Plan.

The minimum stream flow considered in the Draft Payette River Basin Plan was 145 cubic feet per second from April 1 to June 30, and 72 cubic feet per second from July 1 to March 31. (The original application filed in 1994 was for 145 cubic feet per second from April 1 to September 30, and 72 cubic feet per second from October 1 to March 31.) Based on stream flow records from 1944 to 1997, the suggested minimum stream flow of 145 cubic feet per second for April through June would be met or exceeded about 83 percent of the time. The suggested minimum stream flow of 72 cubic feet per second for July through March would be exceeded about 64 percent of the time. (The flow duration curves do not distinguish between natural flows and storage water.)

The Draft Payette River Basin Plan proposed to process this minimum stream flow water right application. Written comment and testimony revealed some concerns that should be addressed before the Board pursue processing its minimum stream flow water right application. Local citizens, including the McCall City Council and Mayor, have expressed support for the minimum stream flow.

The Lake Reservoir Company, managers of Payette Lake storage water, have concerns about the proposed minimum stream flow. The Company's operations at Payette Lake would not be impacted, because of its senior water right. However, the Company is concerned that the public will expect releases of storage water from Payette Lake to meet a minimum stream flow even in years when this may not be practical. This expectation could impact the good public relations the Company has strived to establish. In July through October the proposed minimum stream flows are usually achieved through release of storage water.

Most concerns may be resolved by discussions between the interested parties. The Board encourages the Lake Reservoir Company, Trout Unlimited, McCall and Valley County representatives, and interested individuals to work cooperatively to address the concerns raised. The Payette River Watershed Council would be a good forum for these discussions. The Board will consider a request to process the minimum stream flow water right application when the interested parties reach a satisfactory resolution, maintaining the May 1994 priority date in the interim.

Minimum Stream Flow Studies

In support of recommendations by the Payette River Citizens Group, the Board requests that instream flow technical studies or analyses be conducted to determine if minimum stream flows are warranted for the following river reaches:

- Lake Fork - Little Payette Lake to Cascade Reservoir;
- Gold Fork River - Gold Fork diversion dam to Cascade Reservoir; and
- Several reaches of the Payette River:
  - Banks to Black Canyon
  - Black Canyon to Letha
  - Letha to Snake River confluence

Idaho law requires specific data to support an application for a minimum stream flow. The Board currently does not have the data required to pursue minimum stream flows on the river reaches listed above. The Board recommends that the Idaho Division of Environmental Quality and/or the Idaho Department of Fish and Game conduct studies to quantify flows and acquire other necessary information to process minimum stream flow applications for the above-mentioned streams. First priority should be given to Lake Fork because of the extensive investments made in constructing the J Ditch irrigation pipeline.

Minimum pools were administratively established by the U. S. Bureau of Reclamation for Cascade and Deadwood reservoirs. The Idaho Department of Fish and Game has noted that these minimum pools were intended for winter periods, and based on nutrient loading conditions occurring in 1980-81. Reexamination of minimum pools to maintain water quality and for fishery enhancement is needed. The Board supports minimum pools for these reservoirs, as long as they do not interfere with irrigation storage and delivery authorities.

Irrigation Diversion Improvements

Several studies have occurred in the basin examining opportunities to improve diversion structures and/or irrigation practices. A summary of recommendations from these studies are contained in Tables 1 (page 13) and 2 (page 14). Recommendations may include converting from

flood to sprinkler irrigation, consolidating or relocating diversions, controlling stream/canal bank erosion, and improving water control and measurement. The Board supports pursuing funding for these projects, focusing on those improvements recommended in the Idaho Division of Environmental Quality's implementation plans for water quality management.

Roads and Sediment

Best management practices are encouraged to mitigate or minimize sediment contributions from roads. The filtering capabilities of riparian zones should be protected. Slope stabilization should be required and can include using gravel or seeding. Runoff control should be required.

