Comprehensive
STATE WATER PLAN

Snake River: Milner Dam to King Hill

Idaho Water Resource Board
December 10, 1993

COMPREHENSIVE STATE WATER PLAN

Snake River: Milner Dam to King Hill

Idaho Water Resource Board

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EXECUTIVE SUMMARY

This component of the Comprehensive State Water Plan is prepared for the Snake River from Milner Dam to King Hill, Idaho, defined locally as the Middle Snake (Figs. 1-2), by the Idaho Water Resource Board in keeping with their constitutional and legislative charge to formulate and implement a State Water Plan. The Idaho Legislature directed the Board to place the Snake River from Section 5, Township 11 South, Range 20 East, B.M. to King Hill under interim protection, with the goal of identifying in the planning process whether or not the reach deserved designation as part of a state protected rivers system. For hydrologic congruity, the geographic delineation of the plan was extended upstream to Milner Dam.

The Middle Snake reach is visually delineated by the Snake River canyon, a deep, often vertical walled canyon cut through successive basalt flows, with numerous springs which issue through the canyon walls. Water flow through the reach is dependent on Milner Dam releases and discharge from the Snake River Plain Aquifer. Irrigation diversions at Milner Dam diminish summer flows at the upper end of the reach, but tributary springs maintain a relatively secure flow from the backwaters of Upper Salmon Falls Reservoir to King Hill.

Agriculture is the predominant industry of the region. Over the years, many water supply projects in the region have been built by private individuals and non-profit irrigation companies which rely on Snake River flows. At the eastern end of the reach, farming activities are tied to irrigation canals on the Snake River Plain, with grazing use more prevalent adjacent to the river. In the canyon, benches provide limited opportunities for development and grazing. Much of the land adjacent to the river is undeveloped.

As one travels downstream, more mixed land uses are found because of increased water availability from springs and tributaries, and an expansion of the river floodplain. Development along the river is primarily for aquaculture, residences, recreation facilities, and pasture. Aquaculture facilities are prevalent between Crystal Springs and Hagerman. Residential development within the canyon and along the canyon rim occurs from Shoshone Falls downstream to the town of Bliss. Substantial hydropower developments, operated by Idaho Power Company and many private owners, have been built along the reach.

Pressure for future water development projects along the reach can be expected with projected growth. However, development in the reach is constrained by upstream water rights, critical groundwater management areas, the Swan Falls Agreement, and minimum flows.

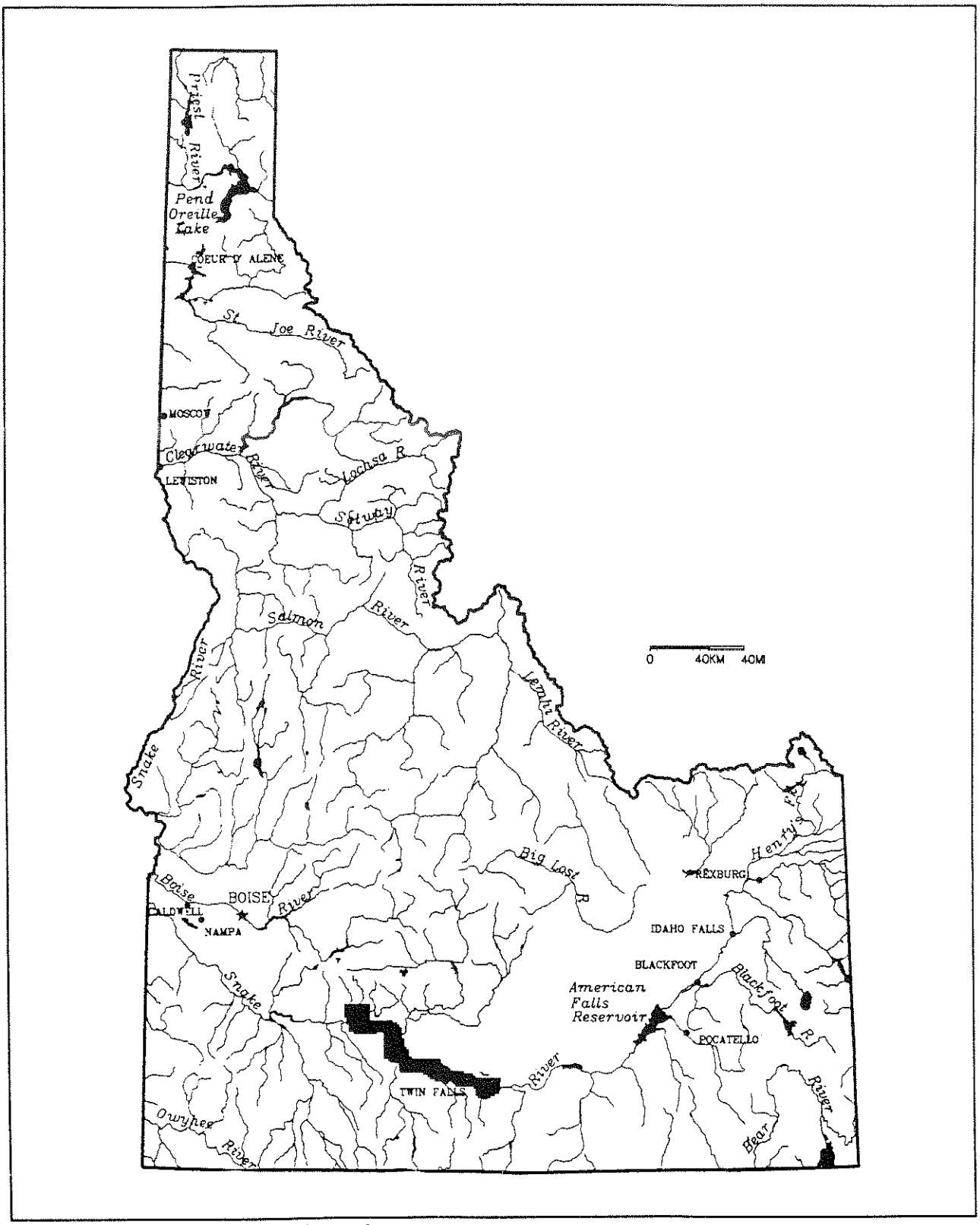

Figure 1. Location of Middle Snake reach

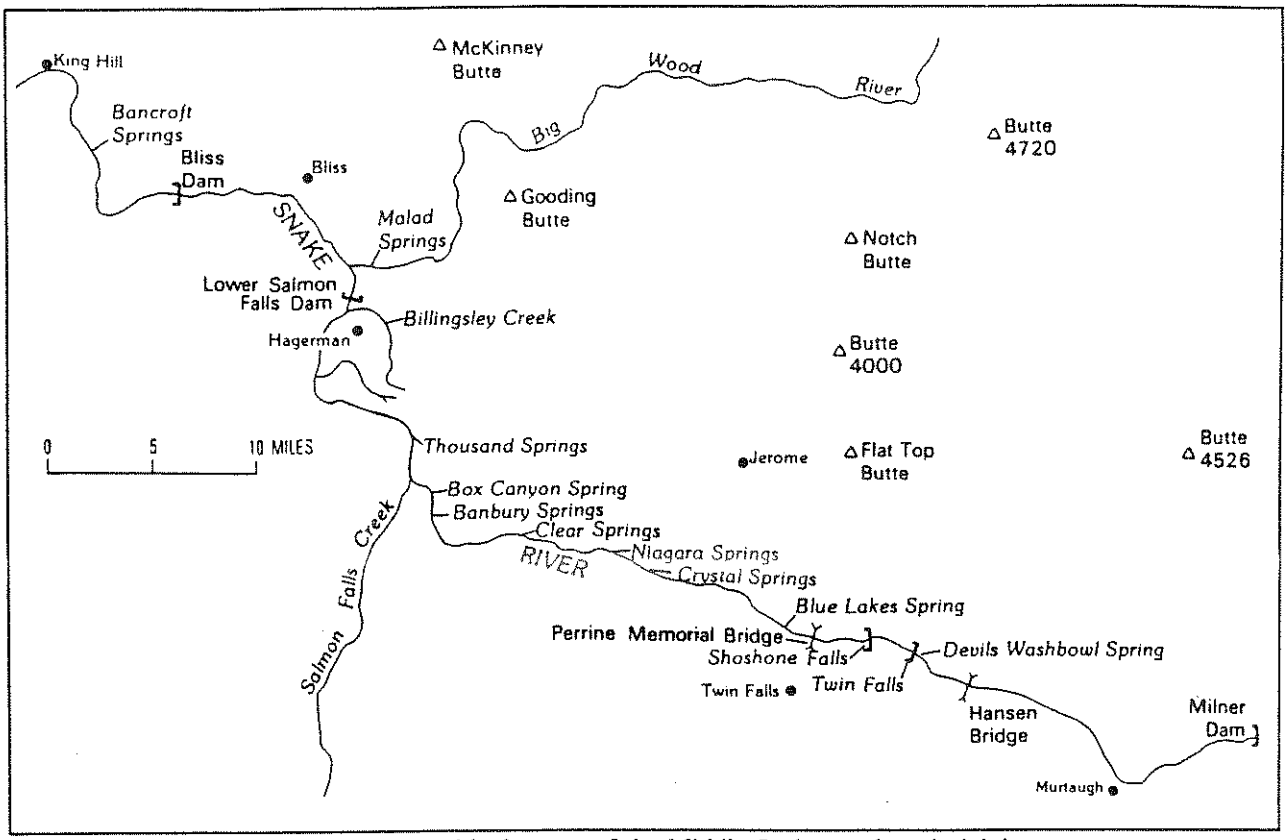

Figure 2. Map showing major geographic features of the Middle Snake reach and vicinity.

An overwhelming concern about water quality has been expressed by residents of the area. Water quality problems in the Middle Snake reach are the consequence of low water flows and nutrient and sediment loading from agricultural runoff, hatchery discharge, municipal effluent, and degradation of inflowing groundwater. Water quality degradation detracts from the scenic character of the Snake River canyon, limits recreational opportunities on the river, and threatens diversions for beneficial uses in and downstream of the Middle Snake reach. The quality of fisheries, wetlands, and wildlife in the Middle Snake reach has declined and will continue to decline under present conditions.

Based on local concern, the single overriding consideration in developing a comprehensive plan for this reach of river is water quality. Forestalling or reversing environmental degradation cannot be realized as long as the Snake River resources are allocated on a piecemeal basis. More attention needs to be paid to cumulative impacts, the assimilation capacity of the river, and coordinated allocation of water resources, both ground and surface water. Public comments also indicate a desire to minimize additional visual changes to the river canyon, particularly in natural or undeveloped areas. To accomplish this objective, visual changes in remaining free-flowing sections of the river and other natural landscapes must be minimized.

Designations

In planning for the use of the water resources of the state, the Water Resource Board is charged with weighing and balancing competing uses and needs. Multi-objective resource planning necessarily involves making trade-offs aimed at achieving the greatest number and best combination of objectives, based upon the overall goals of planning.

No action by the Board would not support the coordinated efforts of local government to improve the water quality of the Middle Snake reach. The Board believes State protected river designations are preferable to federal protection, and are in the best interest of the residents of the State of Idaho. Federal protection limits the flexibility of planning for the reach, and removes the option of amending the designation by action of the Water Resource Board and the Idaho Legislature.

Actions of the Board are consistent with the Idaho Code, private property rights, local and state management plans, the local *Coordinated Water Resource Management Plan for the Middle Snake River* adopted by Gooding and Jerome counties, and public comment garnered at the Public Scoping meetings, through the local Advisory Group, and the public hearings. The Board considered impacts of protection, improvement, and development on the social, economic, and environmental livelihood of the region, and makes the following designations and recommendations in the public interest.

In order to protect current resource use, and the multiple-use character of the Middle Snake reach, and recognizing that no action by the Idaho Water Resource Board using their comprehensive water planning authorities can interfere with vested rights, or the repair, replacement, or continued operation of existing facilities or works, the Idaho Water Resource Board takes the following action (Fig. 3):

1) Designates the Snake River from the downstream project boundary of the Milner Hydroelectric Project, (approximately 700 feet downstream from the Idaho Power Company main Milner powerhouse), River Mile 637, to a point 100 feet downstream of the Murtaugh Bridge "Recreational" (7 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations which do

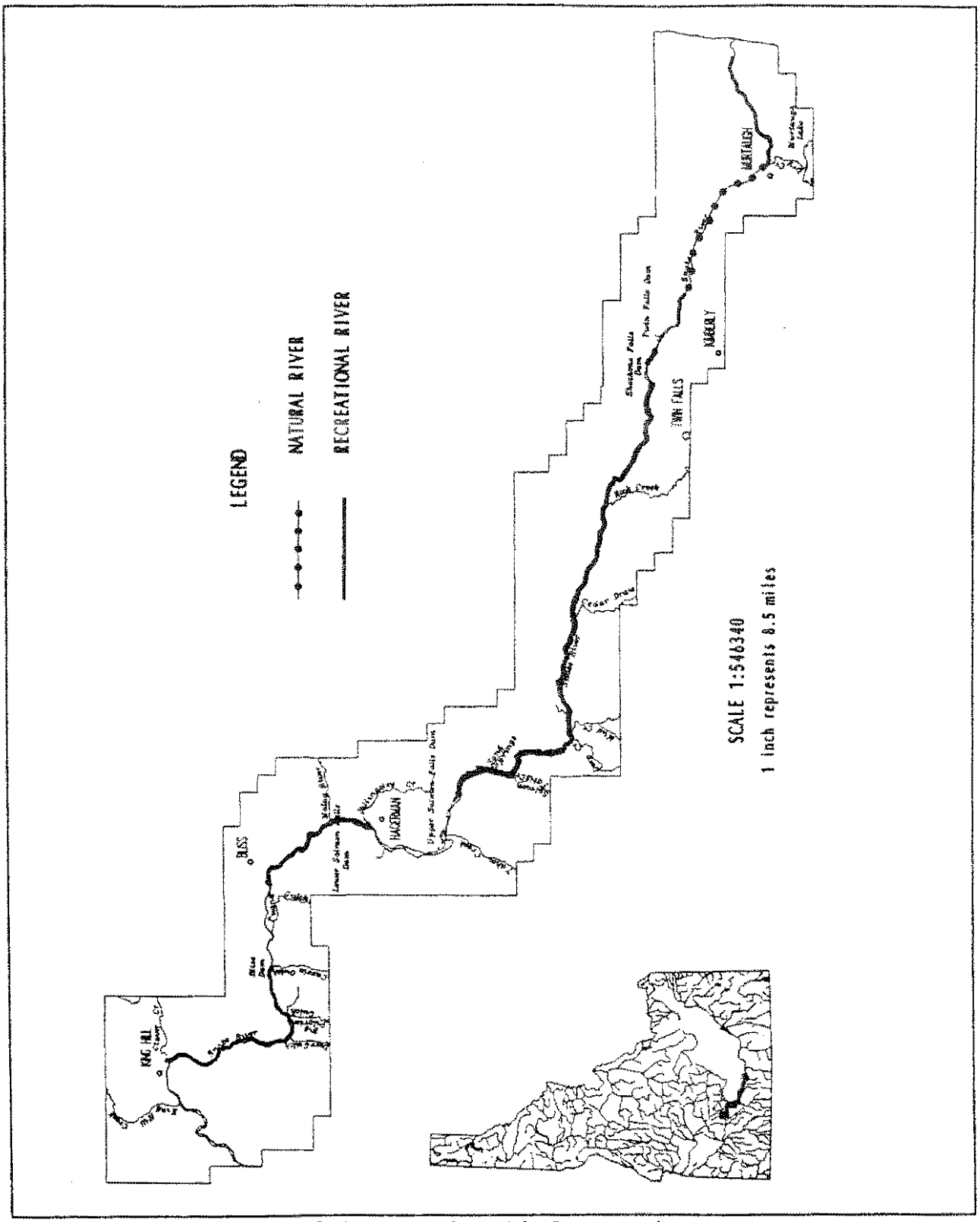

Figure 3. Segments of the Middle Snake reach designated for State protection.

not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

2) Designates the Snake River 100 feet downstream of the Murtaugh Bridge to a point 100 feet upstream of the Hansen Bridge as "Natural" (9.5 miles). Within the segment the Board prohibits 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.

3) Designates the Snake River 100 feet upstream of Hansen Bridge to the upstream project boundary of Twin Falls Hydroelectric Project [River Mile 619.5, the east boundary of Lot 5, Section 10, T10S, R18E, B.M.] "Recreational" (2 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

4) Designates the Snake River from the downstream project boundary of the Twin Falls Hydroelectric Project [River Mile 617] to the confluence of the westerly spring flow from the Devil's Corral spring area [River Mile 616] "Recreational" (1 mile). State protection of this segment shall in no way impede relicensing of the Shoshone Falls Hydroelectric Project, or an expansion of the Shoshone Falls Hydroelectric Project boundary that would not result in any change in the size of the impoundment or in reservoir elevation. Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations which do not create an obstruction in the river; are to supply water for domestic,

commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

5) Designates the Snake River from River Mile 614.4 (approximately 800 feet downstream from the Shoshone Falls powerhouse) to the Highway 30 Bridge "Recreational" (32 miles). The licensed Auger Falls Hydroelectric Project, FERC #4797, is exempt from the prohibitions of this designation. A permit to appropriate water for the Boulder Rapids Hydroelectric Project, FERC #10772, was approved in May 1984 with extensions for proof of beneficial use authorized in 1989 and 1993. A public hearing, held in response to a request for exemption from interim protection designation prohibitions, identified significant public concern that the Boulder Rapids development would preclude or jeopardize existing beneficial uses. However, Idaho Code 42-1734F(1) states that prohibitions promulgated pursuant to State designation of protected rivers shall not limit, restrict, or conflict with approved applications for the appropriation of water.

Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

6) Designates the Snake River from the downstream project boundary of the Lower Salmon Falls Hydroelectric Project [River Mile 573] to the upstream project boundary of the Bliss Hydroelectric Project [River Mile 565.5] "Recreational" (8 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply

water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

7) Designates the Snake River from the downstream project boundary of the Bliss Hydroelectric Project [River Mile 560] to the confluence of Clover Creek "Recreational" (12 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

It is the policy of the Board to amend the water plan when it determines that amendments are in the public interest. The Board will consider proposals for amendment to the 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 follow the procedures required for the adoption of the original plan (Sections 42-1734A and B, *Idaho Code*). In addition, the Board shall review and reevaluate the Comprehensive State Water Plan at least every five years (Section 42-1734B(7).

Plan Recommendations

The Middle Snake River reach receives major nutrient, sediment, bacteria, and chemical loadings from a number of sources. Studies attempting to quantify the impacts of existing impoundments, fish hatchery effluent, sewage outflows, and agricultural return flows must be supported and continued. Planning for the various uses of water requires an understanding of the water quality impacts of the different competing uses.

In order to address water quality standard violations on the Snake River, the Division of Environmental Quality has initiated development of a water quality management plan under the Idaho Nutrient Management Act (Idaho Code 39-105(3)(o)). At the core of the overall plan will be industry-specific nutrient management plans. These plans are to contain both short and long-term

actions, monitoring to demonstrate plan implementation and effectiveness, and mechanisms to ensure compliance.

- The Board supports development of a Nutrient Management Plan under the direction of the Division of Environmental Quality to improve water quality of the Middle Snake reach. The State's Water Pollution Control Account should be used to support planning, education, monitoring, and enforcement of water quality standards on the Middle Snake reach.

- The Board recommends studying methods for increasing flows during low-flow periods through the Middle Snake reach.

- The Board recommends examination of the need for additional protection of spring flows in a Snake River Plain Aquifer Plan, in light of concerns about reduced spring discharges into the Middle Snake reach, and declining ground water levels. The water quality and quantity aspects of conjunctively used stream-aquifer systems must also be understood.

It is the policy of the State of Idaho (Energy Plan, 1982) that private and public utility companies place a high priority on conservation, full development of generation at existing dams and hydropower facilities, and development of other renewable resources.

- The Board encourages the Idaho Public Utilities Commission to continue, through its regulatory authority, to encourage energy conservation and the commercialization of cost-effective alternative energy systems.

- The Board encourages the investigation of the feasibility of hydropower development on canals and return flows not associated with natural springs in the Middle Snake reach.

- The Board supports testing and implementation of new technology to increase hydropower potential.

Under the traditional form of ratemaking, a utility loses money for each kilowatt-hour conserved, even though conservation may be the utility's least-cost investment in the long term. If it reduces sales, a private utility loses some of the revenues it needs to cover fixed costs and pay a return to its stockholders. This effect creates a strong short-term disincentive to conservation, and an incentive to promote sales.

- The Board encourages the Idaho Public Utilities Commission to investigate regulatory models in which utility revenues and profits are linked to some measure other than kilowatt-hour sales, to remove financial disincentives that utilities face when they cost-effectively save kilowatt-hours.

Local counties of the Middle Snake region have worked hard to address problems related to water quality and water supply. Intergovernmental cooperation is crucial to planning and implementation of measures to develop, improve, and conserve the water resources of the region.

- The Board encourages cooperation with local government entities in identifying water distribution and water pollution problems.

- The Board encourages counties to more forcibly address the problem of unauthorized disposal of rubbish into the canyon.

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Appendices to the Snake River: Milner Dam to King Hill plan are compiled in a separate document, available from the Department of Water Resources, 1301 N. Orchard, Boise, Idaho 83706.

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I. 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 Amendment 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 Amendment of 1965 Legislation

(1) "The board shall designate the following waterways as interim protected rivers pursuant to section 42-1734D, Idaho Code . . . . (c) Snake River from Section 5, Township 11 South, Range 20 East, B.M. to King Hill."

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With the approval of HB780 in 1988, the Idaho Legislature redirected state water planning efforts. The Idaho Water Resource Board was given the task of developing a state water plan incorporating comprehensive plans for river basins, river reaches, or other geographic regions. Comprehensive basin plans and a state protected rivers system are logical additions to the Idaho State Water Plan, a collection of policies designed to direct water use in the state. HB780 also directed the Board to place a number of river reaches under interim protection with the goal of identifying those reaches deserving designation as part of a state protected rivers system.

House Bill 780 became law on July 1, 1988. Accordingly, on that date the Idaho Water Resource Board designated the Snake River, from Section 5, Township 11 South, Range 20 East, B.M. to King Hill as an interim protected river. Using their new authorities (Idaho Code 42-1734D), the Water Resource Board prohibited for the duration of interim protection:

(a) construction or expansion of dams or impoundments;
(b) construction of hydropower projects;
(c) construction of water diversion works;
(d) dredge or placer mining;
(e) alterations of the stream bed; and
(f) mineral or sand and gravel extraction within the stream bed.

An initial draft plan for the Middle Snake reach was reviewed at a Public Information Meeting on May 17, 1990, in Twin Falls, and the public was invited to comment and testify on the draft at a June 4, 1990, public hearing. After the formal public hearing the Board deferred action on a plan for the Middle Snake reach. The 1991 Idaho Legislature re-established interim protection for the Middle Snake at the urging of local county government officials. The county officials cited local concern about water quality and development in the reach as the rationale for continued protection and planning.

In developing a plan for any waterway or geographic area, the Board is expected to identify goals and objectives, as well as make recommendations for improving, developing, or conserving the water resources of the waterway or area. The Water Board cannot regulate non-riverine activities except through recommendations concerning the allocation of water, nonetheless their planning activities must consider the existing and potential uses for:

(a) navigation;
(b) power development;
(c) energy conservation;
(d) fish and wildlife;
(e) recreational opportunities;
(f) irrigation;
(g) flood control;
(h) water supply;
(i) timber;
(j) mining;
(k) livestock watering;
(l) scenic values;
(m) natural or cultural features;
(n) domestic, municipal, commercial, and industrial uses; and
(o) other aspects of environmental quality and economic development.

Only after considering these values can the Water Resource Board make recommendations for the use of an area's water resources including the merits of state protected river designation.

Goals

The plan for the Middle Snake reach is prepared at a reconnaissance level, giving a general assessment of problems and demands and identifying their location. Water management and current issues are delineated, and all potential uses of the river are considered. It is intended that both the formulation of a plan and its implementation will provide for a balance of environmental, economic, social, and political factors.

In adopting a comprehensive state water plan the Board is guided by these criteria (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 the 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 and 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 shall be encouraged.

II. PLANNING PROCESS

The planning process encompasses: (1) developing an inventory of resource attributes, (2) assessing current and potential water uses and constraints, (3) identifying local issues, concerns, and goals specific to water use in the Middle Snake reach, (4) formulating development, improvement, and/or conservation policy alternatives, and (5) guided by public interest, setting forth actions and recommendations relative to improving, developing, and conserving the water resources of the Middle Snake Reach. Figure 1 outlines the planning process.

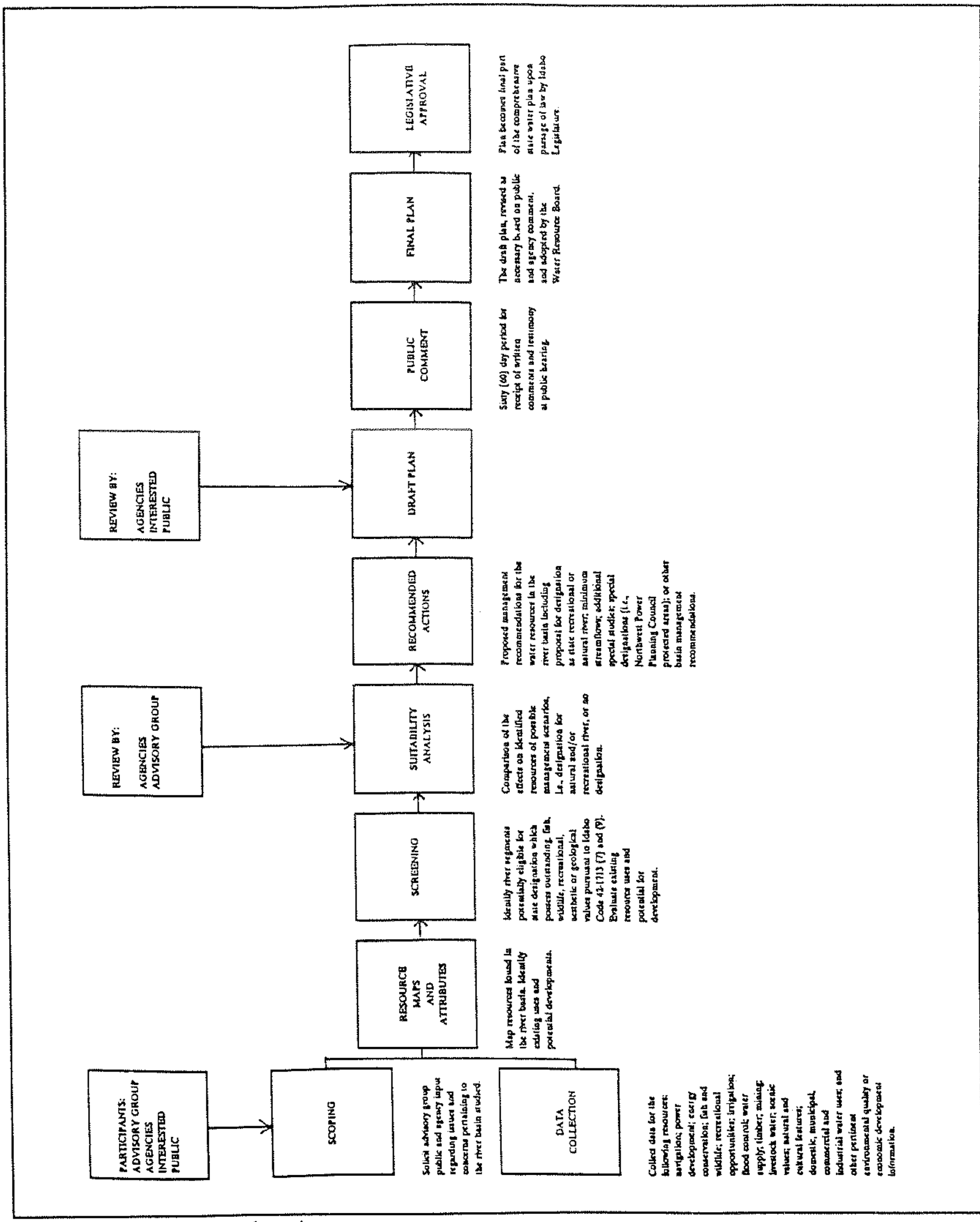

Figure 1. Planning process schematic.

The plan, in keeping with legislation, identifies river segments with outstanding fish and wildlife, recreational, aesthetic or geologic value, and then evaluates the environmental and social impacts of their designation as state protected rivers. If the Board determines that the values of preserving the waterway in its existing state outweigh the values of continued development, it can, subject to legislative approval, prohibit a number of activities from occurring within the stream channel in an effort to protect existing values and uses.

Screening evaluates 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. River segments with at least one "Outstanding" evaluation for fish, wildlife, recreation, geologic or scenic values are judged eligible for consideration as possible state protected rivers. Specific criteria for resource evaluation are described in Section III, pp. 7-22, and Appendix C: Screening for Outstanding Values.

River segments with outstanding resource values, identified during screening, are assessed for State protection with a spectrum of alternatives that encompass development, improvement, and conservation of resources. A comparison is made of the effects that the possible policy scenarios, such as a protection designation or a recommendation for development, might have on identified resources and resource uses. This involves an evaluation of the existing and potential water constraints and the 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.

Information, figures, and statistics for this plan were obtained through literature review, field reconnaissance, contact with management agency personnel, and public scoping and review. 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 local Advisory Group, agencies, and interested public.

Public Involvement

Public involvement is an important part of the planning process, and is necessary in assessing viewpoints and conditions in the planning area. The opportunity for public discussion and input was provided at the local, state, and federal levels as plan formulation moved through various phases. Rules and regulations of the Water Resource Board require formation of a local advisory group to "inform the Board of local concerns" (Rule 5,1,2). A Middle Snake Advisory Group was formed in

January 1992. The Advisory Group met five times to identify local issues of concern, provide information to planning staff, and review evaluations and alternative plan proposals. The advisory group represents many of the local governments, water-user organizations, and other interested parties. A listing of Advisory Group members and a summary of public and Advisory Group meetings is furnished in Appendix A.

In addition to input from the local Advisory Group, public scoping meetings were held March 10, 1992 in Hagerman and March 12, 1992 in Twin Falls, to listen to general public comment regarding basin issues. A questionnaire concerning current use, potential water development, and conservation was given to those who attended the meetings, and mailed to interested individuals upon request. Concerns and ideas expressed by the public at the scoping meetings were:

(a) Water quality monitoring and remediation
(b) Need to protect free-flowing reaches
(c) Coordination with other agencies and local plans
(d) Consider "demand" rather than "supply" management for energy and water resources
(e) The economic implications of remediation measures
(f) The effect of water allocation in the Upper Snake on Mid-Snake flows
(g) Need to monitor/measure water diversions
(h) Concern for recreational opportunities, aesthetic features, and public access
(i) Need to increase flow in the Middle Snake reach
(j) Need to provide allowances for hydropower development

The Draft Plan for the Middle Snake reach was released to the public January 6, 1993. Public information meetings and formal public hearings were held in Hagerman and Twin Falls in January and February, 1993 to discuss and receive comment on the Draft Plan. One-hundred and twenty people attended the formal hearings, 40 people testified regarding the plan, and 88 written comments were received by the Board prior to close of the 62 day comment period on March 8, 1993.

After consideration of this record, the Board reviewed the present and proposed uses of the river segments relative to protective actions, and determined protected status for each of the designated river segments and what activities to prohibit. Following adoption by the Board, the Plan will be presented to the Idaho Legislature for its consideration as required by Section Idaho Code 42-1734B. The Middle Snake plan is a component of the comprehensive State Water Plan of the Idaho Water Resource Board.