FLOOD MANAGEMENT

As the basin sees an increase in population and development, the potential impact of flood events could increase. Recent flooding has led to public concern about floodplain development and taxpayer liability for future damage from flood events. The Board encourages local governments to take proactive actions to prevent or minimize impacts from future flood events. Pre-disaster flood planning and floodplain management are essential elements in reducing flood risk.

The Payette River Citizens Group supports local governments applying stricter regulations for floodplain development. Local governments should consider prohibiting any new development in the 100-year floodplain, or at least allowing only development that is adequately protected. Floodplain cut and fill standards should be adopted that require compensating for fill placed in the floodplain by excavation to maintain stream channel flood capacity. Higher elevation standards for structures in the floodplain should be considered. These activities may result in reduced flood insurance premiums through the Community Rating System discussed later in this section.

It is State policy to encourage protection of floodplains, and rely on management rather than structural alternatives in reducing or preventing flood damage (Idaho Water Resource Board, 1996; See Policy 3I). Future growth may lead to increased land values and pressures to allow development in floodplains. In keeping with State policy, the counties and communities are encouraged to zone floodplains for appropriate uses that avoid expensive structural flood control and flood repair. Land use planning is a more viable and economical way to minimize flood damages. Structural controls are expensive to build and maintain. Lack of adequate maintenance can result in failure and an increased danger. The current lack of federal funding to repair damaged levees or to construct new ones must be considered in state planning.

The adoption of floodplain ordinances as a participant in the National Flood Insurance Program (managed by the Federal Emergency Management Agency) is one nonstructural alternative for flood management. The Board encourages all counties and communities in the basin to participate in the National Flood Insurance Program. Participation has resulted in adoption of floodplain ordinances which outline land use measures to minimize flood damage. The Board encourages the counties and communities to continue monitoring floodplain development to ensure ordinances are followed and that development does not increase potential flood damage.

As participants in the National Flood Insurance Program, communities may enhance flood management and further minimize flood risks by enrolling in the Community Rating System. This program provides a means for local governments to

voluntarily engage in additional flood management activities, choosing from several options with minimal investment. The result is decreased risks to property and life, and reduced flood insurance premiums for property owners. Valley County is the only basin jurisdiction currently participating in this component of the National Flood Insurance Program. Other communities are encouraged to contact the State Flood Coordinator at the Idaho Department of Water Resources to enroll in the Community Rating System.

Jurisdictions from Horseshoe Bend downstream may want to consider forming a "flood management committee" to prepare a flood management plan. This plan should include exploring coordinated management of the existing levee system to insure proper maintenance and adequate protection. Currently, regulatory oversight of levee construction and maintenance is limited. The Board recommends that minimum standards for levee maintenance and construction be established. Repair or replacement of levees should be monitored so that improvements do not place additional areas at risk by transferring erosion and flood problems to downstream property owners. The committee is encouraged to investigate alternatives to levee replacement and expansion. The "flood management committee" should explore the possibility of forming a Flood Control District for long-term management of levees and the floodplain.

Additional information is required to develop a flood management plan. Accurate floodplain and floodway mapping is needed that reflects the current river channel configuration. Aerial photography produced during the 1997 flood event should be obtained and input into a geographic information system to produce accurate maps. Development of a computer model to help determine what is inundated at various flows is desirable. More accurate spatial information is needed about levee location along the lower reach of the Payette River so that coordinated maintenance and management may occur. Spatial identification of all levees using Global Positioning System (GPS) technology is suggested.

RESOURCE DEVELOPMENT

The Board has not amended the state recreational designation to allow construction of a hydropower project proposed for the Smiths Ferry to Banks reach of the North Fork Payette River for the reasons cited on page 9. Recognizing the future need for new generating capacity, the Board believes there are alternatives to meet future energy demands, including expansion of capacity at existing hydropower facilities in the basin. Developing hydropower at existing dams in the basin should also be explored in more depth. Some of these options may be preferable because of favorable economics, and the potential to minimize environmental and other impacts.