Amendments

Because public concerns, values, and demands change over time, the Board must be flexible and responsive to changing circumstances. Therefore, the Comprehensive State Water Plan must be reevaluated over time, and adjusted as needed.

The Board will amend the Comprehensive State Water Plan when it determines that revisions are in the public interest. The Board will consider proposals for amendment to the 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 follow the public hearing process and procedures required for the adoption of the original plan (Idaho Code Sections 42-1734A and B). 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 action or recommendation. In addition, the Board shall review and reevaluate the Comprehensive State Water Plan at least every five years (42-1734B(7). All amendments to the state water plan shall be submitted for review and possible amendment by the Idaho Legislature as required by law (42-1734B).

III. SCREENING FOR OUTSTANDING VALUES

Fish, wildlife, recreation, scenic and geological resources, pursuant to Idaho Code 42-1731(7) and (9), were identified and evaluated for the Middle Snake reach. This evaluation or "screening" 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. River segments with at least one "Outstanding" evaluation for fish, wildlife, recreation, geologic or scenic values were judged eligible for consideration as possible state protected rivers. Resource attribute categories are based on the following general criteria:

Value of the Resource: The uniqueness, rarity or significance from a national, regional and/or local perspective, including the level of public concern.

Regulation or Agency Policy: The degree of protection accorded the resource through statute, regulation, rules, or agency management policy.

Detailed inventories are provided in Appendix C: Screening for Outstanding Values.

Scenic Values

The objective of the scenic evaluation was to determine the distinctiveness or scenic quality of landscape settings. The evaluation was conducted from November 1991 to September 1992. Data collection for the scenic value study involved review of visual resource inventory information available from other agencies, and photographic documentation of visual landscapes in the Middle Snake reach.

The planning area was previously inventoried for visual resource values by three Bureau of Land Management (BLM) Districts (Boise, Burley and Shoshone) as part of their resource management plans. 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), originally published in 1980 with revisions in 1984 and 1986 (U.S. BLM, 1986). Review of the visual inventory data available from the three BLM districts located in the planning area revealed differences in inventory dates, quantity of available data, and study scales. All districts had VRM class data mapped, but scenic quality classes were only available from one district. Given the varying inventory periods and differences in types of available data, it was determined that IDWR needed to conduct an independent evaluation.

IDWR conducted a scenic distinction evaluation to derive current data at a scale consistent with the planning area. The scenic distinction evaluation involved two steps: (1) defining visual unit boundaries, and (2) evaluating the scenic distinction or scenic quality of each visual unit. Visual unit boundaries were determined through extensive field reconnaissance and photographic documentation. Boundaries were mapped on U.S. Geological Survey 7.5 minute quadrangles and then field checked to verify accuracy. Forms were completed in the field and through review of photographic documentation recording landform, vegetation, water character, cultural modifications and other visual characteristics for each unit.

Scenic distinction ratings were determined using the BLM's scenic quality model described in the agency's VRM manual for each of the 28 visual units identified in the Middle Snake reach. The numerical ranking system for determining scenic distinction has a maximum of 32 points. Those landscapes with "Outstanding" or distinctive scenic values received scores of 32 to 19. Landscapes considered above average, but not outstanding, received scores of 18 to 12 and were rated "High" for scenic distinction. Landscapes with little visual variety received a score of 11 or less and were rated "Moderate to Low" for scenic distinction. Visual sensitivity levels and distance zones were not evaluated or delineated in this study.

Scenic Values Evaluation for Middle Snake Reach

SCENIC DISTINCTION CATEGORY	CRITERIA	MIDDLE SNAKE REACH
Outstanding	Landscapes with significant variety in landscape features; and/or possessing distinctive or unique features (received a score of 32 to 19) Landscapes with vertical or steep canyon walls, strong enclosure and immense scale; variety in water forms characterized by whitewater, falls, and numerous springs; variety in vegetation pattern, texture and color with contrasts introduced by wetlands, riparian and spring-associated vegetation; cultural modifications add visual variety and are generally harmonious to the visual unit as a whole	*Milner Bridge to Bickel Springs (near Gridley-Hwy 30 Bridge)* *Bliss Dam to Little Pilgrim Gulch* *Bancroft Springs area*
High	Landscapes which provide above average variety in landscape features (received a score of 12 to 18) Areas where canyon is defined by dissected hills or canyon walls which are less vertical, enclosure and scale are not as distinct; whitewater is lacking or minimal; some variety in vegetation patterns and types; cultural modifications add little or no visual variety to landscape	*Bickel Springs (near Gridley-Hwy 30 Bridge) to backwaters of Bliss Reservoir* *Little Pilgrim Gulch to Bancroft Springs* *I-84 Bridge to Clover Creek*
Moderate to Low	Landscapes where characteristic features possess little variety (received a score of 11 or less) Areas where canyon walls are characterized by moderate to low hills; minimal variety in vegetation, usually one type	*Backwaters of Bliss Reservoir to Bliss Dam (Bliss Reservoir)* *I-84 Bridge vicinity* *Milner Dam to Milner Bridge*

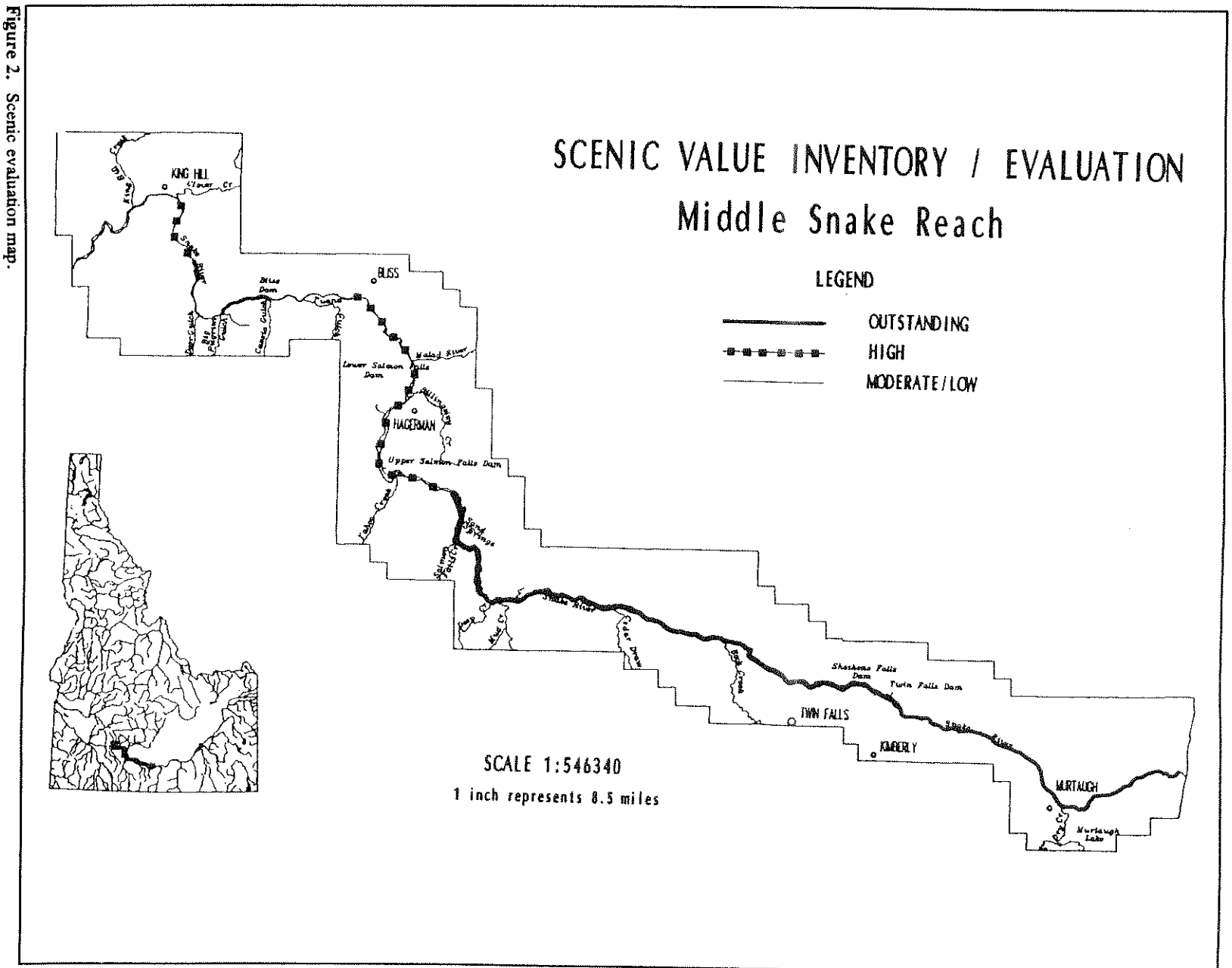

Figure 2. Scenic evaluation map.

Geologic Features

The geologic features evaluation considered the uniqueness or significance of geologic features from a national or regional perspective, and the degree of protection accorded the resource through statute, regulation, or agency management policy. Geologic data came from the National Park Services National Natural Landmark studies, the Bureau of Land Management, and unpublished and published sources. An inventory of the Middle Snake reach identified landforms, water features (i.e., waterfalls, springs), cultural modifications to the site or along the segment, and distinctive features of the site or segment.

A numeric measure is used to evaluate the degree of geologic distinction of a feature under four factors: scarcity, quality, scientific value, and cultural modifications. The size and degree of disturbance related to historic land-use practices of the specific site were considered in the ranking.

Scarcity refers to the distribution of the feature both within the state and worldwide. Quality refers to the relative physical condition of the geological feature in comparison to other known occurrences of the same feature. A site which is among the best known examples of its kind received a higher evaluation mark than a marginal or low quality occurrence. The scientific value of a feature or a given site refers to its usefulness and importance as an educational resource. The historical, current use, potential use, and accessibility of the given feature or site was considered under the cultural modifications category.

Each factor was rated using a value of 0-5, with the exception of cultural modifications, which is rated from -2 to 2. The ranking system has a maximum of 15 points. Those segments with Outstanding or distinctive geologic features received scores of 11 to 15. Segments considered above average, but not outstanding, received scores of 6 to 10 and were rated High for geologic distinction. Segments with little distinction received a score of 5 or less and were rated Moderate to Low for geologic features.

Geologic Features Evaluation for Middle Snake Reach

CATEGORY	CRITERIA	MIDDLE SNAKE REACH
Outstanding	Segments possessing distinctive or unique geologic features defined by scarcity, quality or scientific value (score of 11 to 15); limited in occurrences nationally or within the State; site is one of best known examples of geologic feature; size of features is distinctive; recognized as high quality study location; agency designation indicates national significance (National Monument, National Natural Landmarks)	*Twin Falls Reservoir to Blue Lakes Golf Course* - distinctive scabland topography remnant of Bonneville Flood has well-defined dry falls and displays flood scouring of canyon floor and sides; largest water falls in the state (height and width); site under consideration as a National Natural Landmark *Crystal Springs to Thousand Springs* - discharge volume of Snake River Plain Aquifer from the canyon walls is unique on a global scale; 10 of 65 largest springs in the U.S. (discharge > 100 cfs) are along this segment; Box Canyon is 11th largest spring in the U.S.; Niagara Springs is National Natural Landmark; Box Canyon is under consideration as a National Natural Landmark *Upper Salmon Falls to Malad River* - Hagerman Fossil Beds is a National Monument; average discharge of Malad spring complex is > 1,000 cfs; Malad Canyon displays distinctive features of the Bonneville Flood; Malad Canyon is under consideration as a National Natural Landmark
High	Segments with above average geologic features (score of 6-10); limited in occurrences regionally; distinctive, though somewhat similar to other comparable geologic features within the State; accessibility or land ownership may limit study of feature	*Bliss Dam to Clover Creek* - sand dunes; melon gravel of large diameter deposited by Bonneville Flood in significant quantity *Milner Dam to Dry Creek* - scabland topography along the top of the canyon remnant of Bonneville Flood; falls at Caldron Linn are the only undeveloped falls of the Middle Snake reach.
Moderate to Low	Segments with little distinction (score of 0-5); fairly common regionally; site does not clearly display feature; not recognized in literature or locally as a study location	*Dry Creek to Twin Falls Reservoir* *Blue Lakes to Crystal Springs* *Thousand Springs to Upper Salmon Falls* *Malad River to Bliss Dam*

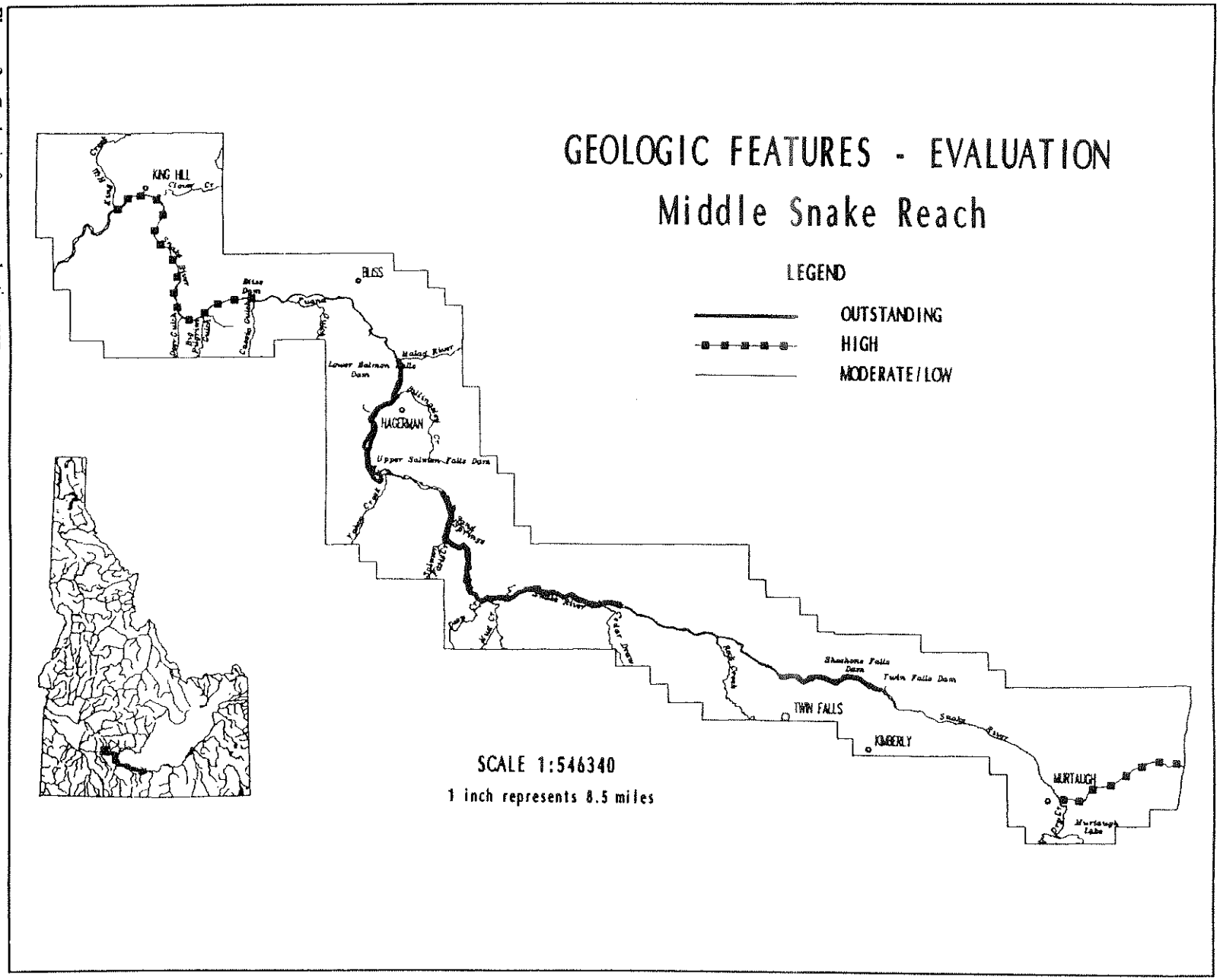

Figure 3. Geologic features evaluation map.

Recreation

The recreation evaluation focused on recreational opportunities occurring within specific river reaches. The evaluation entailed identification of recreation units; analysis of the recreational diversity and importance of each unit; and categorization of a final evaluation value (Outstanding, High, or Moderate to Low) based on diversity and uniqueness of the recreational experiences available on the river segment.

The Middle Snake reach was grouped into thirteen segments or discrete recreation units delineated on the basis of landform, hydrology, land use patterns, visual character, and 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 assessment forms filed with the Department of Water Resources.

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: (1) identification of land-based and (2) water-based recreation opportunities, (3) natural features and (4) level of access. Land-based activities include camping, hiking, or hunting. Water-based recreation includes fishing, swimming, and boating.

Four criteria were assessed to determine recreational importance: (1) unique or rare features which enhance the recreation experience, (i.e., unusual landforms, hot springs, water falls or rapids), or highly-valued fisheries; (2) public concern for the recreational values of the unit (determined from public and advisory committee input, and agency consultation); (3) use based on recreational survey data; and (4) special designations and/or management objectives.

Land-based and water-based recreation activities occurring within the river corridor were identified through review of agency documents and maps describing recreation facilities; communications with various agencies and user groups; and review of several recreational surveys conducted by the IDPR, IDFG, Idaho Power Company and Myers Engineering Company, for various segments within the reach over the last fifteen years.

Natural features were identified which enhance recreation opportunities or experiences. Evaluation included a description of water characteristics influencing boating activity; a summary of the aesthetic values of the unit; identification of 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 volume, and opportunities for primitive or isolated recreation experiences versus a 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.

The final recreation evaluation class for each recreation unit was based on an assessment of the diversity and importance values described above. A recreation unit evaluated as Outstanding a) provides significant recreation opportunities encompassing a great diversity of activities; or b) provides a unique or rare experience within the region or planning area; or c) receives the highest use; 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; or b) potentially providing an important recreation experience which is not rare but lacking in the region. Moderate to Low designations define those river segments with recreational opportunities typical in the region and receiving moderate to low use, and/or having low recreation diversity.

Recreation Evaluation Criteria and Results for the Middle Snake Reach

EVALUATION CLASS	CRITERIA	RECREATION UNITS
Outstanding	Significant recreational opportunities available as indicated by a great diversity of activities; a unique or rare experience; highest use areas; or agency designation indicating the national or regional significance of recreational opportunities	***Milner Bridge to Main Milner Powerhouse*** - unique expert whitewater boating run (Class V) at high flows ***Star Falls to Twin Falls Reservoir*** - Star Falls one of the last undeveloped waterfalls in the reach, unique expert whitewater boating run comparable to the Grand Canyon (Class IV-IV+) ***Twin Falls Reservoir to Shoshone Falls Dam*** - recreational use of reservoirs and parks is very high ***Crystal Springs to Thousand Springs (north end of Ritter Island)*** - significant diversity combined with unique recreational opportunities ***Thousand Springs to Lower Salmon Falls Dam*** - Hagerman National Monument and high diversity of recreational opportunities ***Lower Salmon Falls Dam to Bliss Bridge*** - unique year round whitewater boating opportunity receiving significant use ***Bliss Dam to Clover Creek*** - unique and highly-valued sturgeon fishing opportunities
High	River segments with a high use volume; and/or a recreation opportunity which is not rare but not typical in the region	***Main Milner Powerhouse to Star Falls*** - potential intermediate whitewater boating run offering easy access in an isolated setting ***Pillar Falls to Centennial Park*** - high use volume
Moderate and Low	River segments with moderate to low use volume; low diversity of opportunities; and/or providing recreational opportunities typical and abundant within the region	***Milner Dam to Milner Bridge*** - low use and diversity ***Shoshone Falls Dam to Pillar Falls*** - low use and recreation diversity ***Centennial Park to Rock Creek*** - moderate recreation diversity ***Rock Creek to Crystal Springs*** - low use and recreational diversity ***Bliss Bridge to Bliss Dam*** - low use and recreational diversity

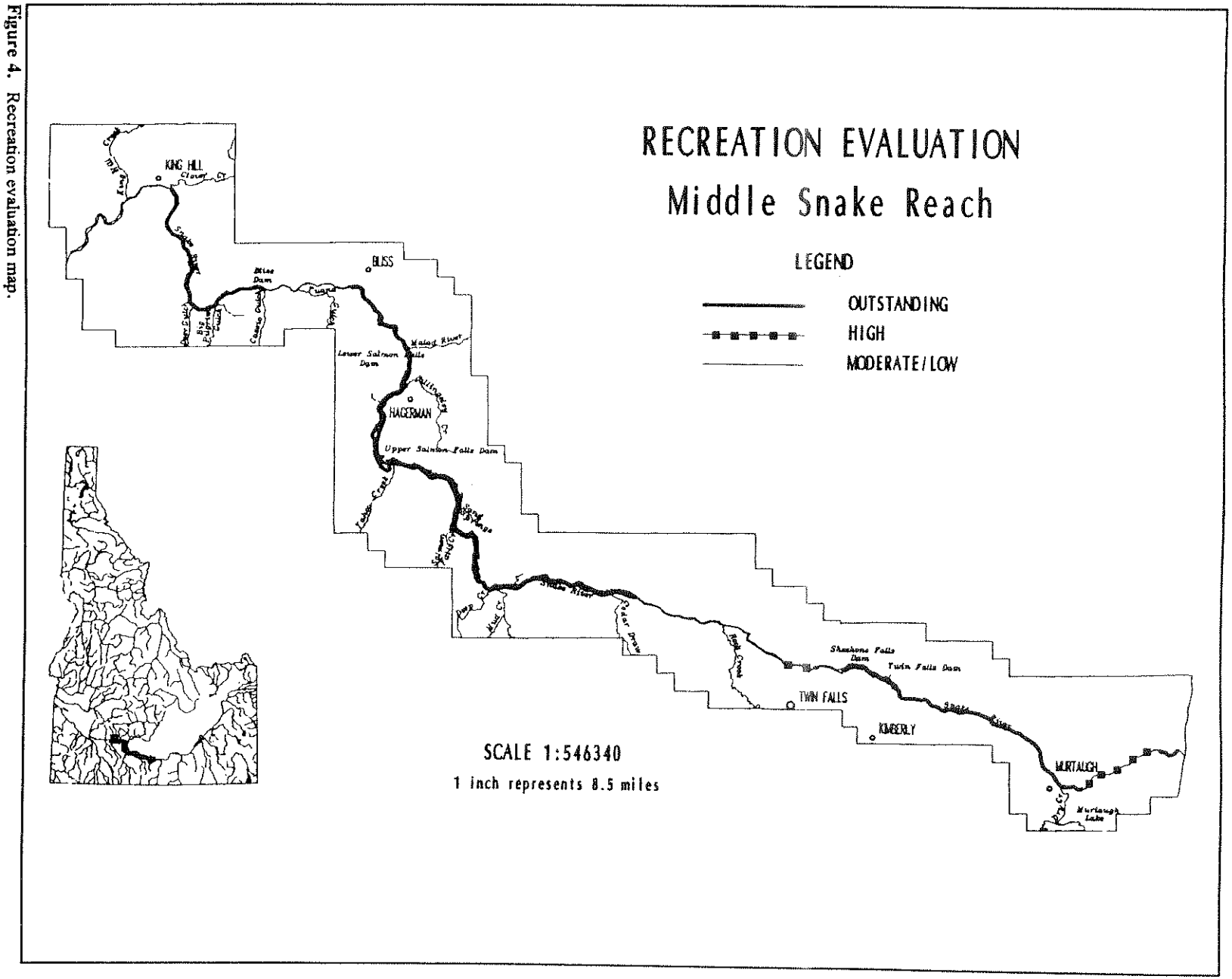

Figure 4. Recreation evaluation map.

Fish & Wildlife

The fish and wildlife evaluation involved two steps: (1) delineation of biological ecosystems, and (2) evaluating the distinction of each unit. Segment boundaries define an area with similar characteristics, and for the most part are distinguished by whether they are a reservoir (lacustrine) or a free-flowing segment (riverine).

Physical and biological variables were identified to evaluate each segment as an ecosystem. The physical variables considered for each segment were:

1. Water Quantity
2. Water Quality
3. Springs or perennial tributaries with high spawning potential
4. Fish habitat
    (a) in a lacustrine environment--depth, shoreline, rocky substrate, and vegetation are evaluated
    (b) in a riverine environment--pool:riffle ratio, and cover are evaluated
    (c) water quantity
    (d) water quality

    If all other physical parameters for fish habitat are good, but current water quantity/quality problems limit populations and species, habitat was rated Intermediate.
5. Wildlife habitat; heterogeneity would provide more niche opportunities and therefore greater or potentially greater species diversity (riparian woodland, springs, cliffs, etc.).

The biological variables taken into consideration were:

1. Sensitive species presence - aquatic (sturgeon, sculpin, snails)
2. Sensitive species presence - terrestrial (raptors, bats, plants, etc.)
3. Spawning
4. Special management areas (WMA, ACEC, wetlands)
5. High species diversity represented by several trophic levels.

In order for a segment to be considered Outstanding, four of the five physical criteria must be met, and four of the five biological criteria must be met. The justification for this assumes that in order for an ecosystem to warrant an Outstanding evaluation, it must be relatively whole and relatively healthy, and consequently, meet the majority of the criteria.

Physical Habitat					
Segment Name	1) Water quantity currently sufficient	2) Water quality currently good	3) Perennial tributaries or springs	4) Fish habitat: good*	5) Wildlife habitat: good**
Milner	No	Yes	No	No	No
Murtaugh	No	Yes	Yes	Yes	Yes
Twin Falls Res.	Yes	Yes	Yes	Yes	No
Devil's Corral	Yes	Yes	Yes	Yes	No
Shoshone Falls Res.	Yes	Yes	No	No	No
Auger Falls	No	No	Yes	Yes	No
Kanaka Rapids	No	No	Yes	No	Yes
Thousand Springs	Yes	No	Yes	Yes	Yes
Dolman Rapids	No	Yes	No	Yes	No
Lower Salmon Falls Res.	Yes	Yes	Yes	No	No
Hagerman	Yes	Yes	Yes	Yes	Yes
Bliss Res.	Yes	Yes	No	No	No
King Hill	Yes	Yes	Yes	Yes	Yes

***Lacustrine fish habitat**: 1) Good--if it currently possesses following characteristics: good depth column, heterogeneous shoreline, rocky substrate, and vegetation cover.
***Riverine fish habitat**: Good--if it currently possesses following characteristics: good pool:riffle ratio, cover, etc.
****Wildlife Habitat**: 1) Good terrestrial habitat is of high quality and provides numerous wildlife niches.

Species					
Segment Name	1) Sensitive aquatic species present (sturgeon, sculpin, snails)	2) Important spawning occurs	3) Sensitive terrestrial species present (raptors, bats, plants, etc.)	4) Special management areas: WMA, ACEC, isolated wildlife tracts (IWT), Idaho Priority Wetlands (IPW)	5) Unique species richness (high diversity, several trophic levels represented)
Milner	Unknown	No	Yes-plants	IWT, IPW	Yes
Murtaugh	Unknown	No	Yes-plants	IWT	No
Twin Falls Reservoir	No	Yes-salmonids	Yes-plants	IWT, ACEC, IPW	No
Devil's Corral	No	Yes-salmonids	Yes-plants	IPW	No
Shoshone Falls Res.	No	No	No	None	No
Auger Falls	Yes-sturgeon	No	Yes-plants	IPW	Yes
Kanaka Rapids	Yes-sturgeon, sculpin, snails	No	Yes-plants, blue grosbeak	IWT, WMA	Yes
Thousand Springs	Yes-sturgeon, sculpin, snails	Yes-salmonids	Yes-plants	WMA, IPW, ACEC	Yes
Dolman Rapids	No	No	No	None	Yes
Lower S.F. Reservoir	No	No	No	WMA	No
Hagerman	Yes-sturgeon, sculpin, snails	Yes-sturgeon, salmonids	Yes-plants, bats, long-billed curlew	IPW	Yes
Bliss Reservoir	No	No	Yes-plants	None	Yes
King Hill	Yes-sturgeon, snails	Yes-sturgeon	Yes-plants	None	Yes

Fish and Wildlife, Biological Communities Evaluation for the Middle Snake Reach

EVALUATION CLASS	CRITERIA	SEGMENTS
Outstanding	Four out of five physical parameters must be met and four of the five biological parameters must be met: **Physical Parameters** 1) Water quantity good **OR** reversible 2) Water quality good **OR** reversible 3) Perennial tributaries **OR** springs present 4) Fish habitat good 5) Wildlife habitat good **Biological Parameters** 1) Sensitive aquatic species present (sturgeon, sculpin, snails) 2) Important spawning occurs 3) Sensitive terrestrial species present (raptors, bats, plants, etc.) 4) Special management areas (WMA, ACEC, wetlands, etc.) 5) Unique species richness; several trophic levels represented	*Banbury Springs to Upper Salmon Falls Dam* - water quantity good; water quality reversible; perennial tributaries and springs; wildlife habitat has good heterogeneity; sturgeon and sculpin present; salmonid spawning; sensitive plants; isolated wildlife tracts; Idaho Priority Wetland; Wildlife Management Area, Area of Critical Environmental Concern (BLM) *Lower Salmon Falls Dam to Bliss Bridge* - water quantity good; water quality good; perennial tributaries and springs; fish habitat = Good; wildlife habitat has good heterogeneity; sturgeon, sculpin present; spawning for sturgeon and salmonids; sensitive plants; Idaho Priority Wetland; several tropic levels are represented *Bliss Dam to Clover Creek* - water quantity good; water quality good; perennial tributaries and springs; fish habitat = Good; wildlife habitat has good heterogeneity; sturgeon present; spawning for sturgeon; sensitive plants; several tropic levels are represented

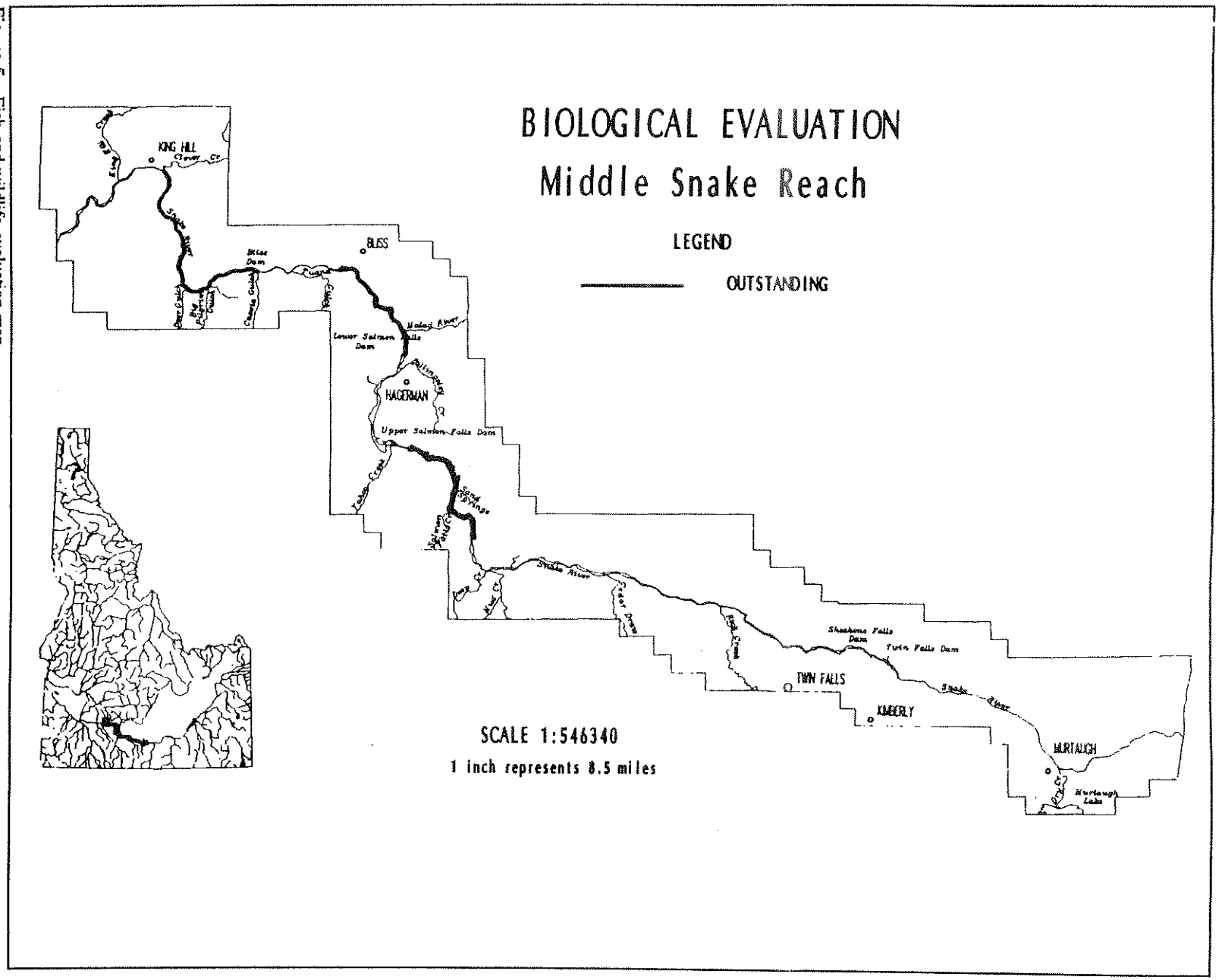

Figure 5. Fish and wildlife evaluation map.

All segments of the Middle Snake reach, with the exception of Bliss Reservoir, were found to possess at least one, and usually two or more, "Outstanding" classifications for either fish and wildlife, geologic features, scenic values, or recreation, as defined by criteria in Section III.

IV. WATER ISSUES AND CONSIDERATIONS

Water Allocation and Use

The Snake River Basin is divided administratively at Milner Dam. Senate Bill 1358 amended the Idaho Code (1986) to provide that no water above Milner Dam shall be considered in the determination and administration of rights downstream from Milner Dam.

SWAN FALLS AGREEMENT

The Swan Falls agreement, between the State of Idaho and the Idaho Power Company, establishes certain rights and policies concerning water use in the Snake River basin above the Swan Falls Dam near Murphy, Idaho (approximately 100 miles downriver from King Hill). The State agreed to assert that the Snake River is fully appropriated above Swan Falls Dam. Consequently, the Idaho Legislature determined that an adjudication of the entire Snake River basin was in the public interest, and should proceed subject to stated constraints regarding federal reserved right claims (Idaho Code 42-1406A).

The solicitation of water right claims began in February, 1988. The Idaho Department of Water Resources is presently ascertaining both surface and groundwater rights for the Snake River Basin. This process is expected to determine approximately 135,000 claims to water rights.

MORATORIUM ON SNAKE RIVER BASIN WATER RIGHTS

On May 15, 1992, the Director of the Department of Water Resources ordered a moratorium on the issuance of permits to divert and use water from the Snake River Basin upstream from the USGS gaging station near Weiser, Idaho for new consumptive uses. The order was established to protect existing water rights and established minimum stream flows. The moratorium applies to all applications proposing a consumptive use of water filed after the date of the order, except as defined below, and to all applications filed prior to the entry of the order for which approval had not been given. The moratorium is tied to the drought conditions existing when the order was issued, and it will last until the Director rules that the drought has ended.

The moratorium does not apply to (1) any application for domestic purposes as defined in Idaho Code 42-111; (2) any application proposing a nonconsumptive use of water; (3) applications seeking to appropriate ground water as a supplemental water supply conditioned to allow use only when the appurtenant surface sources are not available due to drought conditions; and (4) applications for drilling permits to replace or deepen existing wells having valid existing water rights.

CURRENT WATER USE

The natural flow of the Snake River above Swan Falls is fully appropriated during years of below normal run-off. Annual irrigation diversions from the Snake River in Milner Reservoir average 2,697,000 acre-feet under present conditions. Consumptive use is an estimated 30 percent of irrigation diversions, ground-water recharge is 60 percent, and return flow averages 10 percent. Table 1 estimates present water use, and Table 2 outlines water budgets for the Middle Snake reach calculated by the USGS in 1980.

Table 1. Estimated Annual Water Use in Gooding, Jerome, and Twin Falls Counties

	Gooding		Jerome		Twin Falls	
Aquaculture	1,370,000	AF	152,000	AF	131,000	AF
Hydropower Generation	14,596,000		538,000		7,673,000	
Industrial	1,790		100		10,900	
Irrigation†						
Ground Water Withdrawals	124,000		133,500		80,000	
Surface Water Withdrawals	450,000		1,200,000		1,150,000	
Nonindustrial Public-Supply Water	1400		2200		3800	
Rural Domestic and Livestock Water	1200		1400		1300	

†Irrigation withdrawals for Snake River Plain and canyon bottom lands within the planning area; does not include water use in the Salmon Falls or Wood River watersheds, or on lands in southern Twin Falls County or northern Gooding County outside the U.S.G.S. delineation of the Snake River Plain. Irrigation withdrawals from the Middle Snake reach for the King Hill Irrigation District in Elmore County total approximately 32,000 acre-feet.

Source: Goodell, 1988

Table 2. Water Budgets for Middle Snake Reach, 1980

	Inflow (Thousands of acre-feet)			Outflow (Thousands of acre-feet)			Residual
Reach	Snake River	Tributaries and drainages	Total	Snake River	Diversions	Total	Gain from ground water
Milner to Kimberly	1,290	10	1,300	1,510	--	1,510	210
Kimberly to Buhl	1,510	320	1,830	2,710	--	2,710	880
Buhl to Hagerman	2,710	270	2,980	5,590	40	5,630	2,650
Hagerman to King Hill	5,590	220	5,810	6,780	50	6,830	1,020

Source: Kjelstrom, 1992.

An inventory and description of resources, resource development, and the current use or status of resource use in the Middle Snake region is provided in Appendix B: Area Overview and Resource Summary.

MINIMUM STREAM FLOWS

The State may appropriate previously unappropriated water for instream use. Minimum stream flow water rights are enforced by not allowing appropriations of a later priority date if the diversion would result in a flow decrease below the minimum flow (Idaho Code 42-1505).

A minimum flow of zero is specified for the Snake River at Milner Dam in the State Water Plan. This is recognition that flow has sometimes been reduced to zero at the dam. In licensing the Milner hydropower project, the Federal Energy Regulatory Commission (FERC) has specified "target flows" for the Snake River at Milner Dam (200 cfs). The target flow must be satisfied only when water in excess of irrigation needs is available (FERC, 1990). Target flow water may be acquired from Idaho Power Company storage in American Falls Reservoir, or may be leased from the Upper Snake Rental Pool. FERC estimates that water will be available in sufficient quantities to meet the Milner target flow in most years. Other minimum flows on the Snake River are 3900 cfs (April 1 to October 31) and 5600 cfs (November 1 to March 31) at Murphy, Idaho, and 4750 cfs at Weiser.

The Idaho Water Resource Board has applied for minimum stream flow water rights on thirteen springs or spring creeks and on the Malad River, all of which are tributary to the Middle Snake reach (Table 3). Nine of the spring filings have been permitted while the others are still in the application stage.

SPRINGS

Springs tributary to the Middle Snake reach have been utilized since pre-historic times. Today, the springs are used as a source of water for irrigation of bottom lands along the river; as a consistent supply of high-elevation water to drive hydroelectric plants; as a relatively stable source of well aerated, constant temperature water needed to maintain fish hatcheries and trout farms. In recent years, the picturesque springs have drawn an increasing number of tourists who enjoy the many recreational aspects of the area.

Because of the importance of the springs to the local economy, declines in the quality or quantity of flow are a cause for concern. Previous investigations have established a correlation between changes in the ground-water regime of the Snake River Plain Aquifer and a change in spring discharge. Users of spring flow are concerned that recent changes in irrigation practices upstream

from the springs and increased withdrawals of ground water from the Snake River Plain Aquifer are affecting spring discharge.

Table 3. Middle Snake Reach Spring Development

		Minimum Stream Flow Water Right
Vineyard Creek	Undeveloped	17 cfs
Devil's Corral Springs	Undeveloped: 48 cfs pending for fish farming and hydropower	48 cfs
Blue Lakes Springs (Alpheus Creek)	The springs and upper reaches of the outflow streams are undeveloped and flow through the Blue Lakes Country Club. In its lower reaches water is heavily diverted for fish farming and municipal use. Pending applications propose further development for fish farming, hydropower, and aesthetic uses.	
Crystal Springs	Developed for fish farming and irrigation. This complex of springs supplies water to a large federal steelhead hatchery and a private fish farm. There are existing permits and pending applications for development for fish farming and hydropower.	126 cfs
Niagara Springs	Developed for fish farming and irrigation. Other pending applications propose development for fish farming and hydropower.	45-264 cfs - pending
Clear Lakes Springs	Developed for fish farming, fish processing, irrigation, and hydropower. Pending applications and undeveloped permits propose further development for fish farming, hydropower, irrigation, and aesthetics.	
Briggs Springs	Developed for irrigation, fish farming, and hydropower. Pending applications propose further development for fish farming.	56 cfs - pending
Banbury Springs	A large spring complex which is only partly diverted. Existing diversions are for irrigation, domestic use, recreation (a commercial swimming pool resort), and a small private hydro plant. Other pending applications propose development of existing diversions and flows not now diverted for fish farming and hydropower.	97 cfs - pending
Blind Canyon	Developed for fish farming.	8 cfs
Box Canyon Springs	Developed for fish farming and hydropower. There is an existing permit for further fish farming development.	75-162 cfs 850 & 550 cfs - pending
Blue Heart Springs	Undeveloped This large spring emerges in the bed of the Snake River below the water level, and is a popular scuba diving area.	66.57 cfs
Sand Springs	Developed for hydropower.	34 cfs
Minnie Miller Springs	Developed for irrigation, stock, domestic, and commercial uses.	200-450 cfs
Magic or Bickel Springs	Developed for fish farming, irrigation, and a small private hydro plant. Pending applications propose expansion of the existing fish farm and commercial hydro development.	
Billingsley &	Extensively developed for irrigation, fish, stock,	

		Minimum Stream Flow Water Right
Riley Creek systems	domestic, hydropower, & municipal uses.	
White Springs	Developed for fish farming.	11 cfs - pending
Birch Creek	Developed for irrigation under decreed rights, & irrigation, fish, & power under permits and licensed rights.	
Lower Malad River	Developed primarily for hydropower. Undiverted water is subject to a number of MSF rights covering various reaches.	
Springs in the Malad River to Bliss reach	Numerous springs in this reach are developed for irrigation, fish farming, hydropower, and other uses.	
Bancroft Springs	Undeveloped.	17 cfs

River Regulation

River regulation is a function of the operations of the Bureau of Reclamation, Water District 01, and the Idaho Power Company. Operations above Milner Dam control flows to meet storage, power, and irrigation diversion rights upstream. The storage and diversion system of the Upper Snake basin fully regulates the river in the driest one-fifth of all years. During very dry years little flow passes Milner in the early irrigation season. However, in recent years Idaho Power Company has used its American Falls storage (approximately 45,000 acre-feet), plus water obtained from the rental pool to raise flows to the range of 600 to 1000 cfs in late June or early July. Flows of this magnitude have then been maintained as long as available storage permitted or until diversions end in the fall. When the Milner power plants begin operation in late 1992, Milner Reservoir will be kept full and a target flow of 200 cfs will be released, if available.

BUREAU OF RECLAMATION

Flows of the Snake River above Milner are determined primarily by Bureau of Reclamation reservoir operations. The Bureau manages in a system operation approximately 4 million acre-feet of water storage capacity in the Upper Snake Basin in Idaho and Wyoming. Existing federal reservoirs include American Falls, Grassy Lake, Island Park, Jackson Lake, Lake Walcott, Palisades, and Ririe (Table 4).

The reservoirs store streamflow during the winter and spring months, then release storage to augment natural flows during the summer irrigation season. There are variations from the pattern at some reservoirs when flood control operations delay reservoir filling. Streamflow forecasts are used to maximize summer yields for irrigation and operate reservoirs during the peak runoff period in such a manner that the storage space used to control flood discharges will be full when flood threats have passed.

Power facilities have been installed at three of the mainstem Reclamation reservoirs. As seasonal operation of these reservoirs is normally dependent on irrigation and flood control functions, the monthly flow fluctuations are not significantly affected by power operations.

Table 4. Bureau of Reclamation Reservoirs Above Milner.

	Total Storage (AF)	Purpose
American Falls	1,672,000	Irrigation/Power
Grassy Lake	15,450	Irrigation
Island Park	135,200	Irrigation
Jackson Lake	847,000	Flood Control/Irrigation
Lake Walcott	210,000	Irrigation/Power
Palisades	1,402,000	Fish and Wildlife/Flood Control/Irrigation/Municipal/Power/Recreation
Ririe	100,000	Fish and Wildlife/Flood Control/Irrigation/Recreation

WATER DISTRICT 01

Delivery of water is the responsibility of district watermasters under the supervision of the Idaho Department of Water Resources. The watermaster for Water District 01 administers water rights above Milner Dam. The existing network of irrigation organizations in the Upper Snake Basin is extensive. Over 300 associations divert flows from the Snake River above Milner Dam.

Rental Pool

The Idaho Legislature provided the Idaho Water Resource Board (IWRB) with the authority to operate water banks in 1979. Water Bank rules and regulations were adopted by the IWRB 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 appointed the Committee of Nine as the local entity to operate the water bank for District 01. The Committee of Nine is an advisory committee representing major irrigation entities in District 01.

The Upper Snake Rental Pool is the largest and most active water bank in Idaho. Since 1979, an average of 350,000 acre-feet of space has been leased (consigned) to the rental pool, and an average of 178,000 acre-feet has gone unused (Table 5). Of the total 1,584,328 acre-feet consigned

to the rental pool since the drought began in 1987, 46 percent has not been rented. However, in 1992, the sixth year of a continuous drought, only 9,953 acre-feet was leased to the Upper Snake Rental Pool, while requests for irrigation water far outstripped supply.

Table 5. Water District 01 Water Bank Activity

	Total Consignments	Total Amt. Used	Total Used by IPC	Total Used by Irrigators	Total Unused
1979	88,870	73,960	50,000	23,960	14,910
1980	72,190	14,575	0	14,575	57,615
1981	170,107	149,039	125,000	24,039	21,068
1982	290,426	203,515	200,000	3,515	86,911
1983	540,606	353,084	350,000	3,084	187,522
1984	806,400	277,433	275,000	2,433	528,967
1985	497,302	362,169	350,000	12,169	135,133
1986	895,642	159,735	150,000	9,735	735,907
1987	365,006	192,506	150,000	42,506	172,500
1988	236,050	186,181	50,000	136,181	49,869
1989	450,319	115,736	150,000	15,736	334,583
1990	295,000	168,800	63,000	105,800	126,200
1991	228,000	181,000	99,000	82,000	47,000
1992	9,953	9,921	0	9,921	32
Avg.	353,276	174,832	143,714	34,690	178,444

The primary purpose of the Upper Snake Rental Pool is to meet the requirements of irrigation water users within Water District 01, and priority in renting water is given to irrigators above Milner. However, the largest purchaser of District 01 rental pool water has been Idaho Power.

Shoshone-Bannock Tribal Water Bank

The Fort Hall Indian Water Rights Agreement of 1991 provides for a Shoshone-Bannock Tribal Water Bank. The Bank will be operated by a Tribal Rental Pool Committee and will contain up to 83,900 acre-feet of space in Palisades Reservoir and up to 46,931 acre-feet in American Falls Reservoir. Water that accrues to Tribal storage space in Palisades may not be released for use past Milner. The Tribal water stored in American Falls Reservoir may be used for minimum streamflows below Milner Dam without refill penalties being incurred by the Tribe. Water users within the Fort Hall Indian Irrigation Project have a right of first refusal to rent any storage water available from the rental pool.

IDAHO POWER

Water rights issued by the State, license articles issued by the Federal Energy Regulatory Commission (FERC), and customer loads govern flow releases at Idaho Power projects in the Middle Snake reach. The Middle Snake hydroelectric facilities are primarily run-of-river projects, depending

mainly on natural streamflows for power generation. However, during low flow periods, storage permits a limited amount of block loading, resulting in some hourly flow fluctuations. Operating rules on the Middle Snake facilities vary by project. Facilities at Lower Salmon Falls and Bliss have storage which permits additional daily and weekly flexibility in power operations. The limited storage precludes any significant effect on seasonal flow variations within the reach, but water rentals from the District 01 rental pool may have a significant impact on flow patterns.

Power use or customer demand varies through a 24-hour cycle. Daily peaks occur in the morning and early evening. Lower Salmon Falls Dam is operated on a 24 hour cycle whereby the reservoir is drafted an average of 1.5 feet between the hours of 7:00 am and 10:00 pm, and refilled during the remaining hours with no net storage or depletion from one 24-hour period to the next. Plant flow is adjusted to maintain the reservoir cycle. Bliss Dam and Lower Salmon Falls Dam follow system load swings, however, most of Idaho Power's peaking operations are confined to the Hells Canyon complex (Fig. 6). Flow fluctuations at either Lower Salmon Falls or Bliss average 3,000 cfs over a 24-hour period (Fuhrman, 1992).

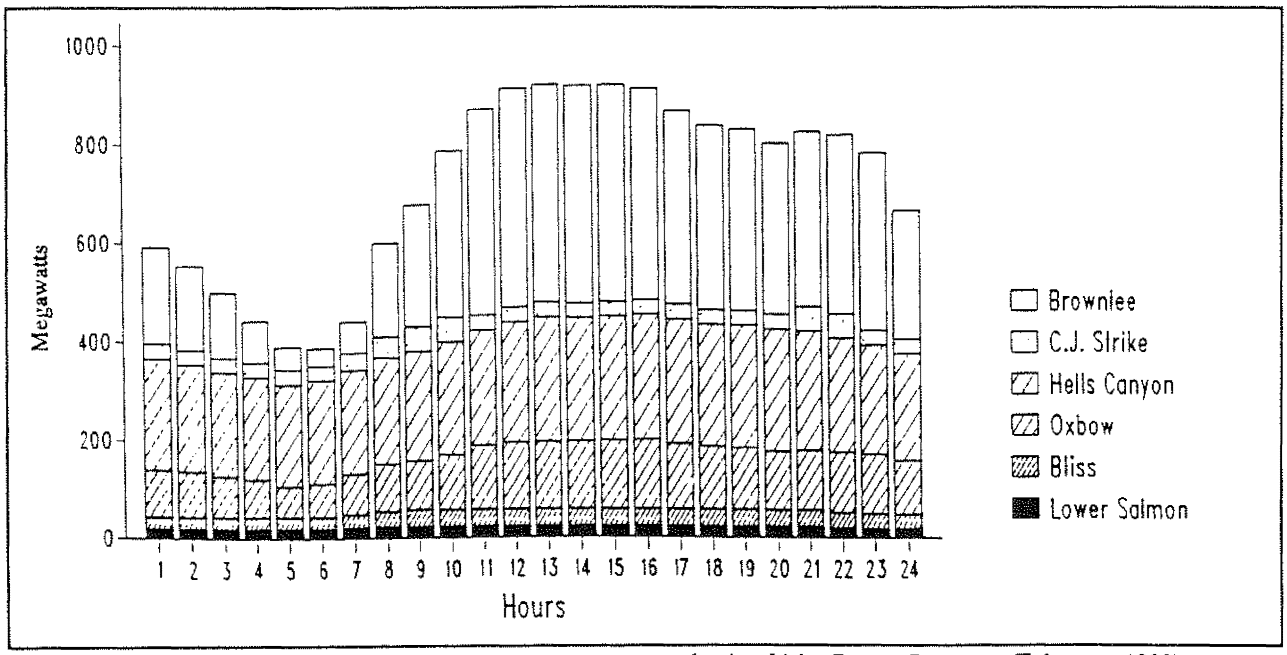

Figure 6. Average summer-day hydropower resource response to loads - Idaho Power Company (Fuhrman, 1992).

SALMON FLOWS

The timing of water flow through the Middle Snake reach could be modified significantly as a result of actions taken pursuant to the federal Endangered Species Act. The National Marine Fisheries Service listed Idaho's sockeye salmon as "endangered" under the federal Endangered Species Act in 1990. Three runs of wild chinook salmon were added to the list as "threatened" in 1992. In 1990 adult chinook salmon numbers were 75 percent below runs of the 1960s and only four adult sockeye returned to the state in 1991.

The National Marine Fisheries Service is required to develop a salmon recovery plan. The Northwest Power Planning Council at the request of the northwest governors, the congressional delegation, and the National Marine Fisheries Service, developed a comprehensive salmon plan. Council recommendations include:

1. Increased flows in the Snake River during the spring out-migration by drawdowns of lower Snake River reservoirs to near minimum operating level and providing additional water out of Dworshak Dam.
2. Operation of Brownlee reservoir by Idaho Power Company so upper Snake River Basin water is passed to assist spring migrants.
3. Study of the potential for new storage in the Snake River Basin to provide additional water.
4. Water efficiency improvements, water conservation, improved forecasting, water marketing, dry year option leasing, storage buy-backs and other measures to secure substantial additional Snake River water for spring migrants.
5. A call for states to conduct water availability studies, establish minimum instream flow levels, deny new water appropriations that would harm anadromous fish, and acquire existing water rights on a voluntary basis to improve fish flows.
6. Improved enforcement of water rights at diversions, including measuring devices.

Idaho Code (42-1763A) was amended to provide interim authority for storage water from reservoirs within Idaho to be rented through the Water Bank to augment flows for salmon migration, provided such flows are used for power production purposes within the state. Idaho Power has acted as the purchasing agent of salmon flow augmentation water for the Bonneville Power Administration (BPA). The Company purchased 99,000 acre-feet of water from the Upper Snake Rental Pool in 1991/92 for salmon flow augmentation; 50,000 acre-feet was released past Milner Dam from July 13 through August 17, 1991, which caused flows in the Middle Snake reach to increase from 200 cfs to 600 cfs for 19 days in July, and to about 800 cfs for 17 days in August. Another 49,000 acre-feet was released in the winter of 1992.

The Bureau of Reclamation, in cooperation with federal and state agencies and the Northwest Power Planning Council, is conducting an appraisal study of potential storage sites in the Snake River basin above Lower Granite Dam and Reservoir. The study will provide information on storage water supply potential and costs to meet both water augmentation flows and refill of the four lower Snake River reservoirs. Initial inventories listed sites at Deer Gulch and Pilgrim Gulch, tributaries to the Middle Snake reach.

Flood Control

The Middle Snake reach shows no appreciable flood problems. The Snake River, in this reach, flows through a deep narrow canyon cut in the Snake River Plain. Developed lands adjoining the river are generally above the elevation of flood discharge. In addition, upstream regulation and diversion for irrigation substantially reduces flow peaks. Local flooding may, however, occur along tributaries (U.S. CoE, 1961). Annual maximum flows of the Snake River occur generally in the months of April through June, but have occurred in all months of the year, except August and September (Table 8). Late spring or summer snowmelt rarely exhibits a sudden flood peak, but fall or winter rainstorms may produce characteristically abrupt crests.

The regulation of the Snake River between Heise and Milner reduces natural flood flows. Peaks in most years will not exceed 20,000 to 30,000 cfs and will cause little flood damage (U.S. CoE, 1961). As a result of regulation, frequency curves for high flows on the Snake River have flattened as upstream storage has increased. However, because the degree of regulation may vary from year to year, high- and low-flow frequency curves for regulated streams are unreliable for estimating future events. The combined capacity of reservoirs along the Snake River above Milner Dam is approximately 4,300,000 acre feet and is considered sufficient for lowering peak flows. However, only Palisades and Ririe were constructed with stated flood control benefits. Idaho Power's reservoirs, or pools, within the reach are for power generation and have no flood storage allocation.

The numerous irrigation diversions between American Falls Reservoir and Milner Dam also serve to alleviate flood flows. Since there are no appreciable inflows there is an actual decrease in flow below American Falls from May through the end of September. For the purposes of county flood insurance studies, canal diversions are considered effective for flood control.

The largest flood on record for the Columbia River Basin occurred in 1894. In the Middle Snake reach the 1894 flood had a maximum discharge approximating 80,000 cubic feet per second.

Table 6. Instantaneous Peak Discharge at King Hill, Idaho

Water Yr.	Cfs	Date	Water Yr.	Cfs	Date	Water Yr.	Cfs	Date
1909	41,900	06/11	1936	27,800	06/08	1963	27,200	06/22
1910	34,000	05/02	1937	12,700	05/11	1964	32,000	06/23
1911	38,100	06/22	1938	27,800	05/06	1965	31,900	12/23
1912	37,400	06/17	1939	17,800	04/11	1966	18,500	01/17
1913	36,500	06/12	1940	11,300	05/01	1967	22,900	07/19
1914	37,500	06/10	1941	9,560	11/12	1968	18,600	06/18
1915	26,300	11/16	1942	21,200	04/26	1969	24,000	04/27
1916	24,800	05/12	1943	31,000	06/07	1970	24,800	05/11
1917	36,600	05/31	1944	27,100	06/15	1971	33,400	04/27
1918	47,200	06/22	1945	24,900	06/12	1972	29,100	04/17
1919	18,100	03/30	1946	28,000	04/29	1973	20,800	11/08
1920	20,900	05/19	1947	29,600	06/14	1974	30,600	04/23
1921	37,900	06/03	1948	23,400	06/25	1975	28,100	05/01
1922	28,700	05/24	1949	18,100	02/25	1976	28,400	04/15
1923	23,300	06/27	1950	29,500	06/28	1977	18,400	12/03
1924	15,800	02/08	1951	25,600	04/16	1978	17,500	04/11
1925	25,400	05/26	1952	27,800	05/10	1979	24,100	01/12
1926	15,300	11/10	1953	27,900	06/11	1980	28,900	06/06
1927	34,100	07/04	1954	19,100	05/30	1981	20,700	06/12
1928	26,200	06/01	1955	18,400	04/02	1982	26,000	04/17
1929	21,000	04/08	1956	29,400	06/04	1983	32,400	05/12
1930	16,300	11/04	1957	30,300	05/22	1984	33,700	06/15
1931	14,000	11/22	1958	19,000	04/25	1985	24,000	10/21
1932	14,900	02/28	1959	16,400	10/16	1986	30,900	04/07
1933	11,800	12/19	1960	15,300	03/07	1987	21,000	10/30
1934	9,800	10/24	1961	14,700	12/17	1988	11,600	10/21
1935	7,980	01/06	1962	21,600	05/02	1989	14,100	02/27

Source: U.S. Geological Survey.

Although some damage must have occurred in the newly settled town of Hagerman, there is no mention of the event in historic documents. Maximum flows since 1909 are 40,000 cubic feet per second at Milner Dam and 47,200 cfs at King Hill in June, 1918. According to Idaho Department of Water Resources and Corps of Engineers records there are no levees for flood control between Milner and King Hill.

Local flooding caused by spring thaws, ice jams or heavy summer thunder storms has occurred along tributaries to the Middle Snake reach. Flooding caused by severe thunder storms tends to be localized and of short duration. The highest flows usually occur during the winter when

there is a lack of percolation into frozen ground or when heavy rainfall augments runoff from existing snowpack (Gooding County, 1985a).

Future Development

The Future Development section examines only prospective ventures and programs related to each resource category. An inventory and description of resources and resource development, and the current use or status of resource use in the Middle Snake region is provided in Appendix B: Area Overview and Resource Summary.

FISH AND WILDLIFE

Fish and wildlife development options primarily focus on actions that will allow for conservation and recovery of species that are considered sensitive: the white sturgeon, Shoshone sculpin and five species of mollusks. Management practices may change in the near future to protect and preserve these species, particularly those listed under the federal Endangered Species Act. A conservation plan will be developed for recovery of the five mollusc species that are federally listed as endangered and threatened.

The Shoshone sculpin will probably be upgraded in the near future to a candidate C1 category (Duke, 1992). A C1 category means that the U.S. Fish and Wildlife Service currently has substantial information to support the appropriateness of listing as endangered or threatened. If listing occurs, a conservation plan will be developed to provide for their recovery.

While the white sturgeon is not yet federally listed, the Idaho Department of Fish and Game (IDFG) considers the Snake River population a Category A: Priority Species, which means that they are either in low numbers, limited in distribution, or have suffered significant habitat losses (Moseley and Groves, 1992). Consequently, they intend to continue the catch-and-release policy and reintroducing individuals to those free-flowing stretches below Shoshone Falls (except possibly below Bliss, where the population is considered to be doing well). Hydropower facility activities that affect the white sturgeon will most likely be addressed in FERC licensing and relicensing proceedings.

The management direction of the IDFG for the salmonid and warmwater game species varies within the Middle Snake reach, and is largely dependent on whether they are managing a free-flowing stretch or a reservoir. Plan details can be found in their Fisheries Management Plan (1991-95). The IDFG has maintained that proposed hydropower facilities on both the Middle Snake or its tributaries

that would have potential negative consequences on the fisheries are opposed by the Department (IDFG, 1991).

In general, the IDFG will continue to stock hatchery rainbow and cutthroat trout where the native populations are depleted or nonexistent. For the most part, the clean tributaries and their habitats will be managed for wild trout spawning. IDFG is planning to renovate spring channels between Shoshone Falls and Upper Salmon Falls over the next few years to improve spawning habitat. Sediment will be removed and gravel added (Partridge, 1992). Warmwater species, such as smallmouth bass and channel catfish, are considered for stocking in certain mainstem reaches and the Malad River.

IDFG has placed several hundred wood duck and Canada goose nest boxes throughout the Middle Snake reach. Plans are to rebuild those that have deteriorated and add new ones (Smith, 1992). Through the Habitat Improvement Program (HIP), the IDFG hopes to encourage more private land owners to place nest boxes on their property. IDFG reports that Canada geese are moving out of the area due to hunting pressure (Smith, 1992). IDFG intends to place additional hunting closures on geese to provide them sanctuaries and encourage them to remain in the area.

SCENIC RESOURCES AND GEOLOGIC FEATURES

Future actions taken with respect to scenic and geologic values entail interpretation, scientific research, or agency designations for the purpose of protecting outstanding or significant features within the planning area.

Designations encompassing scenic values are (1) federal wild and scenic rivers and (2) areas of critical environmental concern (ACECs). The Shoshone District BLM has conducted initial eligibility studies under the Wild and Scenic Rivers Act. Several segments in the planning area were determined to possess "outstandingly remarkable" scenic values (U.S. BLM, Shoshone District, 1992). Future actions will entail a suitability study evaluating the feasibility of federal wild and scenic designation.

There are three potential National Natural Landmarks (NNL) proposed for the Middle Snake reach -- Dry Cataracts, Box Canyon, and Malad Canyon. Designations recognize and encourage preservation of nationally significant geological or ecological features of an area. This designation may elicit scientific and educational programs, or management actions to preserve an area's significant features. There is a moratorium on NNL designations, so additional designations in the planning area are not expected in the near future.