FISHERIES

Many fishery issues in the basin are associated with water quality concerns. Recommendations made in the earlier *Water Quality* section address some of these concerns, including minimum stream flows, improvements to diversion structures, and irrigation management. Recommendations specific to reaches in the Cascade Reservoir watershed are summarized in Table 3. The Board supports further evaluation of the design and financial feasibility of these alternatives. An alternative to expensive fish screens may be orienting diversion openings parallel to flows to minimize diverting fish into ditches, and positioning diversion structure overflows where fish can most easily use
them. Another alternative is to consider constructing or enlarging existing headwater storage reservoirs to establish lake fisheries and enhance downstream summer flows. Cooperative funding among the many players involved in fisheries, water

quality, and water delivery should be explored.

Table 3. Possible Alternatives to Address Fisheries Concerns in the Cascade Reservoir Watershed.

Priority/Diversion	Problem(s)	Possible Alternatives
1) Gold Fork Diversion - About 4 mi. up Gold Fork from State Highway 55 bridge on Cascade Reservoir	Dam (18 ft. high) with occasionally no flows below that blocks 46 miles of trout habitat capable of producing 250,000 native trout annually for Cascade Reservoir.	- Fishway and partial canal screening - Minimum flow
2) Lake Irrigation District Canal (LID) - Below Little Payette Lake on Lake Fork	Diversion claims adults and juvenile fish in large numbers. The diversion is located immediately downstream of a major rainbow / redband spawning area. There is occasional dewatering of Lake Fork.	- Modify diversion structure and/or orientation to flow - Partial fish screen - Coordination of rental pool releases
3) Cruzen Canal - 5 miles below Lake Irrigation District Canal on Lake Fork	Diversion claims many adult and juvenile native redband/rainbow trout that would otherwise enter Cascade Reservoir. There is frequent dewatering of Lake Fork.	- Modify diversion structure and/or orientation to flow - Partial fish screen - Flow measuring device to pass rental pool releases
4) Brown's Pond Dam - 2 miles above Little Payette Lake on Lake Fork	Dam blocks fish migration to many miles of high quality fish habitat.	- Fishway
5) Alpha Ditch - Located on Clear Creek	Diversion diverts fish claims native redband/rainbow trout adults and juveniles. There is dewatering.	- Modify diversion structure and/or orientation to flow - Partial fish screen

Source: Anderson, Idaho Department of Fish and Game, 1998.

Bull Trout

Bull trout are listed as threatened in Idaho under the Endangered Species Act. In 1996 the state of Idaho prepared a *Bull Trout Conservation Plan* before the listing occurred, to identify conservation actions to recover the species (Batt, 1996). Implementation of this plan in the Payette River Basin occurs under the direction and guidance of the Southwest Basin Native Fish Watershed Advisory Group, with assistance from a technical group. This strategy focuses on locally developed solutions applicable to individual watersheds.

The state will continue bull trout recovery efforts as defined in the state of Idaho plan. The Board supports the actions of the Southwest Basin Native Fish Watershed Advisory Group (WAG), believing the state is best able to address the challenges to recover this species. The U.S. Fish and Wildlife Service is the federal agency charged with recovery of the bull trout since its listing under the Endangered Species Act. The Board recommends that the U.S. Fish and Wildlife Service recognize and work with the state WAGs to develop recovery strategies for the bull trout and avoid duplicative efforts.

Bull trout focal habitats are "critical areas supporting a mosaic of high-quality habitats that sustain a diversity or unusually productive complement of native species" (Batt, 1996). Bull trout focal habitat for key watersheds in the Payette River Basin are listed in Table 4. Protecting these reaches that support healthy sub-populations can

increase persistence of adjacent populations in lower quality habitats. Land and water management activities should minimize impacts to these reaches.

Table 4. Bull Trout Focal Habitat in the Payette River Basin.