The Hagerman Fossil Beds will see some development in the future as a result of its recent designation as a national monument. Interpretation of geologic features may include an overlook and wayside exhibits, visitor stations, trails for guided and self-guided tours, and a research/visitor center for interpretation and display of fossils.

A common geologic hazard associated with the Hagerman Fossil Beds is landslides. Previous studies indicate that irrigation wasteways are a primary contributor to sloughing. Land managers will need to work on measures to reduce sloughing.

Some potential exists to provide additional interpretation of geologic and natural features in the planning area, particularly on lands managed by federal or state agencies. No specific plans are known at this time. Public scoping meetings have indicated the public would like more interpretation of the Bonneville flood's influence on the formation of the canyon.

CULTURAL RESOURCES

Management of cultural resources by federal agencies will focus on preservation and protection of sites. Activities may entail excavation of sites, maintenance and stabilization to prevent further deterioration, expansion of ranger patrol, and implementation of a volunteer informant program to monitor site disturbance.

As part of the Oregon Trail sesquicentennial (150th year) celebration, planned activities for the Middle Snake area include additional interpretive signage at the Pilgrim Stage Stop and other Trail sites, signage on State Highway 30 and Interstate 84 for an auto tour route directing travellers to important Trail sites, and a trail ride stopping at campsites along the way including Kanaka Rapids and an area above Hagerman.

A backcountry byway is proposed by the BLM as part of the interpretation of the Oregon Trail. The purpose is to promote the recreational opportunities of the trail and give individuals an opportunity to traverse sections of the original trail and view significant sites. An exact route has not been identified to date (Jenks, 1992).

Several hydro project proposals in the planning area will result in additional cultural resource surveys of the reach, and if warranted, detailed excavation and examination of sites. At a minimum, cultural sites will be identified and documented as part of the environmental study required to submit an application to the FERC. If any of these projects are licensed, additional cultural resource opportunities may occur as part of project mitigation.

The National Park Service is investigating the feasibility of designating a National Register District from Milner Dam to approximately Murtaugh bridge. This designation may result in additional interpretation of sites in this reach.

RECREATION

Several developed recreation facilities are mapped out for the planning area. Projects are the result of recreation mitigation for proposed hydropower projects, recommendations in agency management plans, or commercial endeavors by private enterprise.

Several recreation development proposals are associated with hydropower project mitigation plans submitted to the FERC. Idaho Power Company will enhance overlooks and improve park facilities at Twin and Shoshone Falls. The Power Company is also building a boat access at Milner Bridge and at the Main Milner Powerhouse. Recreation mitigation for the licensed Auger Falls hydro project will include a trail system for hiking, equestrian use, and bicycling. The trail will consist of a loop around the perimeter of the project site with side trails, including a trail paralleling the river.

If hydropower projects are built at Boulder and Kanaka rapids, picnic areas, trails, wildlife/rapid viewing areas, and fishing access are contemplated. At Empire Rapids, provision of public access for fishermen, hikers, and sightseers is suggested (Don Chapman Consultants, Inc., 1992). Realignment of the Clear Lakes Grade will include a pull-out at the Clear Lakes Bridge to allow access to the Snake River near Empire Rapids (Thomas, 1992). A hydropower project proposed at Star Falls plans on providing improved road and trail access to the falls, a boat ramp, interpretive facilities, and viewpoints on the north and south canyon rims (B & C Energy, Inc., 1992).

Federal, county and city agencies have plans to provide additional recreation facilities in the planning area. The Burley District BLM is acquiring access for a trail from the south rim into the canyon just west of Twin Falls, where an unimproved trail currently exists. The BLM would develop the trail for hiking use only (Boggs, 1992). The Shoshone District is considering a trail along the rim north of Twin Falls, and a rest stop/picnic area at Hansen Bridge (Sharp, 1992). Other development considerations include expanded facilities at the Bliss Bridge boat take-out, and a take-out in the King Hill area (Ridenhour, 1992). Plans to proceed with proposals in the Bennett Hills Resource Area will not occur unless recommended in the final Resource Management Plan (Sharp, 1992).

Several recreation studies indicate the planning area is ideally situated to attract additional tourism. Recreation trend studies reveal Americans have less leisure time and are taking more, but shorter, trips closer to home (Cordell et al., 1990). This trend suggests that the population bases of

Boise, Pocatello, Idaho Falls, Wood River Valley, and Salt Lake City, all within a day or weekend trip from the planning area, are a ready market for the tourism industry. Whitewater boating currently attracts people from these areas.

The Twin Falls Chamber of Commerce reports more non-resident vehicles pass through the intersection of I-84 and U.S. 93 than any other intersection in Idaho (Twin Falls Chamber of Commerce, 1992). These characteristics suggest there is a ready market passing through the planning area. By focusing marketing attention on travellers passing through additional economic growth in the tourism market may be realized.

The National Park Service is currently preparing a management plan, expected to be available for public review in early 1993, for the Hagerman Fossil Beds National Monument. Erosion and slumping problems will likely limit the degree of developed facilities within the monument itself. A number of sites across the river from the monument are currently being evaluated for possible location of a research/visitor center. Other potential development on the Monument might include trails for guided and self-guided tours, and picnic areas (King, 1992). As a result of the National Monument designation there will likely be additional development by private enterprises to capitalize on tourist traffic attracted to the Hagerman area.

Twin Falls County has several proposals for future recreational developments. Phase two of Centennial Park, located in the canyon to the west of the Perrine Bridge, was recently completed. Other phases will be completed in the future with the addition of picnic areas and trails. Trails linking the park to Rock Creek and Pillar Falls are envisioned. Other county proposals, cited in planning documents but not currently being pursued, include a park for off-road vehicle use and a boat ramp and picnic area in the Thousand Springs area (Heider, 1992).

The City of Buhl plans to build a visitor center in town to direct tourists to nearby recreation attractions (Ramsey, 1992). The City of Twin Falls has plans to expand and improve facilities at Dierkes Lake Park located above Shoshone Falls. Plans include improved hiking trails, interpretive programs for the geology, hydrology, and ecology of the area, an arboretum of native and non-native trees and shrubs, and renovating of walkways (Twin Fall Chamber of Commerce, 1992).

IRRIGATION

Approximately 50 percent of the arable land within Gooding, Jerome, and Twin Falls counties is presently irrigated. Most of the potentially irrigable land is in Twin Falls County (Gooding County - 97% of arable acreage irrigated; Jerome County - 80% irrigated; Twin Falls County - 43% irrigated). A significant amount of the Twin Falls acreage lies within the Salmon River Canal

Company tract, south of the Twin Falls High Line canal. Potentially irrigable lands in Gooding and Jerome counties are generally located north of the North Side tract.

Outside of the Salmon Falls tract, irrigated lands are well supplied with water, since irrigators adjacent to the Middle Snake reach have good natural flow rights and own much of the Upper Snake storage. Virtually all private land in the planning region has been developed. The remaining potentially irrigable lands in the area are in federal ownership and additional development is dependent upon governmental policy regarding public land retention or disposal. Additionally, some potentially irrigable land remains undeveloped because the financial returns are not great enough to attract the necessary capital to develop it.

Water available for new irrigation, from diversion of the Snake River above the Murphy gage, is limited. New irrigation is dependent upon development of a water supply either by ground-water pumping, new storage construction, or purchase of existing upstream water rights, and the construction of the facilities necessary to transport the water to the new lands.

Designation of portions of the Middle Snake reach as "Water Quality Limited" imposed a moratorium on expansion or new development subject to a Total Maximum Daily Load (TMDL) determination. New diversions could further impact the water quality of the reach by reducing the dilutive capacity of the river.

To forestall federal regulation, irrigators in the Middle Snake region will be pressed to improve the water quality of return flows, primarily through development and implementation of new sediment control methods. Toward this end, canal companies are working with the Idaho Division of Environmental Quality in developing a comprehensive water quality improvement program for the Middle Snake reach.

LIVESTOCK OPERATIONS

The Shoshone District BLM is currently considering eliminating livestock grazing below the canyon rim on the north side of the river. This change is being evaluated as part of the Bennett Hills Resource Management Plan. The action would not be implemented until the final plan was completed and a Record of Decision signed (Barnum, 1992).

The dairy industry has expanded rapidly over the last few years in the Middle Snake region, and shows indications of continued growth. In 1990, Gooding, Jerome, and Twin Falls counties contained 40 percent of the state's milk cows. An additional 45,000 milk cows are expected to be

brought to the area to produce the milk necessary for cheese production at the plants in the area (Twin Falls Chamber of Commerce, 1992).

AQUACULTURE

Aquaculture is a world-wide growth industry. The forces contributing to this growth are diminished natural fisheries, higher production costs for natural fisheries, increased demand for fish protein, and a growing population. Currently, the United States imports 60 percent of its food fish supplies. The major factors influencing the future growth of the food fish industry are marketing practices, increasing production costs, water resources development, and discharge effluent requirements.

Growth of the local aquaculture industry may be constrained by the availability of new water sources, since most water supplies are now fully utilized. Increases in production must rely on more efficient use of existing water supplies. Extending the use of water further will require oxygen supplementation. Water recirculation systems have not yet proven economical. Advancements in water-reuse technology need to be implemented if farms constrained by their present water supplies are to continue to grow.

The industry is concerned with a reduction in spring flows. Spring flows in the Middle Snake reach show a steady decline in discharge since the mid-1950s. The drought (1987-1992) has exacerbated this decline. Current average spring discharge is 5,700 cfs, down from a peak of 6,800 cfs in the early 1950s. Declining flows are attributed to ground-water pumping, reduced irrigation recharge, and the drought (Kjelstrom, 1986; 1992; Brockway, 1992).

If spring flows continue to decline, a hardship could befall the aquaculture industry in this area. Hatcheries dependent on southside seep tunnels or canals are already experiencing extreme water supply variability relative to climate and irrigation practices. Fish farms have been operating along the reach since the late 1920s and, because of the available water, have increased in number. If current flow is further reduced, approximately one-third of the facilities could be forced out of business or into capital outlay to recycle or pump water (Klontz and King, 1975).

Designation of portions of the Middle Snake reach as "Water Quality Limited" imposed a moratorium on expansion or new development subject to a 401 certification, and a Total Maximum Daily Load (TMDL) determination. Certification is currently limited by a "no net increase" provision. Waste disposal will face tighter controls in coming years, which will pressure producers to reduce waste as much as possible or to develop new disposal methods. The industry is currently

working with the Idaho Division of Environmental Quality in developing a comprehensive water quality improvement program for the Middle Snake reach.

The aquaculture industry is also concerned about the water quality of the springs. Vegetative build-up on raceway head screens and nitrate levels in spring flows are concerns. High quality water is critical to production potential per unit of flow (Klontz and King, 1975).

DOMESTIC, COMMERCIAL, MUNICIPAL, AND INDUSTRIAL WATER USES

The demand for domestic, commercial, municipal, and industrial water is increasing due to population growth and an increase in the per capita use of water. Idaho per capita use averages 311 gallons per day (USGS, 1990). The combined population of Gooding, Jerome, and Twin Falls counties has increased 27 percent in the thirty years between 1960 and 1990. The cities, which are the fastest growing areas, may require new water supplies to provide for additional people. As the industrial potential of the area is developed, water requirements for industrial use will also increase.

Many communities need to expand and upgrade their systems, and all systems must meet the new, stringent standards imposed by the Safe Drinking Water Act. Improvements cover a wide range of facilities, but they consist mainly of new wells, storage tanks, and pipelines. Some communities have paid for these improvements without outside help, but most have made use of public funding programs. Funding for drinking water improvement may be available from the Idaho Water Resource Board's Revolving Development Account or Water Management Account, and the Rural Development Program of the U.S. Farmers Home Administration (Idaho Department of Commerce). The state agency responsible for regulating and monitoring public drinking water systems is the Division of Environmental Quality.

The use of water in homes and industry involves disposal as well as supply. Only a small percentage of water used for domestic and industrial purposes is incorporated into products or evaporated into the air as water vapor. Most of the water is returned to streams or permitted to infiltrate the ground, from where it percolates toward streams and aquifers. Water thus can be reused many times, but dissolved solids, suspended material, and bacteria may contaminate the water with each use.

MINING

Gold and a variety of industrial minerals are present in the Middle Snake region (Appendix B: Area Overview and Resource Summary). Future development of the mineral resources is dependent on mining technology, material grade, and markets.

Gold - Gold worth millions of dollars is thought to remain in the Snake River and on its banks, however, the very fine, flat flakes makes it extremely difficult to recover. It can take up to 500,000 individual flakes to equal one ounce (Wojchik, 1992). There are numerous higher grade gold deposits, hardrock and placer, elsewhere in Idaho and the United States (Gillerman, 1992).

Diatomite - California has been the leading producer of diatomite since 1910. Despite the presence of a number of diatomite deposits, Idaho has produced only nominal amounts -- an estimated 3,000 tons from 1930 through 1960 (U.S. Bureau of Mines, 1991; Idaho Bureau of Mines and Geology, 1964). Currently there is no production in Idaho. U.S. reserves and production capabilities are very large, markets are well satisfied, and competition among producers is high. Because of the high competitiveness of the diatomite industry and the substantial start-up costs for a new mine, displacing present suppliers would be difficult. In addition, problems might be expected in meeting stringent standards for diatomite products and high transportation costs (U.S. Bureau of Mines, 1991).

Clay - Because the cost involved in shipping heavy-clay products is high, only local clay deposits can be used economically. The supply of raw clay for clay products now produced in Idaho is more than adequate for the needs of the immediate future. Resources of common clay are virtually inexhaustible, although depletion of local pits or a change in consumer requirements could result in periodic modification of the raw materials used for clay products.

Pumice, Sand, and Gravel - Due to transportation costs, any future development will be limited to local markets. With its high bulk and relatively low value, sand and gravel is generally excavated as near to its site of use as possible to keep transportation costs low.

Dimension Stone - The outlook for expansion of Idaho's dimension stone industry is fair. However, future development of deposits in Idaho will continue to be limited by a small local market, remoteness from other markets and prohibitive transportation costs. Because dimension stone is used predominantly for ornamental purposes, it is a luxury item and subject to downturns in the economy.

POWER DEVELOPMENT AND ENERGY CONSERVATION

The four major electric utilities serving the state of Idaho are projecting moderate growth in both peak demand and energy usage over the next 20 years. The projected average annual growth in peak demand is 1.47%, 1.15%, 0.92%, and 1.2% for Idaho Power Company, Washington Water Power, Utah Power and Light, and Pacific Power and Light, respectively (IPUC, 1992).

The projected average annual growth in energy sales is 1.3%, 0.88%, 0.98%, and 1.16% for Idaho Power Company, Washington Water Power, Utah Power and Light, and Pacific Power and

Light, respectively (IPUC, 1992). Idaho's investor-owned utilities continue to forecast growth rates which cluster around the median of growth scenarios of the regional planning bodies. The joint Bonneville Power Administration - Northwest Power Planning Council forecast which forms the basis for the 1991 Power Plan, portrays a broad range of growth. Emphasis is placed on potential loads falling between the medium-high growth rate of 1.6 percent and the medium-low rate of 0.5 percent. Idaho's utilities fall within this range.

Planned acquisitions of non-deferrable resources are expected to meet Idaho Power Company's needs for new resources for the next twelve to twenty years (IPC, 1991a). These resources include generation system efficiency improvements (42 aMW), completion of hydropower projects now in progress (55 aMW), cost effective new conservation programs (110 aMW), and the purchase of cogeneration and small power production from qualifying facilities at avoided cost rates (116 aMW)(IPC, 1991a). A power supply deficit caused by drought or salmon flow enhancement programs would be filled by non-renewables because the region may lack the infrastructure and financial commitment to implement more complex conservation and renewable actions.

Conservation Resources

Conservation programs can provide both capacity and energy savings. Capacity is the ability to supply power, and energy is power supplied. Some conservation programs reduce load only during off-peak hours while others provide load reduction primarily during peak hours and therefore provide substantial capacity savings. The current system requires energy, not additional capacity, and conservation options are designed for the purchase of energy savings (IPC, 1991b).

About 60 percent of residential conservation is available from reducing the energy required to heat homes, both existing and new (NPPC, 1991). In conjunction with utility marketing and incentive programs, energy codes, based on governmental regulatory authority, are the best means for achieving savings in new buildings. For new homes, Idaho has adopted model conservation standards.

Office buildings and retail stores consume about 50 percent of the electricity used in the commercial sector, and space heating, space cooling, and lighting are the dominant end-uses (NPPC, 1991). In the industrial sector, energy savings identified by industrial plant managers, are associated with motors, motor controls, lighting, and other plant equipment. Potential energy savings in the irrigation sector are from the use of more efficient water application systems and irrigation scheduling improvements for both new and existing acreage.

Potential energy savings in agriculture can contribute additional generation potential by conserving water within the hydropower system. Energy used for irrigation pumping accounts for about 7 percent of the total energy generated by Reclamation hydroelectric plants (USBR, 1991).

Approximately 224 average megawatts of potential savings have been identified within the Idaho Power customer service area under the base case load forecast. This figure represents the potential savings which could be achieved with complete implementation of current cost-effective technology (IPC, 1991b). The average cost of deferrable conservation measures is estimated to be approximately 3 cents/kwh (IPC, 1989).

New Hydroelectric Development

The Northwest Power Planning Council estimates that about 410 average megawatts of firm energy may be available from new hydropower development that is cost-effective and not precluded by stream reach protection designations. This potential includes retrofits at irrigation, flood control, and other nonpower water projects; additional generation equipment at existing hydroelectric projects; and construction of new projects at undeveloped sites (Maps: Proposed and Existing Hydropower Sites - State of Idaho; Dams having hydropower potential that do not generate power - State of Idaho). Upgrading hydroelectric generator and turbine units at existing powerplants is one of the most immediate, cost-effective, and acceptable means for developing additional electrical power. It is possible to retrofit many of the older projects using advanced designs, materials, and equipment.

Proposed projects on the Middle Snake reach could add a potential capacity of 230 megawatts. Hydropower projects proposed for the Snake River in the Middle Snake reach include: Star Falls, Auger Falls, Boulder Rapids, Empire Rapids, Kanaka Rapids, A.J. Wiley, and Dike (Map: Hydropower Sites - Middle Snake Reach). Project descriptions are provided in Appendix B: Area Overview and Resource Summary.

Idaho Power, in conjunction with the Northside and Twin Falls Canal companies, has added power generating facilities at Milner Dam and constructed a second power house 1.6 miles downstream. The Company is significantly increasing the generating capacity of their Twin Falls and Upper Salmon Falls facilities, and proposes to upgrade their project at Shoshone Falls. Generating capacity at Twin Falls will go from 10 MW to 52 MW, Upper Salmon will increase capacity from 34.5 MW to 48 MW, and the potential at Shoshone could add up to 119 MW (Sipe, 1992).

Southern Idaho has an extensive canal system for the distribution of irrigation water. The canals provide low-head hydro potential for electric generation with minimal environmental degradation. Idaho Power Company estimates that approximately 150 average megawatts of summer

power generation can be developed at canal hydro sites in southern Idaho, with annual average generation of approximately 75 megawatts. The summer seasonality of canal hydro generation complements the winter seasonality of generation from the Milner project (IPC, 1989).

Other Power Sources

A drop in residential electricity demand for space and water heating can be expected from a switch to natural gas. The relative price gap between gas and electricity is now large. NPPC projections show that relative price gap remaining quite large through their forecast period (IPUC, 1991). It can be expected that gas, if available, will be used in most new homes, and many older home heating systems will be switched to gas.

Cogeneration is a well-established technology involving the sequential production of electricity and thermal energy. Cogeneration projects, using exhaust heat from food processing plants in the Snake River Plain, could generate as much as 150 megawatts. The thermal energy produced in cogeneration may be used for industrial process heating, space heating, hot water heating, and absorption chiller loads. Since the thermal energy offers value that can offset part of the cost of fuel and equipment, the electrical energy produced can be generated at less cost than electricity produced alone using comparable equipment and fuel.

Municipalities have found opportunities for recovering energy in the incineration of solid wastes to produce steam and electricity and the digestion of sewage to produce methane gas. Recent experiences have also shown the potential of recovering methane gas from completed or abandoned landfills. Energy recovery from these processes can displace conventional sources of fuel, while reducing costs and environmental problems associated with traditional waste disposal. Factors which may limit the utilization of these wastes for energy production include the community's population, per capita waste generated, and the availability and cost of alternative disposal methods.

Geothermal, wind, and solar energy are among Idaho's most promising renewable resources, but their future is obscured by technical, environmental, and institutional obstacles. Geothermal resources have been suggested for power development in the region. However, subsurface temperatures in the area are below temperatures for potential power generation (Mitchell et al., 1980). The greatest potential, as far as present knowledge of the resource in Idaho is concerned, is for space heating and greenhouse use.

While wind farms are common in California, the Northwest has little satisfactory experience with this resource. However, wind, in locations, is becoming viable (Fuhrman, 1992). Southern Idaho has several potential wind-generation sites. Annual technical potential at the sites is estimated

at 100 average megawatts. The estimated cost of energy from these sites ranges from 12.6 to 21 cents/kwh (NPPC, 1991).

Solar's cost is continuing to decrease, and the performance of the technologies is improving. Solar insolation ratings indicate that southern Idaho is a good location for solar-powered electricity generation. Idaho Power Company recently joined the Solar Two project in California, a solar energy demonstration effort. The solar-thermal plant will use a molten-salt heat transfer and storage system. Solar-thermal plants may produce electricity at a cost competitive with coal generation, without the environmental impacts or fuel costs associated with fossil-fueled power plants. Solar Two experiments could lead to sales of solar produced electricity from the facility by the year 1998 (NEN, 1992a).

Solar-thermal power plants are heat engines and therefore require water for condenser cooling. Solar-thermal plant efficiencies are similar to, or less than fossil-fueled power plants, and therefore require similar or slightly more water for comparable power production. Water requirements can be reduced by use of dry cooling systems (NPPC, 1991).

Photovoltaic (PV) costs have dropped enormously in the past 20 years, to the point that they are often cheaper than diesel generator sets and utility line extensions. PVs are not presently price competitive with utility power in most areas, but that too will likely change in the future. Projected improvement targets are to lower the cost to 8.5 cents/kwh by 2010 (NPPC, 1991). At that price, photovoltaics clearly will be cost-competitive with other sources of energy. While utility-scale photovoltaics are not yet practical, at least in Idaho, small remote applications are effective.

WATER RESOURCES

Energy and water conservation are closely tied; less water used means that less water has to be pumped, resulting in lower energy needs. Withdrawing less water from a reservoir increases the operating head and energy production of a powerplant. Modifications to water scheduling and operation can reduce peak demands, thereby reducing peak capacity needs for both water and energy.

Conservation and Drought Management

The Palmer Drought Index shows that a meteorological drought has existed in the State during one-third of the period from 1931 through 1982 (Karl et al., 1983; IWRB, 1968). The drought index treats drought severity as a function of accumulated weighted differences between actual precipitation and the precipitation requirement. The precipitation requirement is derived from consideration of temperature and soil moisture.

In light of the probability of drought recurrence, water conservation is crucial to continued reliance on the State's water supplies and to future development. Water conservation measures could save water, control erosion, and reduce pollution in the Snake River and tributary streams.

Water conservation may be examined as an alternative or a supplement to traditional water supply facility proposals. Water conservation may be pursued through demand reduction, by using the existing supply more efficiently, and/or increasing water supplies by operating storage and delivery facilities more efficiently. Structural and non-structural measures apply to each. Although water supplies in the region are generally plentiful, shortages already occur during droughts. In the Middle Snake planning region, water conservation applies principally to irrigation, since irrigation is the primary consumptive use.

Improved management or technology in the delivery and application of water can result in greater efficiency in irrigation water use. Farm operators and delivery organizations are directly concerned with undertaking such improvements, particularly with current drought conditions. There is a significant trend at the farm level toward the adoption of water conserving improvements such as leveling of fields, use of gated pipe, sprinklers, or drip systems, and lining of ditches. Studies by the Soil Conservation Service in the Upper Snake basin, in cooperation with the Bureau of Reclamation, indicate that the farm net irrigation requirement may have been reduced by up to 50 percent over the last decade (Wilton, 1992).

Opportunities to reduce operational costs or to increase delivery reliability provide important water use efficiency incentives at the organization level. Conveyance system losses account for approximately 30 percent of diversions (U.S. SCS, 1977; Wilton, 1992). Open channel irrigation systems with fixed delivery rates, schedules, and long lag times between diversion and delivery are conducive to large operational wastes and inefficient utilization of water. Distribution systems must be able to respond to on-farm water use demands to enhance water-use efficiency.

The Drought Assistance Act of 1988 directed the Secretary of the Interior to identify opportunities to conserve water supplies. The Bureau of Reclamation and the Northside Canal Company are embarking on a demonstration study of water efficiency measures that could have potential for making water available for other uses (Golus, 1992).

A lack of compensation for the implementation of conservation measures is a disincentive to more efficient water use in the State of Idaho. Additionally, the adverse effects of improvements in water-use efficiency are difficult to trace and prevent, regardless of legal provisions. Conservation of irrigation water may lead to a reduction in aquifer recharge or return flow to a stream which provides water for other uses.

GROWTH

Although economic activity has certainly improved in the state, it now appears that the state's pace of economic activity will slacken somewhat, and be more reflective of national trends. Local areas of the state are expected to experience very strong growth for the foreseeable future, while other areas are enduring long-term restructuring or decline.

Communities in the planning area are beginning to deal with growth issues. Issues have focused on the ability of the community to deal with increased demands for services associated with a rapidly growing population, the methods of funding these services, and the effects that growth is having on the character and livability of the community. Several studies have shown that the cost per resident of providing various public services increases with population (Gardner, 1979; Weinstein and Firestine, 1978, both cited in Power, 1988). The larger a local economy becomes, the more sophisticated the range of local public services that the local population demands. This tends to boost the level of taxes needed per capita since a greater variety of services is called for.

V. ALTERNATIVE ANALYSES

Alternatives

River segments with identified Outstanding resource values were assessed for State protection through six alternatives encompassing development, improvement, and the conservation of resources. All segments of the Middle Snake reach, with the exception of Bliss Reservoir, were found to possess at least one, and usually two or more, "Outstanding" classifications for either fish and wildlife, geologic features, scenic values, or recreation, as defined by criteria in Section III. The segments identified as eligible for protection based on the screening process were further refined by overlay of a land use map.

Those segments possessing little or no cultural modification were analyzed for potential designation as a Natural river. Idaho Code, Section 42 -1731, defines a Natural River as a waterway possessing the following characteristics: (a) outstanding fish and wildlife, recreation, geologic or aesthetic values; (b) free of substantial existing man-made impoundments, dams or other structures; and (c) riparian areas are largely undeveloped, although accessible in places by trails and roads. A Recreational River is defined as a waterway having the following characteristics: (a) outstanding fish and wildlife, recreation, geologic or aesthetic values; and (b) might include some man-made development within the waterway or within the riparian area of the waterway.

ALTERNATIVE A - NO ACTION

Under Alternative A no river segments are proposed for state protection. Current policies and authority are considered adequate for development, improvement, and conservation of the Snake River between Milner Dam and King Hill, Idaho (Fig. 7). The likelihood of major water consumptive developments in the planning area is not great, because (1) the basin is considered appropriated above Swan Falls, (2) the Swan Falls Agreement sets minimum flows at Swan Falls and Murphy, on the Snake River, and (3) the limited amount of trust water held by the State can only be used after meeting strict public interest criteria.

The Northwest Power Planning Council (NPPC) has designated the Snake River from King Hill to Perrine Coulee, (excluding Bliss Reservoir), and Shoshone Falls to Twin Falls Powerhouse as protected river segments (Fig. 13, p. 67). The presence of endangered or threatened species also acts as a constraint on development and water use throughout the reach. Site-specific studies and mitigation would likely be required as part of any stream-bed or flow-regime alterations.

Where land adjacent to the river is in federal ownership (Map: Land Ownership) many water impacting activities are proscribed by federal management plans. As an example, the Shoshone District of the Bureau of Land Management has five management plans that effect the reach. Local land-use planning also restricts development options. Gooding, Jerome, and Twin Falls counties all require building setbacks from the canyon rim. Jerome County seeks to maintain a one-half mile preservation zone northward from the river on public lands to provide public access.

Commercial mining activity is currently regulated by the Division of Environmental Quality, the Department of Lands and the Department of Water Resources.

ALTERNATIVE B - PROTECT ALL OUTSTANDING SEGMENTS

This alternative attempts to preserve for posterity the current character of the reach. Alternative B designates for state protection all river segments identified as Outstanding in the screening process for fish and wildlife, recreation, geologic, and scenic values (Fig. 8). State designations for the Middle Snake reach:

Milner Dam to Murtaugh Bridge - Recreational
Murtaugh Bridge to Hansen Bridge - Natural
Hansen Bridge to backwaters of Bliss Reservoir - Recreational
Bliss Dam to Clover Creek - Recreational

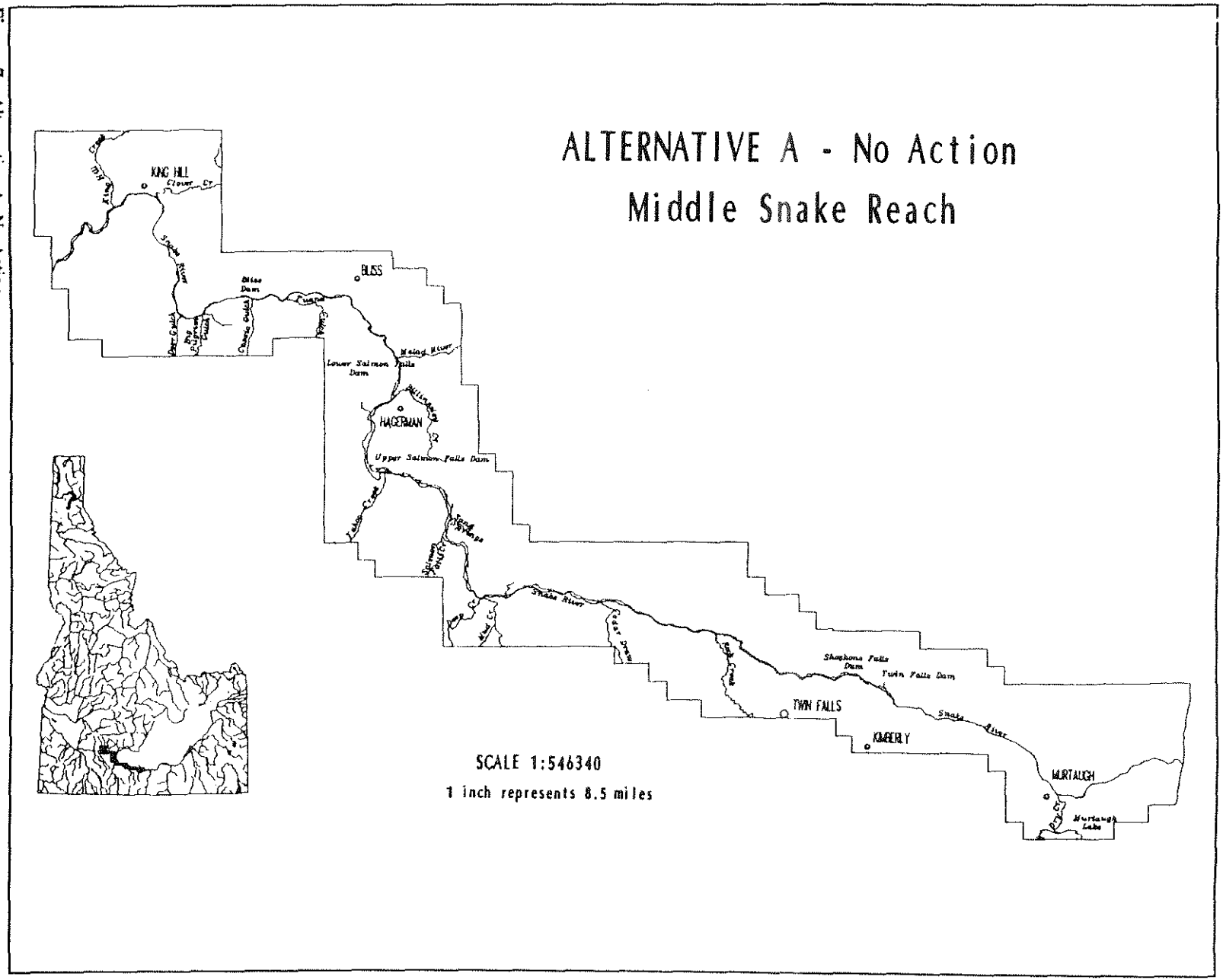

Figure 7. Alternative A: No Action.

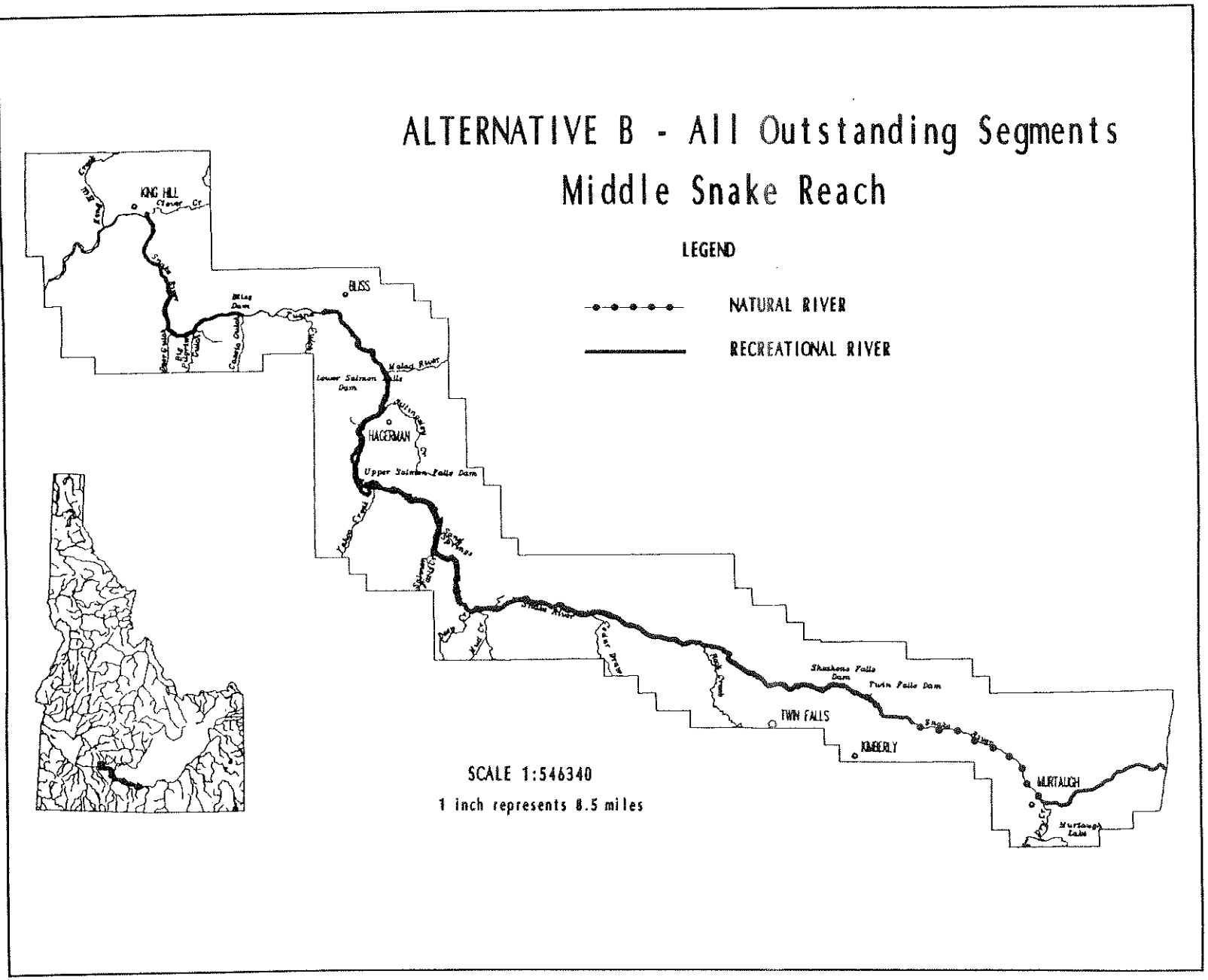

Figure 8. Alternative B: Protect All Outstanding Segments.

ALTERNATIVE C - PROTECT ALL FREE-FLOWING SEGMENTS

Of the 780 miles of the Snake River located in Idaho, approximately 65 percent is in a free-flowing condition (IPC, 1984). Of the approximately 91 river miles in the Middle Snake reach, 68 miles (75 percent) are free-flowing. This alternative embodies the priority issues identified at the public scoping meetings, and the policies set forth in the *Draft Coordinated Water Resource Management Plan for the Middle Snake River*, prepared by the Middle Snake Study Group. The priority issues identified at the public scoping meetings were: (1) water quality, (2) the protection of free-flowing stretches, and (3) coordination with other planning efforts. Alternative C designates for state protection all free-flowing river segments identified as Outstanding in the screening process for fish and wildlife, recreation, geologic, and scenic values (Fig. 9). State designations for the Middle Snake reach:

Milner Dam to Murtaugh Bridge - Recreational
Murtaugh Bridge to Hansen Bridge - Natural
Hansen Bridge to backwaters of Twin Falls Reservoir - Recreational
Shoshone Falls to Warm Creek - Recreational
Rock Creek to Highway 30 Bridge - Recreational
Lower Salmon Falls Dam to backwaters of Bliss Reservoir - Recreational
Bliss Dam to Clover Creek - Recreational

ALTERNATIVE D - DEVELOP HYDROPOWER ON MAINSTEM

This alternative seeks to preserve outstanding characteristics of the Middle Snake reach, but makes allowance for active hydropower development proposals, and requests that the Northwest Power Planning Council remove protected designations from segments not identified under State protection (Fig. 10). State designations for the Middle Snake reach:

Murtaugh Bridge to Hansen Bridge - Natural
Shoshone Falls to Warm Creek - Recreational
Rock Creek to Cedar Draw - Recreational
Deep Creek to Thousand Springs - Recreational
Bliss Dam to Deer Gulch - Recreational
I-84 Bridge to Clover Creek - Recreational

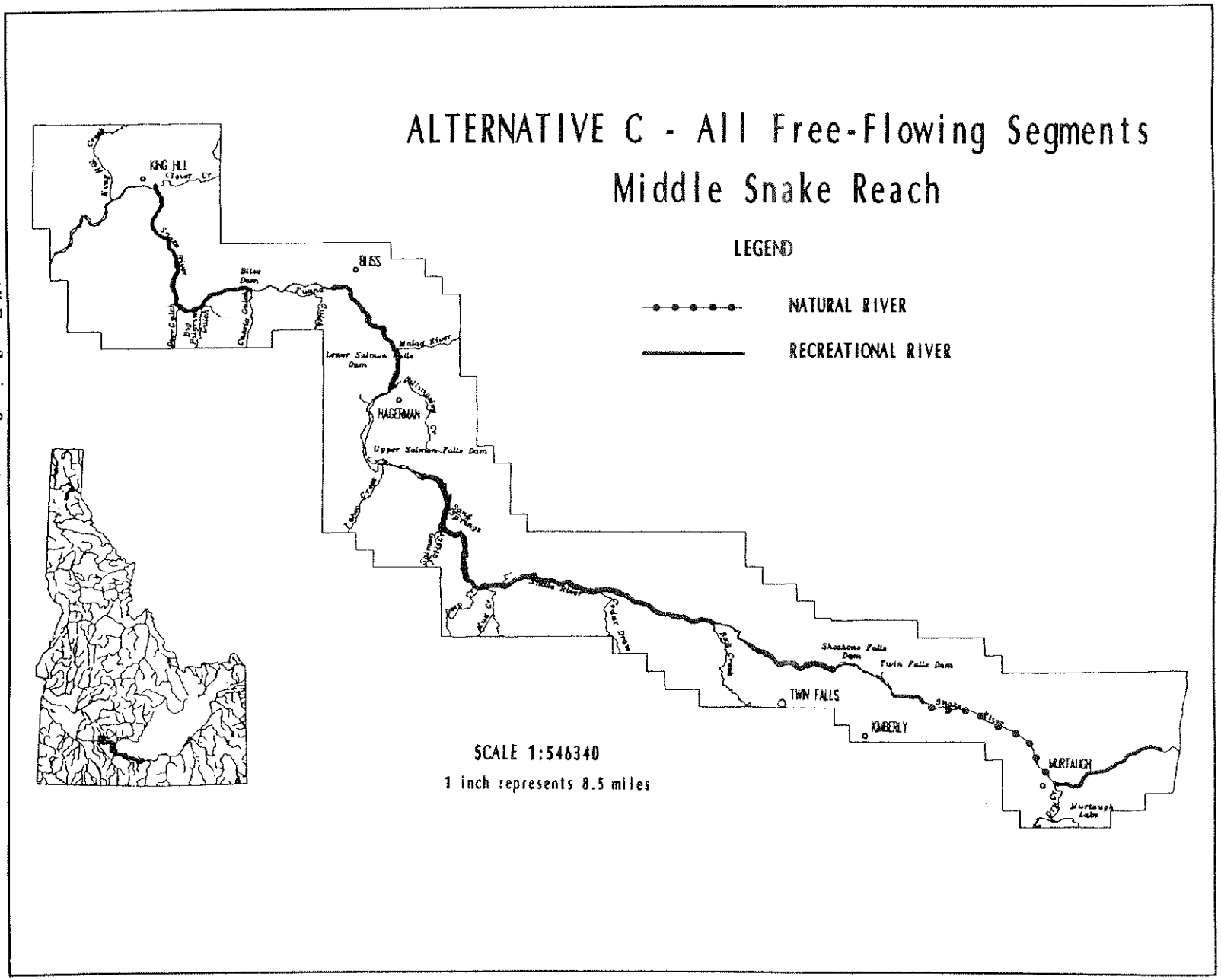

Figure 9. Alternative C: Protect All Free-flowing Segments.

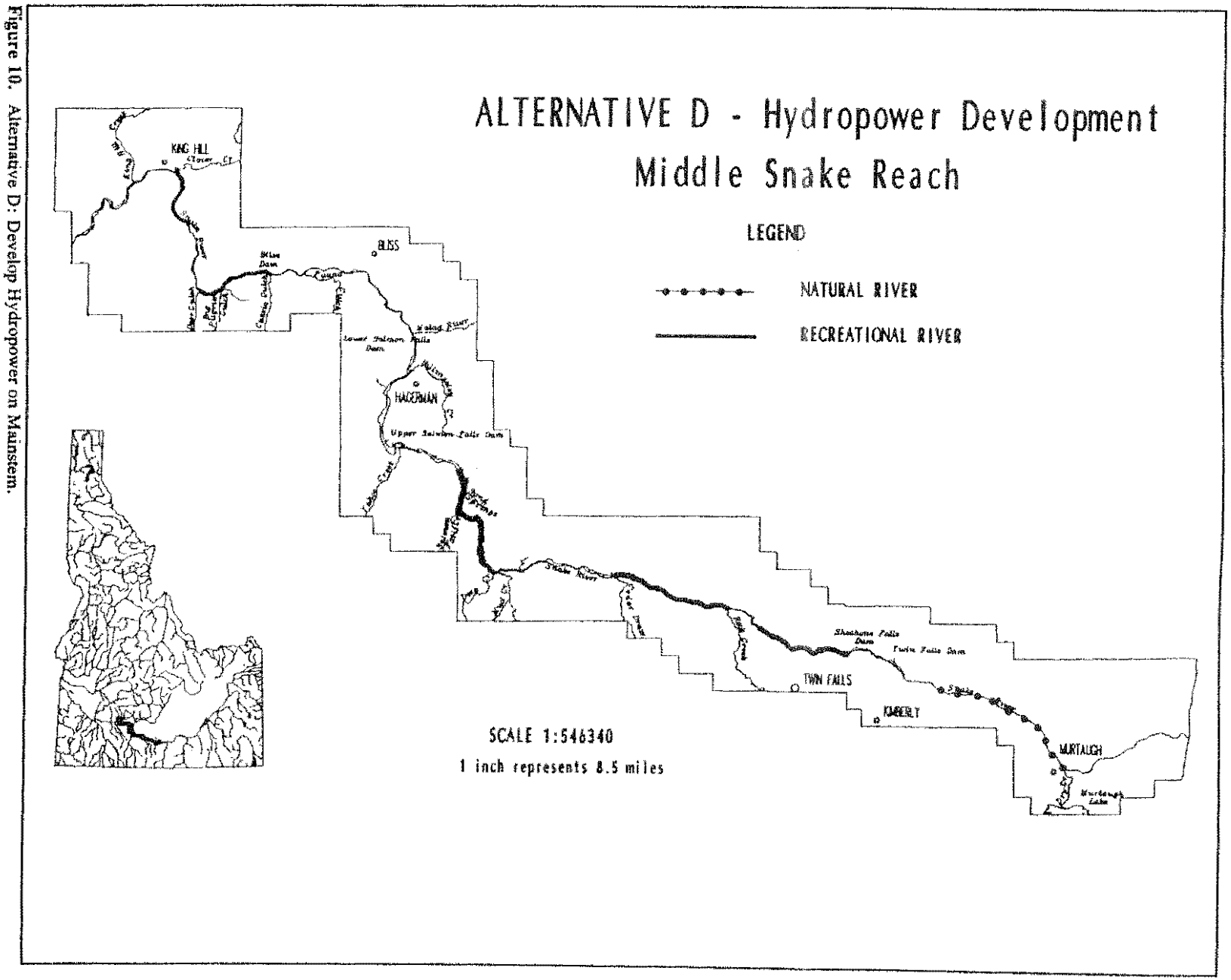

Figure 10. Alternative D: Develop Hydropower on Mainstem.

ALTERNATIVE E - PROTECT MIDDLE SNAKE FALLS AND RAPIDS

This alternative embodies public testimony given at hearings for (1) FERC licensing, (2) the Middle Snake Study Group Draft Plan, and (3) Section 401 certification to protect the remaining rapids and falls in the Middle Snake reach. Alternative E designates for state protection all segments (1) identified as Outstanding in the screening process for fish and wildlife, recreation, geologic, and scenic values, (2) that were also identified as eligible for suitability study under the Wild and Scenic Rivers Act, (3) with the exception of the Milner Bridge to Main Milner Powerhouse segment, and the (4) addition of falls or rapids not covered under the above (Fig. 11). State designations for the Middle Snake reach:

Idaho Power Company Main Powerhouse to Murtaugh Bridge - Recreational
Murtaugh Bridge to Hansen Bridge - Natural
Shoshone Falls to Perrine Coulee - Recreational
Cedar Draw to Deep Creek - Recreational
Lower Salmon Falls Dam to backwaters of Bliss Reservoir - Recreational
Bliss Dam to Clover Creek - Recreational

ALTERNATIVE F - FEDERAL PROTECTION

This alternative seeks long-term protection with federal authorities to prohibit new water supply and hydropower projects in the reach that would have a direct and adverse effect on the values for which the river was designated (Fig. 12). Alternative F recommends federal protection under the Wild and Scenic Rivers Act for segments found suitable for wild and scenic designation by the Bureau of Land Management (BLM). The State would request designation and state management as Scenic and Recreational rivers under the Wild and Scenic Rivers Act for segments of the Middle Snake reach found suitable. Three segments were found eligible by the BLM for suitability studies:

Milner Dam to backwaters of Twin Falls Reservoir - Scenic
Lower Salmon Falls Dam to backwaters of Bliss Reservoir - Recreational
Bliss Dam to King Hill Creek - Recreational

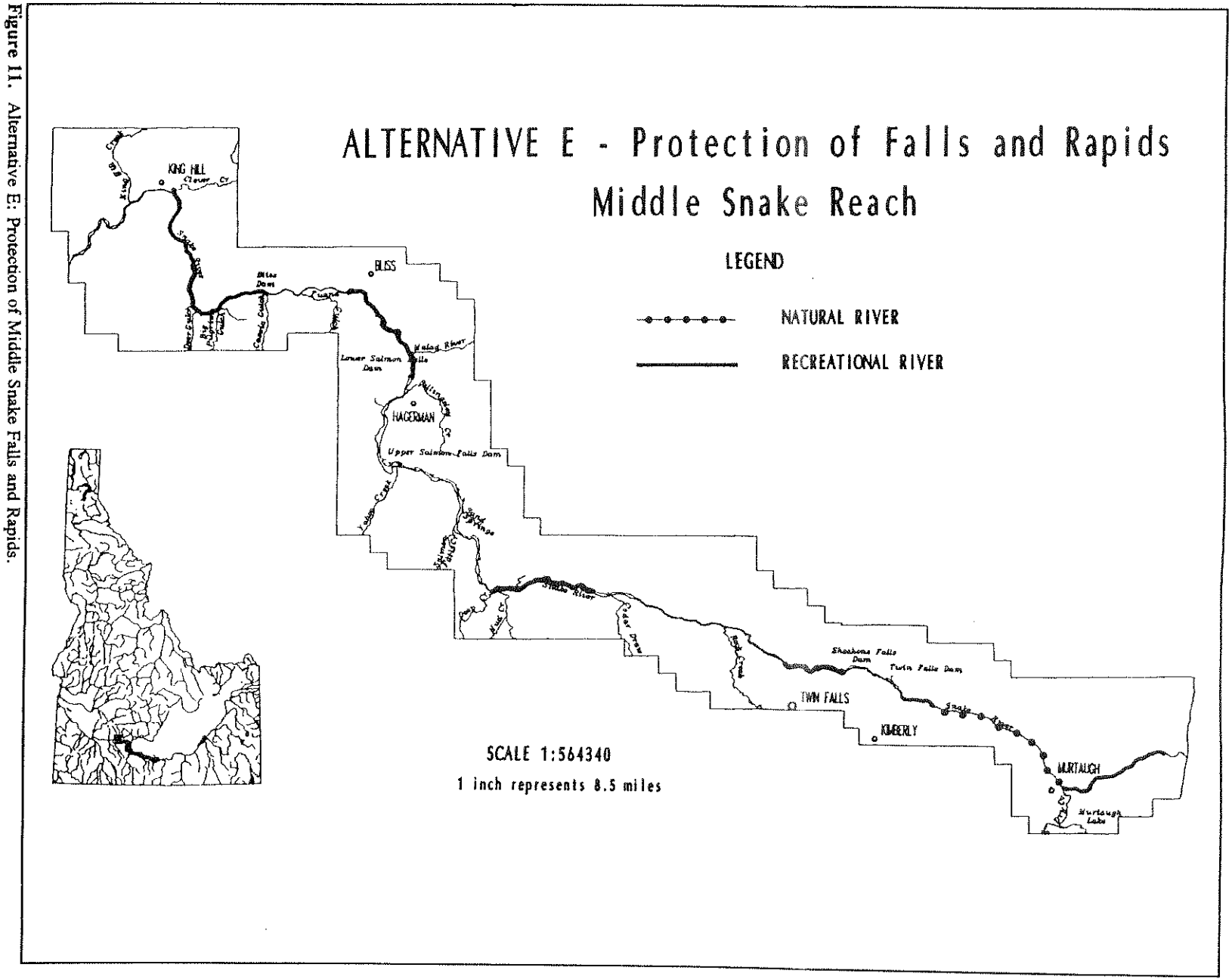

Figure 11. Alternative E: Protection of Middle Snake Falls and Rapids.

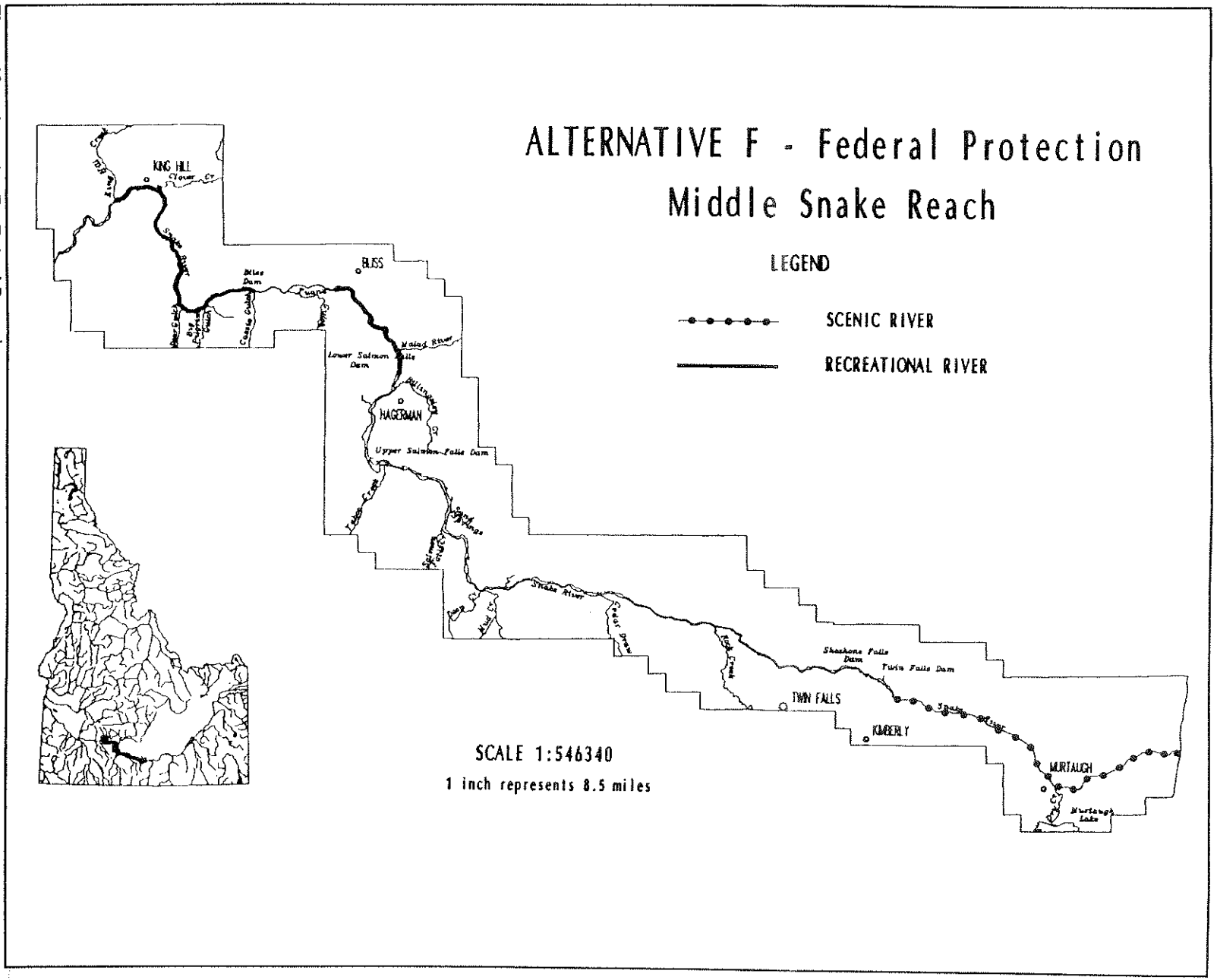

Figure 12. Alternative F: Federal Protection.

Impact of Alternative Actions on Resource Uses

On segments designated Natural, the Board must prohibit 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.

On segments designated Recreational, the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval.

New diversion works are limited to pump installations which do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

Vested Rights

No provision of the Comprehensive State Water Plan shall limit, restrict, or conflict with approved applications for the appropriation of water or with vested property rights, i.e., existing water rights, diversions, improvements, mineral rights, and other private property rights. No provision of this plan shall bar 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. Management of land adjacent to protected rivers remains the responsibility of land owners or managers, and local planning authorities. Nothing in this plan shall prevent or restrict the relicensing of existing hydropower projects that have been licensed by the Federal Energy Regulatory Commission. Designation of waterways as protected rivers shall not affect the operation or relicensing of any existing hydropower project which does not enlarge existing boundaries or project impoundments.

Erosion, Sedimentation, and Water Quality

Land-disturbing activities from construction would cause erosion and sedimentation, and possible water quality problems. Hydrologic modifications may also hinder water quality improvement measures.

Placement of a structure to divert streamflow would alter stream dynamics and the velocity distribution of the flow. Sediment deposition and bedload retention above instream diversion structures and in canals, could result in broadening of the stream channel and increased bank erosion. Channel scour may occur downstream of a dam or powerhouse. Water released from an impoundment or powerhouse can carry a greater sediment load. New diversions would alter flow/velocity distributions in bypassed reaches, and could cause increased deposition in and below the bypassed reach.

Impoundments slow velocity and increase water temperatures, and usually reduce turbidity. Thus light may penetrate to a greater depth and an expansion of macrophyte communities could be expected. Substrate stability is also increased in areas where flow is slowed. The root systems of macrophytes are more able to become established and the area of substrate available for macrophytes increases. Reduced flows over rapids, due to diversion, could further diminish the assimilative capacity of the river. Oxygen, depleted from the water column by macrophyte respiration, is reaerated in rapids.

Hydropower Development

The impacts of new hydroelectric development vary greatly from project to project. A project may effect water quality, land use, wildlife, or aesthetics, and there are specific impacts associated with construction.

There are no emissions of greenhouse gases or particulates, and only small quantities of solid wastes are generated by hydroelectric power plants. However, diversion and/or impoundment of a river or stream alters the hydrologic regime. A hydroelectric project that has an impoundment associated with it would generally have a more severe impact than a run-of-river project.

Fish and Wildlife Protection

Alteration of the existing streamflow patterns, reduced flows and consequent changes in water velocity could cause further degradation to already severely limited habitat in the Middle Snake reach.

Existing data shows that gravel substrate habitat is limiting in much of the Middle Snake reach, as evidenced by the concentration of fish in areas with suitable substrate below rapids. The limited habitat confines fish species, including trout, to areas immediately downstream of rapids, and any subsequent reduction of gravel substrate or water quality in these reaches would cause direct impacts to the existing fishery, since no other adequate habitat refuge exists for fish in the river.

Construction or dredging would likely disturb river sediments, which would have a substantial impact on water quality. Impacts to water quality would vary depending on the location of the dredging. Suction dredges, which pull up sediment with the substrate and catch water in sediment ponds, would not likely impact water quality. However, rock substrate, habitat for aquatic invertebrates and insects, would be removed and with the current lack of flushing flows, disturbed substrate would not be replenished.

Oxygen, depleted from the water column by macrophyte respiration, is restored through reaeration. Flow reduction at rapids, due to diversion, would reduce dissolved oxygen levels. Currently the macrophyte beds comprise up to 20 percent of the stream habitat in segments of the reach from May to October. Increased macrophyte density from increased sedimentation and reduced flow velocity could further intensify existing diurnal oxygen problems in the reach.

Operation of hydropower projects affects both fish and wildlife habitat. The timing and .nagnitude of bypass flows, ramping rates, and fluctuating pool elevations may have detrimental effects. Operation of hydroelectric facilities to meet peak energy demands induces rapid fluctuations in water level. Rapidly increasing or decreasing flows during project start-up or shutdown could strand fish and/or mollusks. Channel scour downstream of dams or powerhouses may have a significant impact on aquatic biota and channel stability. Decreases in mixing depths and rates from hydropower project operations may further reduce dissolved oxygen levels and pool habitat which is already limited to shallow depths. A large reduction in flows could make rapids impassable to sturgeon. Water fluctuation is expected to have adverse effects on nesting and feeding waterfowl.

Construction of structures and water impoundment may destroy wetlands and scarce riparian vegetation, a diminishing resource along the Upper Snake River that provides important habitat for deer, pheasant, waterfowl, and nongame birds. Backwater flooding with impoundments removes habitat and directly impacts fish, riparian, and wildlife resources. Fluctuating water levels may preclude development of shoreline vegetation, reduce shoreline use by riparian wildlife, and lower the spawning and rearing success of fish. Riparian vegetation provides cover, which in turn moderates water temperatures and increases rearing habitat for juvenile fish. Riparian habitat will also be indirectly affected by reduced river flow in reaches bypassed by diversions.

New transmission lines which cross the Snake River could be a collision hazard for birds, such as waterfowl and bald eagles, using the river valley as a flyway and /or using habitat in the Wildlife Management Areas.

Wildlife values may be impacted by disturbance to important habitat or wildlife during critical periods. Wildlife could be disrupted by construction or heavy recreation use. Heavy recreation use may also result in disturbance to wildlife and riparian areas, and erosion of fragile soils.

Recreation Development

New hydropower project proposals for the Middle Snake reach all include measures to increase and develop recreational access. Some projects would provide facilities, such as parking and boat ramps, where they are currently lacking. Developed access sites at new hydropower projects may increase use in the area, and/or change the natural character of some sites.

Many of the resource values attracting recreation use are fragile and susceptible to adverse impacts from recreation activities. Heavy recreation use may result in disturbance to wildlife and riparian areas and/or erosion of fragile soils.

Construction of a dam and water impoundment in the Lower Salmon Falls to Bliss Bridge segment, or the Bliss Dam to Clover Creek segment, would preclude substantial white-water boating use and opportunity. Diversions on other rapids in the Middle Snake reach may preclude future boating opportunities as well as potentially affect fishing, wildlife viewing, and scenic values.

Scenic Values

The impact of facilities construction in the river on scenic values, or natural settings with historical significance would be substantial. Dams, impoundments, weirs, structures, noise, power lines, and reduced flows in undeveloped areas would constitute a significant visual and recreational impact.

Employment and Tax Revenue

The Federal Energy Regulatory Commission may limit hydropower development in the Middle Snake reach in recognition of State designations that prohibit dams and the construction of hydropower projects.

If hydropower projects are precluded from the Middle Snake reach there would be a potential loss of construction jobs and tax revenues to counties. Hydropower projects create employment

through the construction of generating plants and the maintenance of facilities. Construction employment tends to be relatively short term in nature. Operations employment refers to the employees needed to maintain a facility. These employee requirements are less than those needed for construction, but the employment is longer term. Employee positions may last the lifetime of the power plant.

Excluding the Dike and Wiley hydropower projects, the five active FERC projects (Star Falls, Auger Falls, Boulder, Empire, and Kanaka Rapids) could generate approximately $21 million in wages for construction. Construction materials expenditures and the expenditures of construction workers would represent an additional beneficial short-term impact. This additional spending could stimulate some minor, secondary employment in the local retail trade and service sectors. Based upon estimated local expenditures, approximately $3 million in additional state revenues could originate from the proposed projects during construction.

An estimated 360 jobs could be provided by the proposed projects during construction. Permanent operations at the five projects would create eight jobs with annual wages of approximately $250,000. After completion of construction, yearly local taxes could total approximately $900,000 with State sales tax for power sales estimated at $200,000 annually.

Estimates for construction and operation are imprecise for the larger Dike and Wiley hydropower projects. However, an estimated 1,000 construction jobs paying $80 million in wages could be created by the two projects. Estimated additional tax revenues from local expenditures during construction are $7 million. Permanent operations at the two projects could create 27 jobs. Yearly local taxes from the two projects are estimated at $3 million, and state sales tax from power sales at $400,000.