Gold Fork Bull Trout Key Watershed

North Fork Gold Fork River and tributaries *(18.5 miles)* - Headwaters to South Fork Gold Fork River confluence, and unnamed perennial tributaries upstream of the Lodgepole Creek confluence
South Fork Gold Fork River *(4.7 miles)* - Headwaters to North Fork Gold Fork River confluence

South Fork Payette Bull Trout Key Watershed

South Fork Payette River *(9.7 miles)* - Smith Falls to Mink Creek confluence
Goat Creek *(5.8 miles)* - Blue Rock Lake Creek confluence to South Fork Payette River confluence
Baron Creek *(7.6 miles)* - Braxon Lake Creek confluence to South Fork Payette River confluence
Wapiti Creek *(5.5 miles)* - Headwaters to South Fork Payette River confluence
Canyon Creek and tributaries *(14.8 miles)* - Headwaters to South Fork Canyon Creek confluence, and the following tributaries:

- *North Fork Canyon Creek* - Headwaters (including unnamed perennial headwater tributary) to mouth
- *South Fork Canyon Creek* - Headwaters to mouth

Clear Creek *(12.5 miles)* - Headwaters to Blacks Creek confluence,
Warm Springs Creek and tributaries *(18.9 miles)* - Headwaters to East Fork Warm Springs Creek confluence, and the following tributaries:

- *Middle Fork Warm Springs Creek* - Headwaters to mouth, including unnamed perennial tributary
- *East Fork Warm Springs Creek* - Headwaters (including unnamed perennial headwater tributaries) to mouth

Scott Creek and tributary *(9.6 miles)* - Headwaters to South Fork Scott Creek confluence, and the following tributary:

- *Smith Creek* - Headwaters to mouth

Deadwood Bull Trout Key Watershed

Deadwood River *(4.3 miles)* - Headwaters to East Fork Deadwood River confluence
Deer Creek and tributaries *(14.6 miles)* - Headwaters to Deadwood River confluence, and the following headwater tributaries:

- *North Fork Deer Creek* - Headwaters to mouth
- *South Fork Deer Creek* - Headwaters (including unnamed perennial headwater tributary) to mouth

South Fork Beaver Creek *(0.1 miles)* - One hundred yards upstream of Forest Trail 023 to Deadwood Reservoir
Trail Creek *(6.5 miles)* - Headwaters to Deadwood Reservoir

Middle Fork Payette Bull Trout Key Watershed

Middle Fork Payette River and tributaries *(18.3 miles)* - Headwaters to Ligget Creek confluence, and unnamed perennial tributaries
Bull Creek and tributary *(10.6 miles)* - Headwaters to mouth, and the following tributary:

- *Oxtail Creek* - Headwaters to mouth

Squaw Creek Bull Trout Key Watershed

Squaw Creek and tributaries *(11.2 miles)* - Poison Creek confluence to Cold Spring Creek confluence, and the following tributaries:

- *Pole Creek* - Headwaters to mouth
- *Unnamed tributary* - Headwaters (located in T. 13 N., R. 2 E., southeast 1/4 of Section 15) to mouth
- *Third Fork Squaw Creek and tributaries (15.8 miles)* - Headwaters to Mesa Creek confluence, and unnamed perennial tributaries

The Board recognizes the importance of focal habitats in maintaining and recovering the bull

trout populations. State protected river designation of bull trout focal habitat would recognize the outstanding resource values provided by these reaches as important spawning habitat. State protected designation can complement actions proposed in the conservation plan, and would demonstrate the State's ability and willingness to protect critical habitat to ensure long-term persistence. The designation has the flexibility to specify activities allowed for the conservation of bull trout. The Board encourages the Southwest Basin Native Fish Watershed Advisory Group to consider recommending state protected river designation as one action in the bull trout conservation plan being prepared for the Payette River Basin. The Board will consider amending the Payette River Basin Plan to designate bull trout focal habitat for state protected designation at the request of the Watershed Advisory Group.

The Board recommends that other agencies conduct activities in bull trout key watersheds in a manner that does not impact the persistence of the species, and is compatible with the Southwest Basin Native Fish Watershed Advisory Group activities and recommendations. The Board recommends that the Idaho Department of Water Resources continue to coordinate a review of any water right applications in bull trout key watersheds with the Idaho Department of Fish and Game.

AGENCY PLANNING AND COORDINATION

Stream Channel Alteration Permitting

The public desires the stream channel alteration permitting process to be more efficient, particularly in emergency situations. Suggestions to achieve this goal include Idaho Department of Water Resources-sponsored public information meetings in areas susceptible to flooding to identify stream channel protection measures needed before flood season, and adequately funding agencies to review the onslaught of applications after flood events. A streamlined permitting process is used in emergency situations. The Board encourages evaluating the permitting process to see if the process can be further expedited during emergencies. The Board recommends that the U.S. Army Corps of Engineers stream channel alteration permit functions be consolidated under the authority of the Idaho Department of Water Resources.

Naming Convention for the Payette/South Fork Payette River

Citizens in the basin would like the Payette River from the Middle Fork Payette confluence to Banks officially recognized as the South Fork Payette. This requires a request to the U.S. Board of Geographic Names. The Board will complete the necessary paperwork to request an official name change. Boise County Coalition will help the Board with this effort, coordinating with local jurisdictions.

RECREATION

The demands on recreational resources in the Payette River Basin have increased significantly in the past ten years, particularly water recreation. These demands are the result of the outstanding recreational opportunities available in the basin, the growing regional and local populations, and reduced opportunities elsewhere. The budgets of agencies responsible for managing recreation opportunities are not keeping pace with the demand, and many agencies have experienced reduced budgets in recent years. In order to maintain the quality of the recreational experience and protect associated resources contributing to the experience, sufficient funding must be procured.

The Payette River Recreation Fee Demonstration project, begun in 1998, provides one mechanism to raise funds for government agencies that provide recreational opportunities along the South Fork Payette and main Payette rivers. Boise

County will receive some compensation for services provided through this program. However, other mechanisms must be explored to compensate state and local entities for services provided. The Board recommends that some of the fees collected from the federal fee demonstration project be used to examine and quantify the economic impact and benefits to the local counties and communities from the associated recreational activities.

Significant increase in whitewater recreation and agency actions to manage this use have the public concerned that recreation diversity and quality in the Payette River corridor is diminishing. The public desires to maintain a diversity of recreation opportunities along the river corridor. Many feel that funding and recreation management has focused on boating recreation to the detriment of other recreation opportunities. This issue needs to be explored by the recreation management agencies. The Board recommends that all recreation management agencies work together to develop a Payette River corridor recreation management plan. This plan must strive to balance competing uses while maintaining a quality experience for all recreation activities. County commissions and local planning and zoning should be involved in plan development to incorporate their concerns, and ensure recreation activities are compatible with land use comprehensive plans.

Recreational Dredge Mining

During the public comment period for the Draft Payette River Basin Plan, the Idaho Gold Prospectors Association requested the Board amend state recreational river designations for three reaches in the Payette River Basin to allow recreational mining. The request was for the following reaches:

- Payette River - Banks to Beehive Bend
- South Fork Payette - Middle Fork Payette River confluence to Banks
- South Fork Payette - Deadwood River to Big Pine Creek

These are some of the state recreational river reaches designated by the Board in 1991 which prohibited stream channel alterations, including recreational dredge mining.

In considering the Idaho Gold Prospectors Association request, some concerns were identified during discussions with some of the resource agencies. The Idaho Department of Fish and Game indicates opening any of the South Fork Payette reaches would be incompatible with bull trout recovery efforts. Idaho Department of Parks and Recreation noted these reaches receive the most boating use in the basin by private and commercial boaters, and the possibility for user conflicts. The Payette River Basin contains a summary of the background history and other considerations in the Appendix.

The Payette River Citizens Group did not address this issue, because it was not raised until the final hearing for the completed Draft Payette Plan. The Board believes additional discussion between interested individuals needs to occur. The Board encourages the Idaho Gold Prospectors Association to meet with boaters, outfitters, and other recreationists to reach consensus. If an agreement is reached that provides adequate protection to the water resources, the Board will then consider amending the recreational designation to allow recreational dredge mining on the main Payette River.

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