Federal Designations

Under federal designation (Alternative F) a management plan for the river corridor (0.25 mile-wide on each side of the river) would be developed by either State or federal agencies, with public input, for designated segments, and must be approved by federal management agencies.

Under federal designation land uses and development on private lands within the river area which were in existence when the river was designated may continue. New land uses must be evaluated for their compatibility with the purposes of the Wild and Scenic Rivers Act. Where land use controls are necessary to protect river area values, the managing agency may utilize land-use control measures including zoning, scenic easements, and fee acquisition. Grazing and agricultural

activities could continue on public lands provided that these activities do not degrade the outstanding qualities of the river.

Federal "Recreational" designation does not impose new restrictions on existing mining operations, however, federal land within the corridor will be withdrawn from new mineral entry. Recreational use of the river may increase as a result of designation. Federal protection will preclude FERC licensing of hydropower projects on the Snake River in designated segments.

Intergovernmental Coordination

Other state, federal, and local entities have major roles in the regulation and institutional aspects of water use. Comprehensive plan consistency is one factor among several considered by the Water Resource Board in its policy decisions.

Agriculture - The Governor's Task Force on Idaho Agricultural Policy (1980) recommended that a thorough analysis be made of energy, water, and the immediate demand for specific crops before development of new agricultural lands is allowed. The recommendation is aimed at protecting farmers from falling crop prices due to oversupply, rising energy costs due to depleted streamflows, and overappropriation of water supplies.

Idaho Division of Environmental Quality (DEQ) - The DEQ maintains and enforces water quality standards. Under DEQ, the State Agriculture Water Quality Program (SAWQP), created in 1980, makes grants to Soil Conservation Districts to assist in the development of water quality plans, and for cost-sharing with farmers who apply Best Management Practices. The SAWQP projects are funded with dollars from the Water Pollution Control Fund and are intended to be demonstration projects which encourage farmers to adopt Best Management Practices. Projects are selected based on the water quality benefits. In the Middle Snake River area, there are currently three agricultural water quality projects funded under SAWQP: Cedar Draw, Vineyard Creek, and East Upper Deep Creek.

DEQ has identified segments of the Middle Snake reach as water-quality limited. Rather than mandate a Total Maximum Daily Load (TMDL) for the water quality limited reach, DEQ is seeking to model nutrient loading and the hydraulics of the river, and develop industry-specific nutrient management plans pursuant to the Nutrient Management Act of 1989. After approval by public and technical advisory committees, the plans will be sent to the Director of the Department of Health and Welfare for signature, and then returned to the industries for implementation. If the management

plans are deemed acceptable by the U.S. Environmental Protection Agency, a Total Maximum Daily Load would not be established.

Idaho Department of Fish and Game - IDFG is mandated to provide management direction in providing continued supplies of fish and fishing opportunities per state law. The key management goal of the Department's Fisheries Management Plan, (1991-1995), is maintaining and improving the quality of fish habitat. The plan calls for emphasis on coldwater fisheries due to the overwhelming preference of Idaho anglers for coldwater fisheries. Stream fisheries have a higher priority than lakes and reservoir fisheries, as they are preferred by anglers and are in shorter supply than lake and reservoir fisheries. The plans also identifies fish species of special concern. Included among these are white sturgeon and cutthroat trout, both of which have relevance to the Middle Snake.

Idaho Department of Lands - The State Board of Land Commissioners are mandated to manage State Trust lands for maximum financial return (Idaho Const. Art.9, § 8). Income from State Trust lands is used for public education in Idaho. Within the planning area most state lands are leased for grazing. However, the Department of Lands is initiating a planning effort for roughly 1500 acres of state land in the Perrine Bridge area, on the north side of the canyon. A draft plan is expected for public review in late 1993 (Kestie, 1992). An option that will be explored is leasing the lands for commercial development. Currently, the lands are leased for grazing, stockpiling by the Jerome Highway District, and for equipment storage by the Twin Falls Canal Company.

Counties and Cities - A very small portion of Elmore County is in the planning area; most under BLM jurisdiction. Private lands are used for irrigated agriculture. The County's comprehensive plan (1992 Draft) promotes the use of the Snake River as a "working river" with emphasis on agricultural development and multiple use.

The Gooding County Comprehensive Plan was adopted in 1975 and revised in 1985. It contains goals, objectives and policies for government and finance, public facilities and services, soil, mineral, water, wildlife, rangeland, agricultural, residential, commercial, industrial and recreation resources. Specifically, the plan promotes the protection of productive agricultural lands, and protection and conservation of water resources. Development within 300 feet of the canyon rim requires a special use permit. The plan encourages preservation of a greenbelt along the Snake River and promotion of undeveloped recreation as a principal attraction in the county.

The Jerome County Comprehensive Plan (1990) was prepared to establish policies regarding land use development and zoning. The plan contains guidelines for land use in terms of housing, commerce, industry, preservation and recreation. The plan identifies the need to preserve its agricultural base, and promotes conservation of soil, water, wildlife, and other natural resources.

The plan includes a provision for conserving surface water for irrigation, recreation, and wildlife uses. Land uses deemed appropriate in the county are mapped. In the planning area those uses are predominately agricultural with preservation areas described. These include preservation of areas with geologic hazards or excessive erosion potential, unique and historic structures, rehabilitation of gravel mining operations, and public access to the Snake River canyon rim. Accordingly, buildings are not allowed within 100 feet of the canyon rim unless development is proven to do no harm to resource values.

Twin Falls County is zoned for agriculture or outdoor recreation in the Snake River canyon. The County's Comprehensive Plan (1978) focuses on three issues: 1) protection of natural resources; 2) identification of land for municipal growth; and 3) identification of suitable areas for farm-residential development. The plan sets goals and policies to preserve agricultural and recreational resources which contribute to the economic base of the county, and encourages development and enhancement of recreational opportunities in the canyon. Urban development is promoted in close proximity to existing communities to protect productive agricultural land and reduce expenses for provision of services. The Twin Falls plan designates both Star Falls and Murtaugh Bridge as undeveloped recreation sites.

Middle Snake Study Group - A consortium comprised of county commissioners, planning and zoning commissioners, and a representative at large from Gooding, Jerome, Lincoln, and Twin Falls counties, initiated the development of a comprehensive management plan for the Snake River between Milner Dam and Bliss Dam. Protection and improvement of water quality in the Middle Snake reach is the plan's key objective.

The *Draft Coordinated Water Resource Management Plan for the Middle Snake River* sets out policies for water resources management. The plan seeks legislation which would allow communities to adopt ordinances which provide more local control of water quality and quantity issues; asks for the establishment of a water district in the Middle Snake spring discharge area, the installation of water measuring devices, and monitoring to ensure compliance with permitted water rights; seeks (1) minimum stream flows on all streams and springs flowing into the Middle Snake reach; (2) preservation of existing wetlands in the Middle Snake region; (3) maintenance of existing free-flowing stretches of the Middle Snake for recreation and fish and wildlife values; and (4) the restriction of further development in the region which will have negative impacts on the water quality of the Middle Snake reach.

Gooding County and Jerome County have adopted the *Coordinated Water Resource Management Plan for the Middle Snake River*.

U.S. Bureau of Land Management - The Bennett Hills, Jarbidge, and Snake River Resource Management Plans (RMP) establish a framework for managing BLM lands adjacent to the Middle Snake reach. A purpose of the RMPs is to indicate the level of resource protection, management, use and development provided for on public lands. Several areas adjacent to the Middle Snake reach are to be managed for protection of sensitive and significant wildlife habitat, scenic values, cultural resources, watershed, and other resources.

The Shoshone District BLM is the lead District for conducting wild and scenic river studies for the Middle Snake reach. The District is conducting eligibility studies as part of the resource management plan (RMP) for the Bennett Hills Resource Area. 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 reach 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.

An initial eligibility study has been completed for the Middle Snake reach. This analysis involved identification of free-flowing river segments possessing "outstandingly remarkable" geologic, scenic, recreational, fish, wildlife, historic, and/or cultural values. The District will present initial eligibility findings in its draft RMP expected to be available for public review in early 1993. The initial study led to the following eligibility findings:

- Milner Dam to backwaters of Twin Falls Reservoir - Scenic
- Lower Salmon Falls Dam to backwaters of Bliss Reservoir - Recreational
- Bliss Dam to confluence with King Hill Creek - Recreational
- Vineyard Creek - Scenic
- Box Canyon - Recreational

After a public comment period, a final RMP containing the final eligibility findings will be published. River reaches found eligible for suitability analysis will be managed under interim protection to preserve those values contributing to its eligibility.

Within one year of the date of a Record of Decision (ROD), the Shoshone District will coordinate suitability studies with the counties and state (Cordell, 1992). The suitability study will follow a process similar to the RMP with public scoping, publication of draft recommendations for public review, and issuance of final recommendations and ROD. The suitability analysis will consider the effects as well as alternatives to wild and scenic designation. Any recommendations will

be forwarded to Congress for its approval. Congressional approval is needed for a river to become a part of the National Wild and Scenic River System.

The BLM has completed two emigrant trail management plans for lands in Idaho. Both plans recommend and propose actions for the preservation and marking of trail remnants and historic sites, the establishment of visual corridors along trail remnants on public land to protect scenic values, the installation of interpretive signs, and the development of facilities to encourage and accommodate proper public use.

National Park Service - The Hagerman Fossil Beds National Monument was designated by Congress in 1988 for the purposes of preservation, education, research and display of paleontological resources (Public Law 100-696, § 301(a)). The National Park Service is currently preparing a land management plan for the Monument. The plan will include proposals for development of research, recreation and interpretive facilities. A plan is expected to be available for public review in early 1993.

In 1981, the National Park Service completed the Comprehensive Management and Use Plan for the Oregon National Historic Trail. Recommendations made in the NPS plan are designed to make a range of educational and recreation opportunities available to the public along the Oregon Trail. Component sites of the Historic Trail include Thousand Springs (Boise District, BLM), and the cross-country segments include the North Trail Segment (Elmore County) along the Middle Snake reach. Other historic sites, not on lands administered by the Federal government, qualifying as components of the Oregon National Historic Trail include (1) Caldron Linn (private), (2) Shoshone Falls (State of Idaho, City of Twin Falls), and (3) Kanaka Rapids (State of Idaho). In Idaho, the Bureau of Land Management (BLM) was designated as the lead agency for the implementation of the recommendations contained in the NPS plan.

Northwest Power Planning Council - The Northwest Power Planning Council (NPPC), an interstate compact agency, has authority to set policy for hydroelectric power generation, and fish and wildlife protection and enhancement in the Columbia River Basin. The Council supports the concept of protecting some streams and wildlife habitats from hydroelectric development, where such development would have major negative and irreversible impacts, and designates segments to be protected from new hydroelectric development (called protected areas).

The Northwest Power Planning Council named segments of the Middle Snake as protected areas based on their resident fish and wildlife values (NPPC, 1988). The Snake River from King Hill to Bliss Dam, and from the backwaters of Bliss Reservoir to Perrine Coulee, and Shoshone Falls Reservoir are identified as protected areas (Fig. 13). This designation amounts to a recommendation

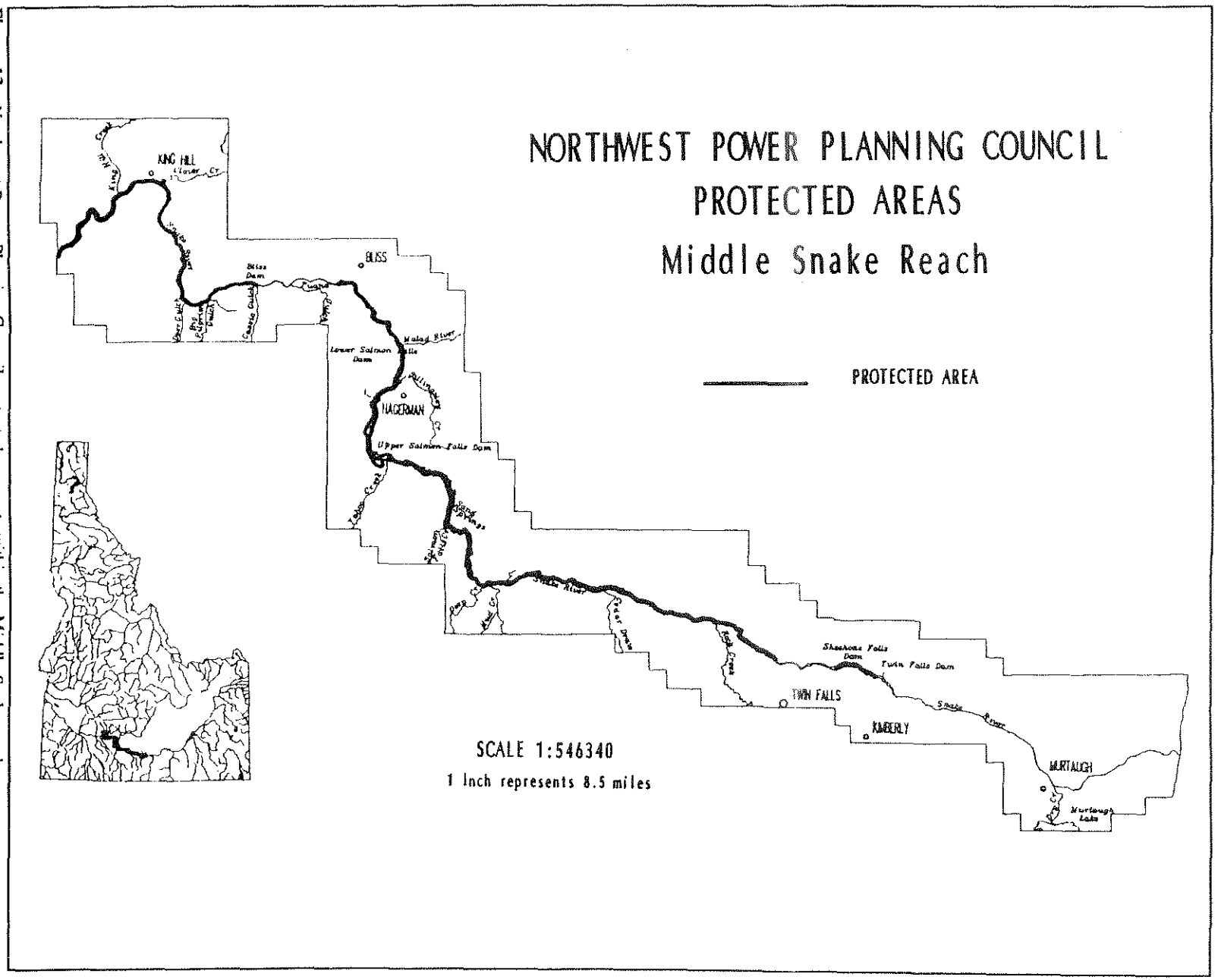

Figure 13. Northwest Power Planning Council protected segments within the Middle Snake reach.

to the Federal Energy Regulatory Commission that they not allow the construction of any hydropower facilities in the identified reaches.

The Council may review power project proposals in protected areas and may remove protected status or may grant exemptions. The Council granted exemption to the Auger Falls hydropower project on the Middle Snake reach. The exemption was granted on the condition that an agreement be reached between the developer and the Idaho Department of Fish and Game. The developer must show that the project will provide exceptional benefits to fish or wildlife. The Council considered, but did not change the designation for Box Canyon or Boulder Rapids. The Council deferred a decision on these projects until legal and biological agreements are reached between resource agencies and the developers.

Summary: Development, Improvement, and Conservation Opportunities

Trends in the economy of the state will affect water allocation policies, which in turn affect the feasibility of water resource projects and programs. While agriculture is the key economic factor in the region, the opportunities to expand irrigated acreage in the area using Snake River water appear severely limited. The Swan Falls Agreement stipulates that the Snake River is fully appropriated. Additional reliable water, particularly during the irrigation season, must come from those former Idaho Power claims now held in trust by the state. In concert with irrigation demands, hydropower production is now dependent on stream flow technological efficiency, or demand-side management. Suburban development, growth in new industries, and more emphasis on outdoor recreation will require additional water supplies. The Hagerman area is growing as a second-home, resort, and retirement locale. A factory center is developing on the southeast side of Jerome. On balance, the economic factors that will predominate will tend toward conservation and less water use for reasons of greater efficiency, cost reduction, and structural shifts in the economy.

An overwhelming concern about water quality has been expressed by residents of the area. Water quality problems in the Middle Snake reach are the consequence of low water flows and nutrient and sediment loading from agricultural runoff, hatchery discharge, municipal effluent, and degradation of inflowing groundwater. Water quality degradation detracts from the scenic character of the Snake River canyon, limits recreational opportunities on the river, and threatens diversions for beneficial uses in and downstream of the Middle Snake reach. The quality of fisheries, wetlands, and wildlife in the Middle Snake reach has declined and will continue to decline under present conditions.

FISH AND WILDLIFE

Statewide goals for Idaho's fishery emphasize the preservation of stream habitat and management of stream fisheries. New impoundments within the reach, continued water quality degradation, or a reduction of fish habitat due to diversions or dredging would conflict with state fishery policy.

SCENIC VALUES

Potential improvement opportunities for scenic resource values are flow increases in the reach, and water quality improvement. Tourist based economies in the Snake River drainage historically have been negatively affected by low water conditions. Water conservation measures coupled with leasing from the water bank, could provide water for higher flows in the river channel, if a balance can be realized between instream flow and flushing needs of the river and aquifer recharge. Most management actions taken to improve water quality will also result in improvement in the scenic values of the river, as long as these actions do not entail major alteration to landforms or addition of contrasting structures.

Relicensing of the Shoshone Falls project will entail close evaluation of enhanced flows over the falls. Other hydro-electric projects will also likely be required to examine minimum flows for scenic value preservation. Although Federal Energy Regulatory Commission (FERC) licensing and relicensing efforts have to date examined bypass flows in terms of visual impacts, the FERC needs to take a harder look at this issue by examining more flow levels and incorporating local perception into the analysis.

As with other resource values in the canyon, cumulative impacts to the scenic landscape are important. Current develop ient proposals would introduce contrasting structures, and modify the flow regime or distinctive features. Individually, these changes may be small, however, over the long term and as a whole, the scenic characteristics of the river canyon would be changed. Visual interest at these features would be diminished as water flow is reduced.

CULTURAL RESOURCES

Opportunities for development of cultural resource sites within the planning area involve interpretation of identified prehistoric and historic sites and occurrences, identification and excavation of sites to obtain additional information, and/or efforts to protect sites from vandalism and deterioration. Significant opportunities to interpret cultural resources exist in the Middle Snake reach. Cultural resource interpretation could economically benefit the region and local communities as part of its objective to promote and expand tourism in the region.

The Snake River canyon plays an important role in understanding the prehistoric and historic settlement of Southern Idaho. The visual and physical setting where these important events have occurred is being altered. Of particular concern are proposals at Kanaka Rapids and Star Falls where the visual setting is important to preserving its cultural value (Green, 1992). Visual impacts should be closely examined in any proposal located near important cultural resources.

RECREATION

The Middle Snake planning area possesses diverse and unique recreational characteristics as described in the Appendices. One of the major factors affecting outdoor recreation in the United States, and particularly in Idaho, is the large and rising demand. Recreational aspects of the state's water resources will play a major part in Idaho's future economy. Increases in recreational use of the Middle Snake reach, despite water quality degradation, signify demand for these resources.

Public scoping identified a need for increased access, more developed and interpretive facilities, preservation of greenbelts and natural areas along the river, and concern for the effects of overuse, low flows, and poor water quality. Point access on the river is plentiful in the planning area; numerous developed recreation facilities are within the river corridor. However, ownership patterns in many areas limit the opportunity for extensive trail systems. Given the lack of contiguous land access along the river, the waterway serves as a trail.

Boat and fishing access, trails, and interpretive facilities were most often identified as recreation facility needs. Facilities development as proposed in hydropower plans, may be beneficial in that area.

Natural settings which are easily accessible to the public are dwindling as more development occurs on the Snake. Preserving a diversity of recreational opportunities and settings on the Snake River insures a broad range of activities for all members of the public. While development needs to occur in some areas to protect resource values, or to provide opportunities which are currently lacking or in demand, continued development of day-use facilities proposed by most new hydropower projects cumulatively diminishes the recreational diversity of the reach. The most important issue from a recreation and aesthetics perspective is the replacement of natural settings with developed facilities available elsewhere in the reach.

As with other uses in the study area, the current water quality problems severely limit recreational uses. Water sports, particularly waterskiing, swimming, and boating are impeded by algal blooms and macrophyte growth in the late spring and summer. Water quality also impacts fish habitat, and thus fishing opportunities.

IRRIGATION

The likelihood of major water consumptive development in the planning area is not great, because all natural flow is considered appropriated above Swan Falls. If additional land is brought under irrigation, there may be a loss in hydropower generation since the water consumptively used by irrigation is not available for running through power plants. New consumptive diversions could also reduce the dilutive capacity of the river and aggravate water quality conditions.

Both generating capacity and energy demand have increased the value of water for energy production. Depleted streamflows reduce downstream hydropower generation and increase opportunity cost (value foregone). Additionally, irrigation demand may consume large amounts of electricity for pumping and pressuring sprinklers. A rise in the price of electricity, due to displacement of hydropower generation would affect the competitive position of irrigated agriculture in the state.

WATER DELIVERY

The *Draft Coordinated Water Resource Management Plan for the Middle Snake River* emphasizes a need for accurate measurement of water to limit diversion to approved amounts. The Director of the Department of Water Resources has immediate direction and control of the distribution of water from all natural water sources in this state to diverting facilities (Idaho Code 42-602). The Director may also create water districts on adjudicated streams or other sources, by entry of an order to administer uses of the water resource. Each water district created shall be considered an instrumentality of the State of Idaho for the purpose of performing the essential governmental function of distribution of water among appropriators under the laws of the State of Idaho (Idaho Code 42-604). The Director's order is subject to judicial review. The adjudication of the Snake River Basin will result in a water district covering the Middle Snake reach.

Both the Northside and Twin Falls canal companies are concerned about reduction of spring flow, above American Falls, to supply natural flow rights. Basinwide conjunctive use of the total water resource will become necessary if economic return to the State and local area is to be maximized as agricultural, industrial, and urban development continues. Surface and subsurface storage and withdrawals must be coordinated. The impact of stresses, both quantitative and qualitative, imposed on aquifer-stream systems by future demands of cities, irrigation, power generation, and other uses must be understood.

MINING

Sand and gravel excavation sites are plentiful in the planning region. An expansion in the industry would not require dredging the river bed for resources. Gold mining within the Middle Snake reach is currently not economically feasible. Other industrial mineral resources, available in the planning area, are not associated with the stream channel.

POWER DEVELOPMENT AND ENERGY CONSERVATION

Material in the latest regional Power Plan leads to several conclusions. First, it is evident that the best and most effective resource action to deal with underlying energy uncertainties is the acquisition of cost-effective conservation and efficiency improvements. All available conservation is needed in most future load scenarios, so an aggressive effort will be required to achieve the potential energy savings.

Second, to the extent that environmental concerns are likely to make it more difficult to utilize conventional thermal resources there is a need to continue efforts to clearly identify the technical potential and cost-effectiveness of renewable resources where they are available. Third, energy planning for a regional system must be done on a regional basis. Finally, regional planning must integrate other power sources, including natural gas. Whether used as fuel for combustion turbines to supplement existing hydropower, or used directly for space and water heating loads, it appears that the future energy needs of the State will be met through an increased reliance on natural gas (IPUC, 1991).

The electrical power surplus is effectively gone. While Idaho utilities are not part of the group which must acquire resources immediately, resource acquisition must seriously begin early in the 1990's. No one energy resource is likely to be sufficient to meet the varied needs of the state. Instead, the state will benefit most over the next two decades by pursuing the development of a variety of resources. Less conventional sources of electrical generation, geothermal waters, solar radiation, municipal waste recovery, wind, and cogeneration are likely options in Idaho's future energy mix.

The State of Idaho will be best served in first improving what it has. Through conservation and the upgrading of existing energy systems, either utility or industrial, the state has the best short-term opportunity to increase generating capacity and moderate the growth in demand. These measures are attractive because of their low cost, short lead-time, and flexibility. Conservation measures and efficiency improvements will be more economic, and have less negative environmental impacts than building new hydropower or thermal plants. Even with the added costs of incentives, the cost of conservation is still less expensive than avoided cost. The regionwide costs of

conservation are half the cost of acquiring the same amount of power from most other types of generation (NEN, 1992b).

In addition to lower costs, conservation creates employment through the installation of conservation measures. A University of Oregon study found that weatherization spending of $25.2 million between 1982 and 1986 generated $52 million in total net income to Lane County, Oregon (Conservation Monitor, 1992). Another study at Simon Fraser University in Vancouver, B.C., concluded that energy conservation has a greater economic benefit to the province than building new hydroelectric projects. The study found that conservation programs would increase income in the province by $762 million more than a specific hydroelectric project and create a greater number of jobs (NEN, 1991).

VI. ACTIONS AND RECOMMENDATIONS

In planning for the use of the water resources of the state, the Water Resource Board is charged with weighing and balancing competing uses and needs. Multi-objective resource planning necessarily involves making trade-offs aimed at achieving the greatest number and best combination of objectives, based upon the overall goals of planning. In theory, resource planning from a societal perspective would require the knowledge and use of the full costs and benefits, including external costs and benefits, of all resource options. In practice, much is unknown about the external costs and benefits of many resources. The quantification of environmental effects in monetary terms is often extremely difficult or impossible. As a result, judgment must often be exercised in resource planning to reflect external environmental and societal costs and benefits.

Plan Objectives

The Snake River is the engine that drives agriculture and industry in the Middle Snake region. But the river serves other values as well. The river is home to a rich variety of fish and wildlife and is a recreation area for residents. It is a place of scenic grandeur that enchants the eye and rejuvenates the spirit. The Idaho Water Resource Board, as its primary objective, would like to see the existing multiple-use mix along the reach maintained; development that would preclude or jeopardize existing beneficial uses or values would not be in the public interest.

Fish habitat in the Middle Snake reach should be protected. Specifically, the white sturgeon habitat below Bliss Dam must be protected to preserve the wild, naturally-reproducing population

existing there. Policy 2D of the State Water Plan states that sturgeon habitat in the Snake and Kootenai Rivers should be protected. The Bliss Dam to C.J. Strike river reach is specifically mentioned in the policy discussion. Most fish prefer to rest in pools during the day. Sturgeon particularly like deep pools. Hill (1991) found the largest and deepest pools to be directly below rapids in the Middle Snake reach. The cutthroat trout fishery above Twin Falls Dam and its spawning habitat in Vineyard Creek also warrant special consideration.

The Water Board believes that the Middle Snake region can contribute additional resources to meet the state's future energy needs. Conservation acquisition, capacity expansion at existing facilities, and a contribution by new hydropower plants on the existing canal system should be the first priorities. An accelerated program in conservation and efficiency improvements can in fact increase the state's generation margin. This course buys time, limits new demands on the environment and is the most cost-effective choice.

The diversity of recreation opportunities available in the canyon must provide for the greatest range of recreation users. In view of the recent increase in the number of whitewater boaters, the Board supports preservation of this recreational opportunity. Special emphasis should be placed on those reaches where the state has licensed outfitters to provide this type of outdoor experience for those lacking the requisite skills and equipment to participate on their own. Where appropriate, additional facilities such as picnic areas and ramps should be developed.

As a long-term goal, the Water Board will work toward higher river flows during the summer months. The Idaho Water Resource Board would like to see more than a zero flow at Milner and will continue to examine options to secure flow throughout the year at the dam or main powerhouse. Increased flows would improve some aspects of water quality and fish habitat, and restore some of the scenic beauty to Twin Falls, Shoshone Falls, and many of the smaller, less famous waterfalls within the reach. At this time, there is no ready mechanism to provide this water. Increased irrigation efficiency could lead to increased operational flexibility in the Snake River, and perhaps more water through the Middle Snake reach during low-flow periods as a byproduct of rental pool use by Idaho Power.

A limited number of dredge mining operations might be acceptable, but the cumulative effect of a number of such operations must have an adverse impact on fishery habitat. Dredging may impact water quality with sediment displacement. Under current conditions dredging within the Middle Snake reach should be restricted to current rights.

Based on local concern, the single overriding consideration in developing a comprehensive plan for this reach of river is water quality and protection of the remaining falls and rapids within the

reach. Preventing changes to river equilibrium will maintain the free-flowing character of the Middle Snake reach and reduce additional impacts to water quality. Forestalling or reversing environmental degradation cannot be realized as long as the Snake River resources are allocated on a piecemeal basis. Although a single, small project may have only a small effect, it is necessary to consider the cumulative effects if a number of projects are developed on the same river or stream. More attention needs to be paid to cumulative impacts, the assimilation capacity of the river, and coordinated allocation of water resources, both ground and surface water.

Public comments also indicate a desire to minimize additional visual changes to the river canyon, particularly in natural or undeveloped areas. To accomplish this objective, visual changes in remaining free-flowing sections of the river and other natural landscapes must be minimized.

Designations

No action by the Board would run contrary to the coordinated efforts of local government to improve the water quality of the Middle Snake reach. In making protected river designations the Board must weigh development, improvement, and conservation opportunities. The Board believes State protected river designations are preferable to federal protection, and are in the best interest of the residents of the State of Idaho. Federal protection limits the flexibility of planning for the reach, and removes the option of amending the designation by action of the Water Resource Board and the Idaho Legislature.

Actions of the Board are consistent with the Idaho Code, private property rights, local and state management plans, the local *Coordinated Water Resource Management Plan for the Middle Snake River* adopted by Gooding and Jerome counties, and public comment garnered at the Public Scoping meetings, through the local Advisory Group, and the public hearings. The Board considered impacts of protection, improvement, and development on the social, economic, and environmental livelihood of the region, and makes the following designations and recommendations in the public interest.

In order to protect current resource use, and the multiple-use character of the Middle Snake reach, and recognizing that no action by the Idaho Water Resource Board using their comprehensive water planning authorities can interfere with vested rights, or the repair, replacement, or continued operation of existing facilities or works, the Idaho Water Resource Board takes the following action (Fig. 14):

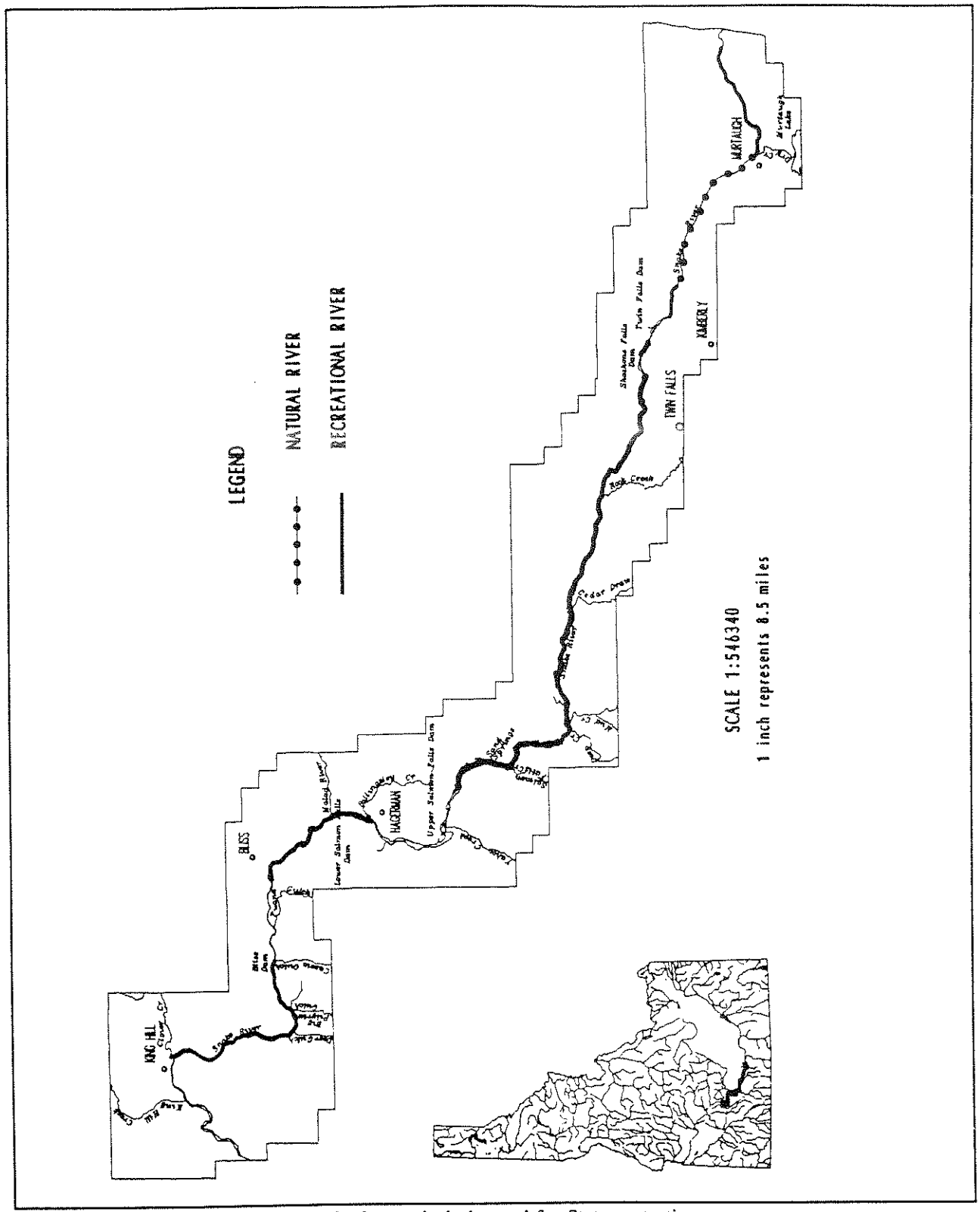

Figure 14. Segments of the Middle Snake reach designated for State protection.

1) Designates the Snake River from the downstream project boundary of the Milner Hydroelectric Project, (approximately 700 feet downstream from the Idaho Power Company main Milner powerhouse), River Mile 637, to a point 100 feet downstream of the Murtaugh Bridge "Recreational" (7 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations which do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

2) Designates the Snake River 100 feet downstream of the Murtaugh Bridge to a point 100 feet upstream of the Hansen Bridge as "Natural" (9.5 miles). Within the segment the Board prohibits 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.

3) Designates the Snake River 100 feet upstream of Hansen Bridge to the upstream project boundary of Twin Falls Hydroelectric Project [River Mile 619.5, the east boundary of Lot 5, Section 10, T10S, R18E, B.M.] "Recreational" (2 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

4) Designates the Snake River from the downstream project boundary of the Twin Falls Hydroelectric Project [River Mile 617] to the confluence of the western most spring flow from the Devil's Corral spring area [River Mile 616] "Recreational" (1 mile). State protection of this segment

shall in no way impede relicensing of the Shoshone Falls Hydroelectric Project, or an expansion of the Shoshone Falls Hydroelectric Project boundary that would not result in any change in the size of the impoundment or in reservoir elevation. Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations which do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

5) Designates the Snake River from River Mile 614.4 (approximately 800 feet downstream from the Shoshone Falls powerhouse) to the Highway 30 Bridge "Recreational" (32 miles). The licensed Auger Falls Hydroelectric Project, FERC #4797, is exempt from the prohibitions of this designation. A permit to appropriate water for the Boulder Rapids Hydroelectric Project, FERC #10772, was approved in May 1984 with extensions for proof of beneficial use authorized in 1989 and 1993. A public hearing, held in response to a request for exemption from interim protection designation prohibitions, identified significant public concern that the Boulder Rapids development would preclude or jeopardize existing beneficial uses. However, Idaho Code 42-1734F(1) states that prohibitions promulgated pursuant to State designation of protected rivers shall not limit, restrict, or conflict with approved applications for the appropriation of water.

Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

6) Designates the Snake River from the downstream project boundary of the Lower Salmon Falls Hydroelectric Project [River Mile 573] to the upstream project boundary of the Bliss Hydroelectric Project [River Mile 565.5] "Recreational" (8 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

7) Designates the Snake River from the downstream project boundary of the Bliss Hydroelectric Project [River Mile 560] to the confluence of Clover Creek "Recreational" (12 miles). Within the segment the Board prohibits construction or expansion of dams or impoundments; construction of hydropower projects; 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 new diversion works; and (4) for construction of new public access facilities and fishery enhancement structures. Construction of private river access facilities (i.e., boat docks) may be allowed with Idaho Water Resource Board and other regulatory agencies' approval. New diversion works are limited to pump installations that do not create an obstruction in the river; are to supply water for domestic, commercial, or municipal uses; are visually blended with the surroundings so as to be less noticeable from the river; and are constructed to minimize harm to fish and wildlife.

It is the policy of the Board to amend the water plan when it determines that amendments are in the public interest. The Board will consider proposals for amendment to the 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 follow the procedures required for the adoption of the original plan (Sections 42-1734A and B, *Idaho Code*). In addition, the Board shall review and reevaluate the Comprehensive State Water Plan at least every five years (Section 42-1734B(7).

Plan Recommendations

The Middle Snake River reach receives major nutrient, sediment, bacteria, and chemical loadings from a number of sources. Studies attempting to quantify the impacts of existing impoundments, fish hatchery effluent, sewage outflows, and agricultural return flows must be supported and continued. Planning for the various uses of water requires an understanding of the water quality impacts of the different competing uses.

In order to address water quality standard violations on the Snake River, the Division of Environmental Quality has initiated development of a water quality management plan under the Idaho Nutrient Management Act (Idaho Code 39-105(3)(o)). At the core of the overall plan will be industry-specific nutrient management plans. These plans are to contain both short and long-term actions, monitoring to demonstrate plan implementation and effectiveness, and mechanisms to ensure compliance.

- The Board supports development of a Nutrient Management Plan under the direction of the Division of Environmental Quality to improve water quality of the Middle Snake reach. The State's Water Pollution Control Account should be used to support planning, education, monitoring, and enforcement of water quality standards on the Middle Snake reach.

- The Board recommends studying methods for increasing flows during low-flow periods through the Middle Snake reach.

- The Board recommends examination of the need for additional protection of spring flows in a Snake River Plain Aquifer Plan, in light of concerns about reduced spring discharges into the Middle Snake reach, and declining ground water levels. The water quality and quantity aspects of conjunctively used stream-aquifer systems must also be understood.

It is the policy of the State of Idaho (Energy Plan, 1982) that private and public utility companies place a high priority on conservation, full development of generation at existing dams and hydropower facilities, and development of other renewable resources.

- The Board encourages the Idaho Public Utilities Commission to continue, through its regulatory authority, to encourage energy conservation and the commercialization of cost-effective alternative energy systems.

- The Board encourages the investigation of the feasibility of hydropower development on canals and return flows not associated with natural springs in the Middle Snake reach.

- The Board supports testing and implementation of new technology to increase hydropower potential.

Under the traditional form of ratemaking, a utility loses money for each kilowatt-hour conserved, even though conservation may be the utility's least-cost investment in the long term. If it reduces sales, a private utility loses some of the revenues it needs to cover fixed costs and pay a return to its stockholders. This effect creates a strong short-term disincentive to conservation, and an incentive to promote sales.

- The Board encourages the Idaho Public Utilities Commission to investigate regulatory models in which utility revenues and profits are linked to some measure other than kilowatt-hour sales (decoupling), to remove financial disincentives that utilities face when they cost-effectively save kilowatt-hours.

Local counties of the Middle Snake region have worked hard to address problems related to water quality and water supply. Intergovernmental cooperation is crucial to planning and implementation of measures to develop, improve, and conserve the water resources of the region.

- The Board encourages cooperation with local government entities in identifying water distribution and water pollution problems.

- The Board encourages counties to more forcibly address the problem of unauthorized disposal of rubbish into the canyon.

Glossary

Acre-foot - the volume of water required to cover 1 acre of land (43,560 ft-2) to a depth of 1 foot; this is equivalent to 325,851 gallons.

Adjudication - a process generally delineated along watershed or basin lines which examines the validity of all water rights and claims, and certifies valid claims in a state court.

Allocation - the process of legally encumbering specific amounts of the water resource for application to specific beneficial uses.

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

Alluvial plain - a plain resulting from the deposition of alluvium by water. In the southwestern United States most alluvial plains are formed by streams having a considerable grade, and hence are generally referred to as alluvial slopes.

Alluvium - soil material, such as sand, silt and clay that has been deposited on land surface by water.

Anadromous - fish species, such as salmon, that spend most of their adult life in the ocean and migrate to fresh water to spawn.

Available water-holding capacity - the capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the welting coefficient, or about 15 atmospheres of tension.

Avoided cost - the price utilities are required to pay for electricity generated by qualifying facilities operating under the Public Utilities Regulatory Policies Act (PURPA) of 1978. Avoided cost represents an estimate of the cost of power that the utility would have to generate or buy from another source.

Base flow - in hydrology, a level of streamflow sustained during dry weather by ground water discharging to the stream.

Beneficial use - a set of uses of water which are deemed by law to provide legitimate bases for a water right.

Benthic invertebrates - organisms that typically live on the bottoms of streams and lakes.

Best management practices - The state-of-the-art practices that are efficient and effective, practical, economical, and environmentally sound.

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.

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

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.

Cumulative effects - the combined environmental or social impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effects can be severe.

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 within municipal boundaries, which are not usually identified separately in available records of water use.

Industrial - water used to manufacture products. Places of industrial use in the Middle Snake region include meat packing, dairies, cheese factories, other food processing enterprises, gravel washing, and ready-mix concrete operations.

Decoupling - is a general regulatory model in which utility revenues and profits are linked to some measure other than kilowatt-hour sales. The objective of decoupling is the removal of the financial disincentive that utilities face when they cost-effectively save kilowatt-hours. With decoupling, a utility will receive the same base revenues between general rate cases even if it sells fewer kilowatt-hours.

Demand-side management - strategies which seek to change consumer behavior to reduce demand, e.g., offering financial incentives, providing education, or direct installation of efficient technologies.

Dewatering - elimination of water from a lake, river, stream or reservoir.

Diversion - taking water from a stream or other body of water into a canal, pipe, or other conduit. The physical structure for the removal of water from a stream channel.

Electric power system - physically connected electric generating, transmission, and distribution facilities operated as a unit under one control.

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.

Federal Energy Regulatory Commission (FERC) - 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.

Fishery enhancement structures - structures deliberately placed within a waterway, under proper authority, to improve fish habitat.

Highwater line (mark) - 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.

Independent power producers - non-utility owned electric resources.

Interim protected river - a waterway designated pursuant to 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.

Irrigation - water used for irrigation of cropland. Residential lawn and garden uses are not included.

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.

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

Macrophyte - any large plant that can be seen without the aid of a microscope or magnifying device; an aquatic vascular plant.

Mainstem - the main channel of a river.

Megawatt (MW) - unit of electrical power equal to 1,000,000 watts, or about 1,340 horsepower.

Mill - a monetary cost and billing unit used by utilities; it is equal to 1/1000 of the U.S. dollar (equivalent to 1/10 of one cent)"

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.

NPDES - National Pollutant Discharge Elimination System.

Peak load - the maximum load in a stated period of time. The peaking portion of the load is that portion of the load that occurs for less than 8 hours per day.

Penstock - a conduit used to convey water under pressure to the turbines of a hydroelectric plant.

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.

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 Utility Regulatory Policies Act of 1978 (PURPA) - federal legislation that, in part, requires utilities to purchase electricity from qualified independent power producers at a price that reflects what the utilities would have to pay for the construction of new generating resources. Portions of the act were designed to encourage the development of small-scale cogeneration and renewable resources.

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 powerplant. 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.

Relicensing - the administrative proceeding in which FERC, in consultation with other Federal and State agencies, decides whether and on what terms to issue a new license for an existing hydroelectric project at the expiration of the original license.

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).

River corridor - the area along each side of the river that is being studied.

Riparian vegetation - vegetation that is associated with aquatic (streams, rivers, lakes) habitats.

Secondary systems - pressurized lawn and garden irrigation systems using untreated water for irrigation of lawns, gardens, and publicly owned open areas.

Trust water - refers to Idaho Power water rights subordinated to certain upstream uses as a result of the Swan Falls settlement.

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 with essential physiological functions of fish and other aquatic organisms.

Vested rights - those rights that are fixed and not contingent upon any future actions. For example, 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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COMPREHENSIVE STATE WATER PLAN

Appendices
Snake River: Milner Dam to King Hill

Idaho Water Resource Board

F. Dave Rydalch, Chairman
Clarence A. Parr, Vice-Chairman
Gene M. Gray, Secretary
Brent J. Bell
David J. Erickson
Kenneth E. Hungerford
Joseph L. Jordan
Mike Satterwhite

March 17, 1993

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APPENDIX A

Middle Snake Advisory Group

Many special interest groups, private organizations, and political entities have a major interest in the Middle Snake plan. In order to involve local participation in the early stages of the planning process, a local planning advisory group was formed. Sixteen local individuals with an interest in state water planning were invited to help coordinate local input throughout the plan formulation phases, and review and comment on evaluation studies and plan alternatives.

1.	Hydropower - Idaho Power Company	Roger Fuhrman
2.	Idaho Aquaculture Association	Harold Johnson
3.	North Side Canal Company	John Beukers
4.	Twin Falls Canal Company	Chuck Coiner
5.	King Hill Irrigation District	Gary Stiehl
6.	Outfitters & Guides	Randy McBride
7.	Idaho Wildlife Federation	Donald Zuck
8.	Idaho Rivers United	Gail Ater
9.	Hagerman Valley Citizen Alert	Carter Wilson
10	Mining	Keith Sligar
11.	Twin Falls Chamber of Commerce (Oregon Trail Commission)	Kent Just
12.	Gooding County (Middle Snake Study Group)	Bob Muffley
13.	Jerome County (Middle Snake Study Group)	Veronica Lierman
14.	Twin Falls County (Middle Snake Study Group)	Marvin Hempleman
15.	Local energy & conservation activist	Bill Chisholm
16.	Association of Soil Conservation Districts (Middle Snake Study Group)	Gary Grindstaff

ADVISORY GROUP MEETINGS

1. Thursday, January 30, 1992, 7:30 p.m.
Jerome County Courthouse, Jerome, ID

Bill Graham, Planning Section Manager for the Idaho Department of Water Resources, introduced himself, Ruth Schellbach, lead-planner for the Middle Snake, and two members of the Idaho Water Resource Board, Clarence Parr and Don Kramer.

After a round of self-introductions by Advisory Group members, B. Graham spoke briefly about two hand-outs, (1) a short description of what the Middle Snake plan will address and (2) a flow chart outlining the planning process.

R. Schellbach passed-out a tentative schedule for the Middle Snake plan and a list of resource attributes the planning staff will be assembling for the GIS mapping.

The Advisory Group decided that public "scoping" meetings were important to the planning process and two meetings should be held in the area: one at Hagerman, and one at Twin Falls.

Each Advisory Group member was asked to briefly voice important issues concerning the Board's plan for the Middle Snake. Each member spoke and their concerns were recorded as follows:

Local Issues and Concerns:

(1) Bypass flows at hydro projects.
(2) Remove nutrients and sediments from the river.
(3) Quantity and quality of tributaries.
(4) Enforcement of water rights/diversions.
(5) River pollution/water quality (macrophytes).
(6) Conservation-based energy policy. Inventory, assess, and prioritize.
(7) Assess individual pollution sources.
(8) Concern for recreational and aesthetic aspects.
(9) Flexibility in power production at existing and future hydro sites.
(10) Tourist and recreational concerns: Shoshone Falls, Murtaugh whitewater, Pillar Falls.
(11) Good-quality spring water.
(12) Balanced, conscientious planning approach.
(13) Continue to implement Agricultural BMPs to enhance quality of return flows.
(14) Enhance river flows by shaping storage releases.
(15) Consider Middle Snake Study Group plan.

2. Thursday, April 16, 1992, 7:00 p.m.
KMVT Community Room, Twin Falls, ID

The topic for the meeting was water quality. Ruth Schellbach, Idaho Dept of Water Resources, introduced Chuck Brockway, Tim Litke, and Bob Muffley as the evening speakers.

Dr. Chuck Brockway, [University of Idaho, Kimberly Research Station], spoke first about the 1990-91 water quality monitoring study of the Middle Snake reach. Concurrent sampling of 55 sites, including 13 instream sites, effluent from 10 fish hatcheries, 19 irrigation return flow streams, and 13 tributary streams, was conducted for the period June 1, 1990 through July 25, 1991.

Findings from the study indicate that the Middle Snake reach accumulates and transports up to 30 tons/day of nitrate+nitrite nitrogen, two tons/day of Phosphate as phosphorus, and 350 tons/day of suspended solids. During the study period, over 13,000 tons of sediment accumulated in the reach. Nitrate+nitrite nitrogen, phosphorus concentrations, and water temperature exceed guidelines or adopted water quality criteria for the designated beneficial uses in the main stem of the Snake River. Low river flows at Milner and decreased spring inflow during the last five years have exacerbated the algae and macrophyte problems in the reach. The study data will be utilized in a river water quality model being developed by the U.S. Environmental Protection Agency.

Dr. Tim Litke [Idaho Dept of Health and Welfare, Division of Environmental Quality] showed slides that illustrate water quality problems on the Middle Snake reach, and then briefly described his agency's responsibilities in the development of a Nutrient Management Plan. Four committees, representing general public and industry interests, have been established to work with the DEQ.

The DEQ must develop a Total Maximum Daily Load for the Middle Snake reach between Shoshone Falls and Lower Salmon Dam. The first step is to determine what the river can assimilate and then load allowances for point discharges and Best Management Practices (BMPs) for non-point sources will be adjusted.

Bob Muffley briefly described the purpose of the Middle Snake Study Group and their Draft Plan. The Middle Snake Study Group, is a joint effort among the counties of Gooding, Jerome, Lincoln, and Twin Falls to address water quality problems within the four-county area and ultimately enhance the water quality in the Middle Snake reach. The group is made up of one County Commissioner, one Planning and Zoning member, and one public member from each of the four counties. The Draft Plan is a water resource management plan which will help direct local, state, and

national resources, as well as formulate recommendations for changes in state and local laws, ordinances, and regulations.

3. Thursday, May 21, 1992, 7:00 p.m.
Hagerman Senior Citizens' Center, Hagerman, ID

The topic for the meeting was "Diverting Water for Beneficial Uses". Roger Fuhrman - Idaho Power Company, Harold Johnson - Idaho Aquaculture Association, and Chuck Coiner, John Beukers, & Gary Stiehl - Twin Falls & North Side Canal Companies, and King Hill Irrigation District respectively, were the meeting speakers. The meeting was both an educational forum and a platform to air issues and ask questions.

Roger Fuhrman touched on several topics. Keynotes were the obligation to provide electric power at a low cost and the increasing demand for power with population growth; river fluctuations; power sales; relicensing activities; new resources for power; the Wiley project; and conservation. Fuhrman also noted that Idaho Power is concerned with flexibility for future power production development, and would like to help with wording that would specifically call for the reevaluation of the hydro potential of the reach for future needs. Idaho Power would like interim protection for the Wiley reach to continue through 1994, and calls for the Comprehensive Plan to state that the plan cannot be used to pursue federal "Wild and Scenic" river designations.

Harold Johnson spoke about the aquaculture industry and its contribution to the economy of the area in terms of employment and revenue. Primary concerns of the aquaculture industry are "mining" of the Snake Plain aquifer and a subsequent reduction in north side spring flows on which the industry is dependent. The industry is also concerned with development limitations exercised by the DEQ due to the water quality conditions of the Snake River. Johnson invited everyone to tour local aquaculture facilities. (If you are interested in a tour, please get in touch with Harold).

Chuck Coiner, John Beukers, and Gary Stiehl covered irrigation development and issues. Coiner concentrated on the new Milner power plant and water quality projects the canal company is building. Ted Diehl presented a brief history of the North Side Canal Company. Conversion to sprinklers and hydropower development were a focus of his talk. Concerns for water planning focused on recharge vs. water conservation. Stiehl described the extent of the King Hill Irrigation District and talked about screen cleaning problems associated with their pumps on the Snake River. The District has spent $62,000 on cleaning at Glenns Ferry alone.

4. Wednesday, September 30, 7:00 p.m. - 9:40 p.m.
Jerome County Courthouse, Jerome, ID

This meeting covered the "Screening" step in the planning process. Agency personnel presented their inventories and evaluations of the reach in regard to fish and wildlife, recreation, geologic and scenic resources. This evaluation or "screening" considered the uniqueness, rarity or significance of the resource; 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. Maps displayed the findings.

The meeting also served as an opportunity for the planning staff to receive input from the Advisory Group and the attending public about the inventories and evaluation. Comments on the evaluations provided by Advisory Group members or members of the public were recorded and are listed below:

Comments on Inventory and Evaluation Maps

Cultural Resources

- Upstream of Shoshone Falls - Depression era mining
- Murtaugh Bridge to Milner Dam - Chinese mining sites - Ron James
  [Twin Falls - Robert Stuart Jr. High]

Recreation

- Note Clear Lakes Bridge Pull-Out
- Concerned Citizens For Caldron Linn - Conducting Recreation Survey - average of six people per day, April-November at Star Falls; Activities - fishing; target practice; pictures; rock climbing; see historic features; sightseeing.

Geologic Features

- Whole canyon is significant; present canyon is a remnant of the former Snake. Shoshone and Twin Falls were probably much higher. From Twin Falls downstream, probably giant cataracts.
- Contact Larry Dee (retired BLM geologist) now living in Idaho Falls.

Fish and Wildlife, Biological Communities

- Extend outstanding evaluation to Shoshone Falls.
- Niagara WMA - excellent diversity of game, e.g. rabbits, deer, pheasant, beaver, muskrat, skunks, etc.; excellent duck populations - mallard, wood duck, g.w. teal, some canvasback.
- Idaho Power Company is inventorying wetland/riparian vegetation from Twin Falls to C.J. Strike.
- Get better wildlife species representation.

1) turkey - Niagara WMA
2) waterfowl, shorebirds

- Hagerman WMA waterfowl populations at 200,000+.
- Perrine Bridge to Lower Salmon Falls tremendous waterfowl populations (fall)
- Better wildlife assessment above Shoshone:
  1) 25-30 deer at Star Falls area
  2) Star Falls P.A. studies (B&C Energy)
  3) IWT studies - BLM [Gary Wright]
  4) Fox, coyotes, beaver, etc. (springs area)
  5) Bobcat, Mountain Lion (Star Falls)
- Need trout assessment for public
- Rock Creek returning as a spawning stream - Cedar Draw/Salmon Falls Creek

Chuck Coiner and Gail Ater briefly discussed water flows needed for the Milner and Murtaugh segments - what is and is not "floatable" in regard to rating the stretch for outstanding recreation.

5. Tuesday, October 20, 7:00 p.m. - 9:40 p.m.
Jerome County Courthouse, Jerome, ID

R. Schellbach presented five alternatives addressing actions and recommendations the Idaho Water Resource Board might take for the Middle Snake plan. A hand-out given to the Advisory Group members summarized the five alternatives.

Advisory Group members were asked to comment on each alternative. Comments were summarized and recorded, and are included in these meeting minutes. A sixth alternative was constructed in response to Advisory Group comments. A summary of that alternative is included with these minutes. Additional comments Advisory Group members may wish to submit should be sent to R. Schellbach in the next two weeks.

Comments on Alternative Actions and Recommendations

ALTERNATIVE - No Action

- Public wouldn't look at it as an Alternative.
- Not a good Alternative after all this input and time.
- This is a reasonable Alternative because more governmental intervention will not necessarily solve the problem.

ALTERNATIVE - Protect All Outstanding Segments

- Community at large pays for small minority that can boat 1.6 mile boating stretch by protecting that stretch. Cost of supplying water to boat Milner segment exceeds its value.
- Too encompassing - covers too much of the river.
- Concerned about availability of energy development options with this Alternative.
- Need to take all encompassing look at the river. We need to stop everything - look at it, and then correct. Need to be fair to everyone.
- Totally undefensible.
- Lower Salmon Falls Reservoir will receive significant use because of National Monument - should receive the highest protection.
- Too encompassing.
- Refine to protect "truly outstanding" sections - look at sections that have been designated Outstanding for more than one resource. [Staff Note: We looked at the evaluation maps. All Outstanding segments are so classified for more than one resource.]

ALTERNATIVE - Protect All Free-Flowing Segments

- Too all encompassing. People are saying they want to protect the remaining falls and rapids on the river. This Alternative supports the Middle Snake Study Group Plan, but on the map it's too much.
- Too all encompassing and there are energy development concerns.
- Too inclusive. People want to protect the rapids, and falls. This Alternative goes beyond that.
- Some reservoirs have outstanding values (scenery, geology and recreation opportunities).
- Idaho Power Co. may be neutral on designation for Lower Salmon Falls Reservoir, but R. Fuhrman will check this out and respond formally to R. Schellbach.

ALTERNATIVE - Hydropower Allowances

- Not encompassing enough from a public-input perspective.
- It's better, but I still prefer the No Action Alternative - the bureaucracy is large enough.
- Not encompassing enough - public is looking for more.
- It stinks.
- Doesn't address public concerns.
- Doesn't protect rapids.

[Staff Note: no recorded comment from Idaho Power Company - R. Fuhrman will respond formally to IDWR].

ALTERNATIVE - Federal Protection

- River management can be better addressed by state protection rather than federal protection. This Alternative does not protect sections the public would want protected.
- Idaho Power Co wouldn't be able to build any hydro projects with federal designation.
- I like this Alternative. State proposal should add three rapids area (Boulder, Empire, Kanaka). But as a public official I would have to go with State protection of all Outstanding segments, or all free-flowing segments.
- This Alternative does not give us the best combination.

- It's stretching it to say that the Middle Snake is Wild and Scenic status worthy.
- Don't need another level of study on the Snake River.
- The whole river is useful for passive recreation from many perspectives.
- I feel more comfortable with this Alternative than with the State protection designations. The No Action Alternative is still best.

NEW ALTERNATIVE - Protect Rapids and Falls

- Make this Alternative like the federal designations, with the addition of the three rapids (Boulder, Empire, Kanaka) as a state plan, not federal.
- Don't want any more power facilities. Public wishes to protect remaining rapids/falls.
- Because of flexibility, a state plan like the BLM proposals with the three rapids area is the best combination.
- Start protection in the Milner segment below the main Idaho Power Co. power plant.
- Need to add protection of Lower Salmon Falls Reservoir for the Hagerman Fossil Beds.
- Idaho Power Co. questions what kinds of regulations go with protection designations.
- Flat-water stretches are important too for wildlife habitat, and from a scenic viewpoint. The Outstanding values encompass more than just the rapids.

- Public would prefer state management.
- Ideal objective: Authority with FERC, but state flexibility to change plan.
- Throw out federal protection Alternative. All Outstanding reaches might be too much, but on second look, it's defensible.
- The Middle Snake Study Group Plan is in line with the All Outstanding Reaches Alternative or All Free-Flowing Segments Alternative.
- Idaho Aquaculture Association members prefer "No Action."

Recommendations

- Shaping upstream flows may be an impingement on Idaho Power Co's property rights.
- Counties would like more input into water allocation issues (i.e., water diversions and water pollution).
- Excellent idea to protect spring flows.
- Protection of senior water rights: the policy now seems to be to sacrifice senior water rights for junior rights.
- Enforcement of injection well regulations and monitoring to protect ground water.
- There are conflicts with protection of spring flows and encouraging water conservation: should we restrict sprinklers? That increases water quality problems.

APPENDIX B

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I. AREA OVERVIEW

The Snake River from Milner Dam to the community of King Hill, Idaho is here defined as the Middle Snake reach. In the planning area the Snake River forms the boundary between Twin Falls County to the south, and Jerome and Gooding counties to the north. On the western edge of the reach the river flows through Elmore County (Fig. 1).

TOPOGRAPHY AND GEOLOGY

From Milner Dam to the community of King Hill, Idaho, the Snake River flows through a deep, often vertical-walled basalt canyon cut into the Snake River Plain. The Snake River Plain, part of the Columbia Intermontane physiographic province, is an arcuate depression, extending 400 miles across the southern portion of Idaho. It is moderately level, sloping from east to west; occasionally the low relief is broken by the occurrence of buttes. The present course of the Snake River is along the southern portion of the Snake River Plain.

The Snake River may have begun cutting its present canyon about 500,000 years ago (Covington, 1976). Immediately above Milner Dam the Snake's river bed is slightly below the level of the Snake River Plain, but in the 22 mile stretch below the dam, the river has cut a canyon 400 feet deep. At Shoshone Falls the river drops another 212 feet. Scab-land topography near the falls is associated with the Bonneville Flood. Approximately 15,000 years ago, overflow from the Pleistocene Lake Bonneville scoured the Snake River Canyon. The flood water swept the canyon and adjacent uplands of rock debris, eroding alcoves and scablands, and depositing huge bars of sand and gravel with boulders over 10 feet in diameter. Most rapids in the area are a result of a large number of boulders deposited at or below a slight widening of the canyon during the Bonneville Flood.

From Twin Falls to King Hill, the river remains 400 to 600 feet below the general elevation of the Snake River Plain. The canyon gradually widens downstream of Twin Falls to include small areas of bottomland and terraces. The largest of these areas is the Hagerman Valley, which is approximately 12 miles long and varies in width from one to four miles. Four major waterfalls occur in the Middle Snake reach: 212-foot Shoshone Falls, 130-foot Twin Falls, 36-foot Star Falls, and Auger Falls, a cascade that drops 55 feet.

The Snake River Plain is a unique series of lava flows and sedimentary deposits dominated by Quaternary basalt of the Snake River Group. The oldest rocks in the area are the Idavada Volcanics which underlie most of the Snake River basalts. This formation consists of a series of silicic, welded

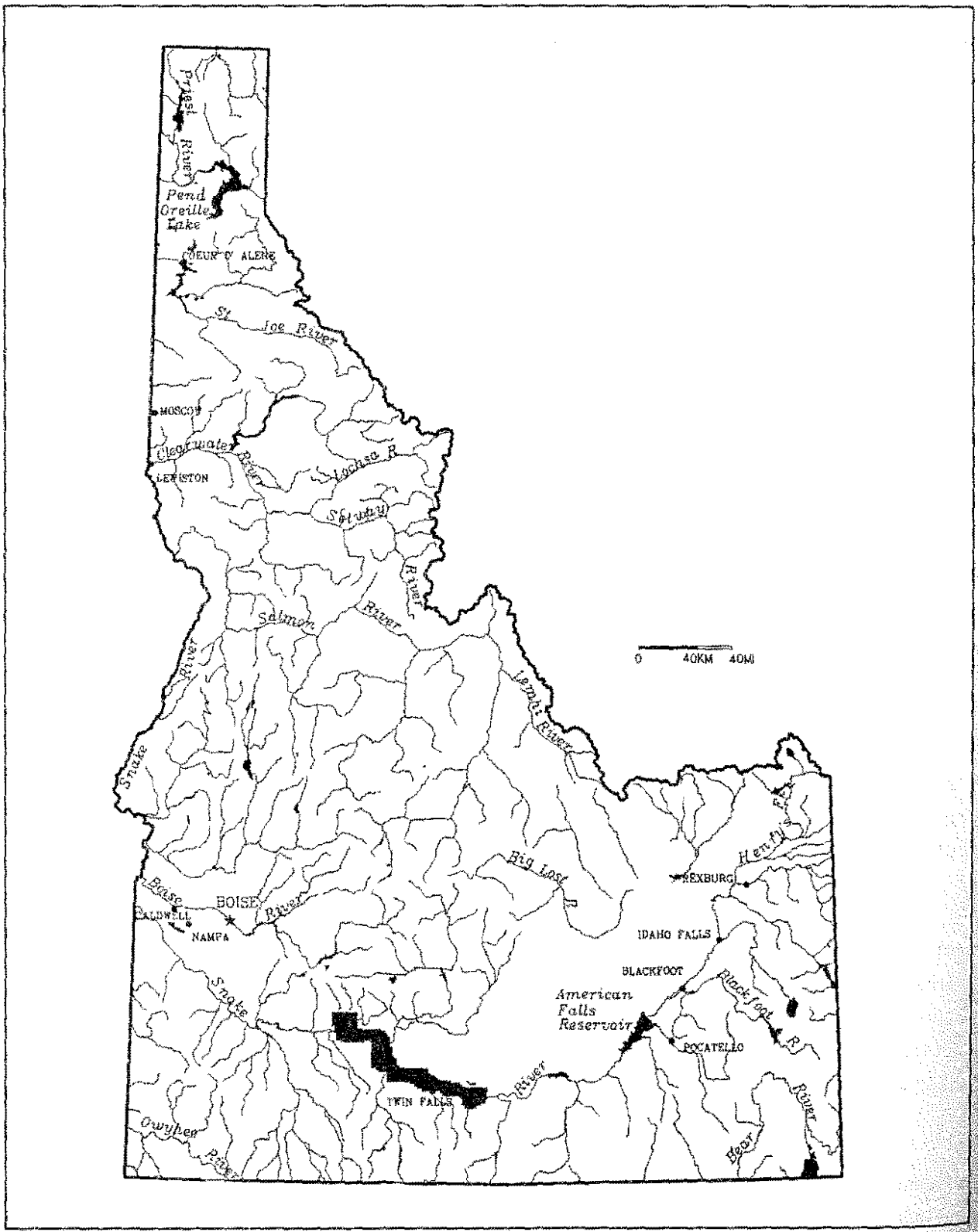

Figure 1. Planning region.

ash flows (Malde and Powers, 1962). Rocks of the Idavada assemblage are exposed within the Snake River canyon near the city of Twin Falls. They represent numerous episodes of volcanism ranging in age from 12 million to 6 million years (Street and DeTar, 1987).

A sequence of Tertiary and Quaternary basalt flows with interbedded stream and lake sediments overlies the Idavada Volcanics (Fig. 2). In the planning area, lavas on the south side of the river are Pliocene and early Pleistocene and most original features have been removed by erosion or obscured by loess. Younger Pleistocene lavas on the north side still preserve features such as pressure ridges and "aa" and "pahoehoe" lava surfaces. The aggregate thickness of the lava and sedimentary deposits is unknown, but probably exceeds 5,000 feet (Moreland, 1976). The thickness of individual lava flows is highly variable but averages about 20-25 feet (Mundorff et al., 1964). Contacts between flows are commonly rubble with high porosities and hydraulic conductivities, which make interflow zones major avenues for horizontal movement of water.

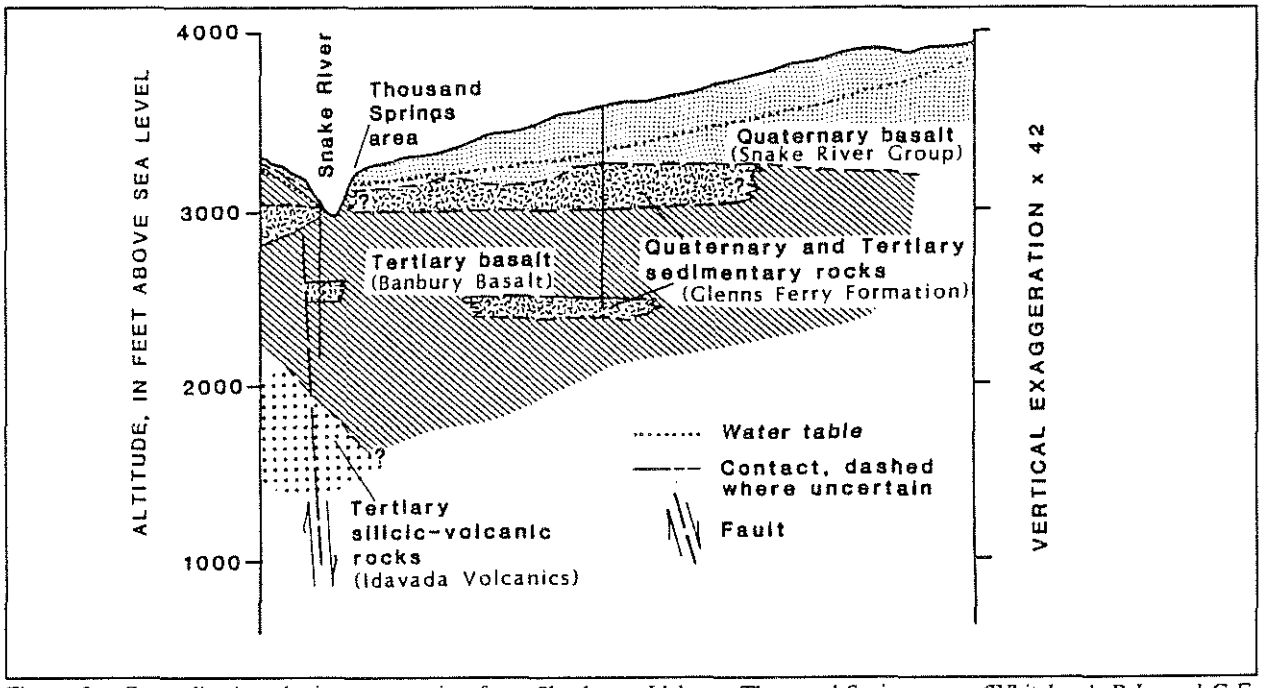

Figure 2. Generalized geologic cross section from Shoshone, Idaho to Thousand Springs area (Whitehead, R.L. and G.F. Lindholm, 1985).

Seismic and geologic field data is insufficient to establish whether any specific faults are seismically active in south central Idaho. Field evidence from faults elsewhere on the Snake River Plain indicates that they are at least 500,000 years old and are probably inactive. A zone of frequent earthquakes lies within the Basin and Range province of eastern Idaho, and the Idaho Batholith region of central Idaho. The active Howe and Arco fault systems are included in the southern part of this zone and are capable of producing strong earthquakes (Harza Engineering, 1983; Greensfelder, 1976).

The Halfway Gulch fault, located south of Grand View, Idaho, has been estimated to be capable of producing a Maximum Credible Earthquake with a magnitude of 6.0 (IPC, 1988). These fault zones are situated about 100 miles from the Middle Snake reach.

SOILS AND VEGETATION

Soils on the Snake River Plain are primarily loessal in origin. Loess is composed of wind-blown particles which have a wide range of composition. A typical Middle Snake soil profile is light in color, of medium texture, and has lime accumulation zones in the subsoil and substratum. Soil depth varies from 6 inches to greater than 40 inches. Near the canyon rim the soil depth is usually shallow and gradually grades to bedrock. Basalt outcrops are common in many areas, particularly on the north side of the river (Yankey, 1992). Loess is very fine and subject to water and wind erosion.

The loess soils are good for most climatically adapted crops, and are relatively free of salt problems due to high permeability. The lack of precipitation in the region limits native vegetation and the organic residue that becomes soil humus, but leaching of soluble minerals from the soil profile is not far advanced. In contrast, soils formed on alluvial terraces in the Hagerman area are relatively high in organic matter. Other areas of alluvial soils occur along tributaries (IDWR, 1978).

Plant species in the canyon represent a mixture of dryland and riparian vegetation. Riverine vegetation is dominant along the river bank. Willow is the primary plant species, but cattail, hackberry, alder, cottonwood, sagebrush and a variety of other shrubs are intermixed. The dry areas of the canyon support sagebrush-grass associations. Sagebrush, rabbit brush, cheatgrass, foxtail, wild rye and other grasses and forbs are found.

CLIMATE

The climate of the planning area is semiarid, characterized by low annual rainfall, moderately hot summers and cold winters. Annual precipitation averages 10.5 inches and varies from 50 to 150 percent of the mean (Fig. 3; Table 1). Precipitation is fairly evenly distributed throughout the year, except from July through September when it is well below monthly averages. Annual snowfall totals average 24 inches. January and July are the coldest and warmest months respectively. During the summer, temperatures in excess of 100°F are common inside the Snake River canyon. The growing season varies with elevation. The average length of the frost free growing season is 140 days at Twin Falls. The longest growing season is along river bottom areas and terraces of the Snake River canyon (IDWR, 1978; Molnau, 1992).

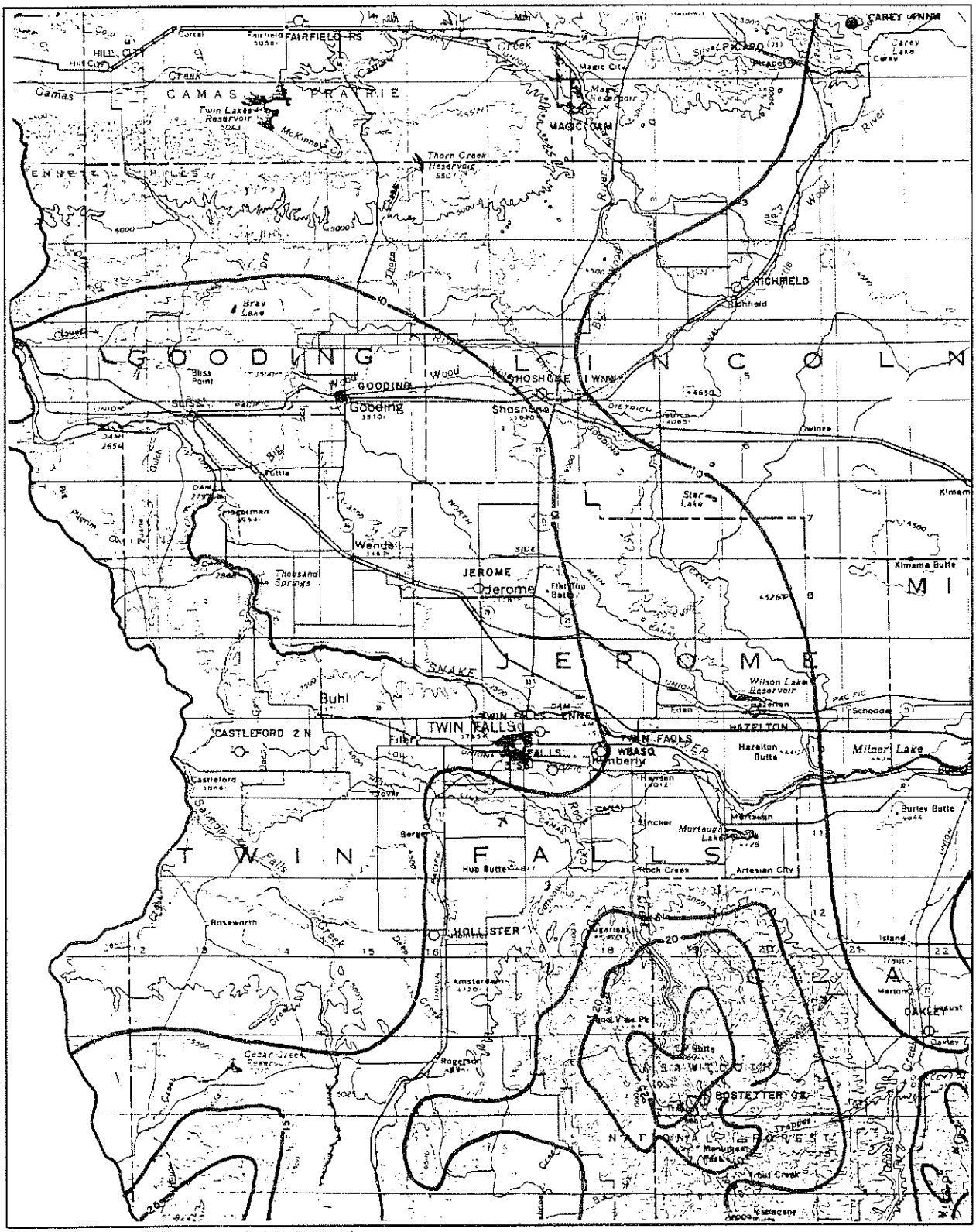

Figure 3. Precipitation map of planning region.

Pacific maritime air masses, brought into the region by prevailing westerly winds, exert a modifying influence on temperatures and contain moisture which is the source of nearly all precipitation. The maritime air masses are displaced or modified by drier continental air masses which are responsible for the clear weather, low humidity, and temperature extremes. Prevailing winds are from the west with sustained velocities of 15 to 20 miles per hour. Winds of destructive force are rare, however wind erosion occurs on newly cleared land that is left unprotected. Storms are seldom severe. Thunderstorms sometimes produce high intensity precipitation for brief periods, but are confined to small areas (USBR, 1961).

Table 1. Climatological Summary Data 1961-89

Station	Bliss	Jerome	Hazelton	Hollister	Twin Falls WSO
Elevation	3,265	3,785	4,060	4,550	3,770
Years of Record	30	30	30	30	30
Avg. January Minimum (°F)	19.3	18.2	17.3	18.1	18.8
Avg. January Maximum	36.3	35.3	34.9	36.5	34.9
Average July Minimum	54.4	55.6	53.7	54.2	53.1
Average July Maximum	91.5	90.8	88.8	86.5	84.9
Lowest Temperature 1961-1989	-22	-20	-27	-26	-19
Highest Temperature 1961-1989	106	108	103	101	101
Growing Season*	135	145	134	115	140
Annual Precipitation (inches)	10.6	10.81	10.24	10.56	10.62
Annual Snow Fall (inches)	20.6	21.4	20.4	25.0	29
Average January Precipitation	1.38	1.24	1.20	.77	1.12
Average July Precipitation	.27	.25	.25	.58	.31
Average Annual Number of Days with Precipitation					
10 inches or more	30	32	30	30	31
50 inches or more	3	3	3	3	3

*The average number of days between last 32°F temperature in spring and first 32°F in fall.

Source: Molnau, 1992.

HISTORY

Archeological evidence indicates the Snake River canyon has been intensively occupied, particularly west of Shoshone Falls which prehistorically marked the upper limit of salmon migrations. Early inhabitants most likely lived in small, highly mobile groups. The mild winters, hot springs, and natural fisheries made the canyon a favorite wintering area. Trails to and from the Snake River traverse the region. As early as the middle of the fifteenth century, small groups of Shoshoni in northern Utah may have extended their food-collecting activities into southern Idaho.

However, the main surge of Shoshoni occupation came in the late eighteenth century, after their displacement from the High Plains by the newly horse-mounted and armed Blackfoot (Butler, 1986).

An abundance of fur bearing animals along the Snake and Big Wood rivers attracted trappers, the first white men to visit the region, in the early 1800's. The numerous springs of the Snake River canyon, the rich agricultural lands of the Hagerman Valley, and gold in the sands of the Snake River induced people to remain in the area. Farming settlements and stock ranches were developed in the late 1800's. Gold mining in the Snake River began as early as 1865, very profitably at first, but declined and continued only on a small scale after 1875. Cattle raising became an important industry in the late 1870s. The area which now makes up Jerome County was originally used for migratory grazing by the earliest livestock concerns in southern Idaho.

Early settlers used water from Snake River tributaries for irrigation. They succeeded in raising wheat, other grains, and alfalfa, as well as fruits and vegetables, demonstrating the productivity of the soil under irrigation. In the summer of 1903 the Twin Falls Southside Land and Water Company tract was opened to entry. A townsite was selected near the center of the project, and delineated land was quickly appropriated. Intensive settlement on the north side of the canyon began in 1907 when the Twin Falls North Side Land and Water Company was granted permission to construct canal systems under the provisions of the federal Carey Act.

DEMOGRAPHICS

The 1990 Census indicates that 80,000 people reside within Gooding, Jerome, and Twin Falls counties. The Middle Snake region may be classified as a rural, agricultural setting, but fifty-three percent of the three-county population lives within the boundaries of a town or city with a population of at least 2,000 people. The City of Twin Falls is the largest population center with 27,591 residents.

A general trend toward urbanization, and a decrease in rural population, prevalent across the United States since the turn of the century, is reflected correspondingly in city and county population figures prior to 1970. However, beginning in the 1960s, but specifically through the 1970s, the U.S. and the region observed an increase in rural population (Table 2). From 1960 to 1990, the combined population of Twin Falls, Jerome, and Gooding counties increased by 27 percent (17,253 persons). An expansion of the area's farm and food processing sectors, the establishment of manufacturing facilities, and the emergence of the city of Twin Falls as the primary trade, financial, and services center in south-central Idaho and northern Nevada, spurred this significant population gain.

Since 1980 Idaho's population has been growing an average 6.23 percent each year. The differences in population change by county, over the last decade, are shown in Fig. 4. Nationally,

EMPLOYMENT AND INCOME

The Twin Falls region historically has built its economic base around agricultural operations and manufacturing of related food and kindred products. A substantial number of food processing companies operate in the area: Green Giant, Falls Brand Meats, Pet, Kraft, Ore-Ida Foods, Simplot, Del Monte, Coors, and Amalgamated Sugar. Universal Frozen Foods, the largest employer in the region, maintains its division headquarters in Twin Falls. Only in the past few years has a significant non-agricultural manufacturing sector emerged. These new industries distribute products generally to the western portion of the country, and possess a great deal of flexibility in location since they are not dependent on a local market (Twin Falls County, 1978).

Agriculture is still the major economic base for Jerome and Gooding counties, but Twin Falls County has shifted to an economy based more on trade and services (Gardner et al., 1990). Twin Falls, the largest town with a population of 27,591 in 1990, is an important trading center and shipping point with retail sales of more than a billion dollars annually. It offers services to approximately 150,000 people in eight surrounding Idaho counties and northern Nevada (Twin Falls Chamber of Commerce, 1992).

In 1990, the economy of the three-county area generated an average of 36,700 jobs (Idaho Department of Employment, 1991). This number includes full-time and part-time employees of private establishments and government agencies, as well as proprietors. Services, retail trade, agriculture, and manufacturing, in descending order, provide the largest number of job opportunities for area residents. The most recent business boom in the area has been dairy farms and dairy processing facilities which have grown dramatically in the last few years.

Average annual employment in the three counties shows an upward trend over the twenty year period 1970-1990 (Table 3). Total employment increased 48 percent in Twin Falls County, 39 percent in Jerome County, and 33 percent in Gooding County between 1970 and 1990. Despite the upward trend overall, Jerome and Twin Falls counties experienced large fluctuations in employment in the 1980s. Employment declines in Twin Falls County were attributed to depressed farm incomes and the closing of food processing plants, and in Jerome County, the closure of Tupperware, one of the county's largest employers.

Farming employed 12 percent of the three-county workforce in 1990, down from 23 percent in 1970, a loss of 1,600 jobs. From 1980 to 1990, farm employment declined an average of 2.7 percent annually. Offsetting this decline is growth in the agricultural services sector. Agricultural services include establishments that provide commodities and services to farms or to businesses that store and transport farm products. These ancillary businesses include distributors of livestock feed, seeds, bulbs, plants, commercial fertilizer, and other agricultural chemicals; farm machinery and

Table 3. Average Annual Employment

	1970	1972	1974	1976	1978	1980	1982	1984	1986	1988	1990
Gooding	3,784	3,856	3,839	3,982	3,837	4,605	5,025	4,964	4,978	5,103	5,059
Jerome	4,460	4,564	6,019	6,350	6,268	6,182	6,192	6,357	6,423	5,841	6,236
Twin Falls	17,128	17,694	20,405	19,250	22,055	22,275	24,003	24,335	24,749	24,540	25,460

Source: Idaho Department of Employment, *The Labor Force in Idaho* 1970-1990.

equipment dealers; and livestock dealers. Agricultural services employment increased 7.3 percent annually, adding 870 jobs between 1980 and 1990. Farm employment and the agricultural services sector together total 16 percent of the labor force.

Trades and services employed 43 percent of the civilian labor force, with construction and manufacturing hiring 15 percent; education and government 14 percent; transportation and utilities 6 percent, and the remaining 6 percent is accounted for by the finance, insurance, and real estate sector. Wholesale and retail trade employment, driven by high rates of population and income growth experienced in both the region and the state, grew 4 percent annually during the 1970s. However, a national recession in the early 1980s led to the loss of over 400 jobs in Gooding, Jerome and Twin Falls counties within the sector. A recovery in the overall levels of wholesale and retail trade employment has occurred since 1986 with the generation of 900 jobs across the three counties.

Employment in the service sector has not shown the same degree of sensitivity to local and national business climates. Since 1970 service sector employment in the three counties has increased at a steady annual rate of 3.5 percent, creating over 4,000 new jobs. Manufacturing had a net employment loss from 1980 to 1990 due to the closure of the Tupperware plastics manufacturing facility in Jerome. The addition of 300 new jobs at Universal Foods and the opening of other new processing and manufacturing facilities have recovered most of the loss. According to the Twin Falls Chamber of Commerce, (1992), the Magic Valley has increased employment by 3,900 jobs since 1989. Strong community support exists for a continued program of attracting and retaining selected, diversified and value-added industries.

In 1990, the average unemployment rate for the three-county area was 4.9 percent, compared with 5.8 percent for the State of Idaho and 5.5 percent nationally (Table 4). Over the last ten years Idaho has maintained an unemployment rate lower than the national average. In contrast, the unemployment rates for Twin Falls County, and Jerome County since 1985, have usually exceeded both the national and state average. Gooding County unemployment has generally been less than both the national and state percentage rates. Unemployment rates in the three counties have fallen

sales for each county (Idaho Tax Commission, 1991). Most of the current tourist traffic is not headed for a local destination, but is passing through the area (Hunt, 1992).

Per-capita income and the percentage of the population below the poverty level are often used as measures of local economic well-being. Table 6 lists median income, average wage, and the economically disadvantaged as a percent of the total population. Median income, as opposed to an average or per-capita income, is not influenced by the magnitude of any one income nor does the family size have any effect on the midpoint. An economically disadvantaged person is one who receives welfare, receives food stamps, or one whose income is below the current poverty level. Real income is defined as dollar income adjusted for the cost of living. A cost of living index relative to other counties or states is not compiled for Idaho or the U.S. Cost of living indices are computed for selected cities in the U.S., but these may not reflect rural conditions.

Table 6. 1990 Income Levels

Area	Median Income	Average Wage/Job	Economically Disadvantaged as % of Total Pop
Twin Falls County	$27,200	$15,975	26.92
Jerome County	24,700	13,156	23.02
Gooding County	22,400	13,033	20.73
Elmore County	21,300	16,848	27.03
State of Idaho	27,200	17,680	20.83
United States	35,700	22,120	--

Source: Idaho Department of Employment, *Idaho Demographic Profile 1992*.

The average value of a home in the three-county area is $47,600. Median rent is $220 a month (U.S. Bureau of the Census, 1990). The average home sale price in Twin Falls in 1991 was $60,000. Home prices range from $40,000 to $300,000. Typical two-bedroom home rent is $350 to $550 per month (Twin Falls Chamber of Commerce, 1992).

There are four school districts in Gooding County, two in Jerome County, and eight in Twin Falls County. The high school graduation rate in the three counties is 74 percent (Idaho Department of Commerce, 1992). The College of Southern Idaho offers two-year academic programs, a wide range of vocational training, and a variety of opportunities for part-time students and adults to further their education through special classes and night classes.

The city of Twin Falls is the medical center for south-central Idaho and northern Nevada. There are over 120 physicians and surgeons in Twin Falls, and Magic Valley Regional Medical Center in Twin Falls provides 165 beds including a 12-bed intensive care unit. Twin Falls County has a total of three hospitals with 237 beds. One hospital, a 40 bed facility, serves Jerome County.

Six physicians operate private practices in Jerome. Gooding County has two hospitals, with a total of 47 beds, and seven physicians.

Broadening of the region's economic base requires the development of activities which do not rely upon the agricultural base of the region. Because this region is neither rich in mineral resources nor a major urban market center, industries with a great deal of flexibility in location are the most likely prospects for business expansion in the area. The major locational requirements for these industries are transportation networks, the ability to distribute products to the central and western areas of the United States, and a favorable living environment. If an industry is considering a rural location which is not near a major urban area, the available labor force and its composition also become important. The Twin Falls region has generally been able to meet these requirements. The magnitude of job growth for the most part is dependent on the ability of the area to continue to attract these businesses.

LAND OWNERSHIP, USE, AND ZONING

There are discontinuous parcels of land along the Middle Snake reach remaining in federal and state ownership. Most productive land in the area, with a source of water and easy access, has been converted to private ownership. Current ownership holdings within the Middle Snake reach hydrologic unit are listed in Table 7. Ownership within the vicinity of the canyon is displayed on the Land Ownership Map.

Table 7. Land Ownership - Middle Snake Hydrologic Unit

	Acres	% of Total Acres
Private	838,170	52.00%
U.S. (BLM)	627,500	39.00%
U.S. (Forest Service)	91,206	6.00%
State	31,654	2.00%
U.S. (Bureau of Reclamation)	10,907	0.68%
Water	5,991	0.30%
U.S. (Military)	333	0.02%

The Bureau of Land Management (BLM) administers 48 miles of river shoreline through the Boise, Burley, and Shoshone Districts. State ownership includes the bed of the Snake River below the mean high water mark, excluding islands located in the river.

Agriculture is the predominant land use on the Snake River Plain, primarily irrigated crop production and grazing. At the eastern end of the reach, farming activities are tied to the irrigation canals, with grazing use more prevalent adjacent to the river. In the canyon, benches formed along the river provide limited opportunities for residential development and cattle grazing. More mixed

land uses are found as one travels downstream, because of increased water availability from springs and tributaries, and an expansion of the river floodplain. Residential development within the canyon and along the canyon rim occurs from Shoshone Falls downstream to the town of Bliss.

Canyon and Rim

Jerome County has established a preservation zone along the north side of the Snake River canyon. The Preservation Zone is defined as a belt a half mile wide from the edge of the river on public lands. The Snake River canyon and Milner Reservoir are included in the Preservation Zone. Lands in this zone are to be preserved in their natural state for future public access (Jerome County, 1984). Present building regulations on private property require a 100-foot setback from the river, and activities within the canyon are regulated.

Twin Falls County zones land within the canyon for outdoor recreation, but industrial or commercial development are the only prohibited enterprises in this zone. The county requires a 100-foot building setback from the canyon rim unless an engineer certifies that the rim is stable. This certification permits a minimum 30-foot setback. Gooding County has established a 300-foot set back from the canyon rim.

A greenbelt along the canyon rim to serve as a natural hazards setback was suggested to the counties in a *Canyon Area Study* dated 1975. The canyon rim is highly unstable and development close to the rim poses a water quality threat from septic systems (Ellwell, 1991). A primary hazard in the canyon is damage or injury by falling rock. Jointing is extensively developed in the basalt flows which form the walls of the Snake River canyon. Cracks ranging from a few inches wide to two to three feet wide can extend downward for at least 20 to 30 feet, and can extend 50 feet back from the rim (B&C Energy, Inc., 1991). Individual blocks of basalt are wedged during cold months when water entrapped in the joints expands during freezing. Extensive cracking often coincides with an area of high seepage. When one block peels off, it may jar others below and cause a slide. Talus along the bottom of the canyon is evidence of landslides or rockfall, and may be found more or less continuously wherever the canyon has steep walls.

TRANSPORTATION

The planning area is served by Union Pacific Railroad, (with Amtrak service 25 miles north at Shoshone), and two major air carriers at the Twin Falls/Sun Valley Regional Airport, (located 10 miles south of Twin Falls). Interstate 84 and U.S. Highways 30 and 93 are the primary automobile and truck transportation routes through the region. Trucking offers a major source of surface transport with 15 companies having terminal facilities in Twin Falls (Twin Falls Chamber of

Commerce, 1992). In the irrigated tracts a majority of the section lines are improved roads. Few farms are over one mile from a paved road.

The Snake River canyon, 300-600 feet deep for most of the reach, greatly influences the road network in the area. It is difficult to enter the canyon or to cross the canyon from rim to rim. Access to the canyon is limited to a few bridges, roads, and trails. Highway bridges cross the canyon to provide access from Murtaugh, Hansen, and Twin Falls on the south to I-84 on the north side of the river. Downstream, State Highway 30 crosses the river near Hagerman. Between King Hill and Twin Falls, there are three additional bridge crossings, one near Clear Lakes (Buhl Bridge), one near Bliss, and one at King Hill. An unpaved improved road (County Road 1300S) crosses the river immediately downstream of Milner Dam.

The Idaho Transportation Department recently completed an environmental assessment of alternatives for reconstruction of the Clear Lakes Grade from the Snake River Bridge to Bob Barton Road on behalf of the West Point Highway District. The current road alignment is considered substandard, causing unsafe travel conditions. The road provides the only crossing of the Snake River between Twin Falls and Hagerman, and is a critical link between agricultural areas north of the Snake River with processing facilities near Buhl. The realignment will result in wider travel lanes, paved shoulders, guardrails, and a truck climbing lane (Idaho Transportation Department and U.S. Department of Transportation, 1988). The West Point Highway District will maintain the project upon completion of construction (Thomas, L., 1992).

II. RESOURCE SUMMARY

Water Quantity

Water sources or supplies within the Milner to King Hill reach of the Snake River include precipitation, the flow of the river at Milner, tributaries within the reach, ground water flow, and returns from upstream irrigation.

PRECIPITATION

Local precipitation in the Milner to King Hill area is not a significant contributor to the water supply of the reach. Annual precipitation in the region averages 10 inches and has varied from a low of 4 inches to a high of 18 inches (1961-89) depending on location (Table 1 and Fig. 3). November through January are the wettest months, and July and August are the driest. Annual snowfall

accumulation averages 24 inches, however, mean snow depth at Bliss is about three inches in January and February. Because of the warmer temperatures in the canyon, periods of snow on the ground there are brief. Excluding the tributaries, overland runoff into the Middle Snake reach directly from snowmelt or precipitation is relatively small (Thomas, C.A., 1969).

SNAKE RIVER

The Snake River watershed upstream of King Hill, Idaho, is often referred to as the Upper Snake River Basin. The Upper Snake River Basin drains an area of 35,857 square miles in Idaho, Wyoming, Nevada, and Utah. In its upper reaches the Snake River constitutes a much larger river than that which enters the planning reach at Milner. At Heise, upstream from nearly all irrigation uses, the average annual flow of the Snake River is about five million acre-feet. The Henrys Fork and its principal tributaries add another two and a quarter million acre-feet per year above diversions. These supplies plus those of smaller tributaries are reduced by irrigation diversions to an average flow at Milner of 2.5 million acre-feet per year.

Flows at Milner vary widely from year to year. The upper storage and diversion system fully regulates the river in the driest one-fifth of all years. In those years total flow at Milner may be less than a half million acre-feet. In wetter years it can be several million acre-feet when upper basin runoff exceeds amounts needed to fill the reservoir system.

The seasonal distribution of river discharge also varies widely. In the driest years Milner flow in late fall and winter is composed almost entirely of the minimum release rate at American Falls Reservoir (about 300 cfs) plus downstream gains. These result in total flows at Milner in the range of 400 to 900 cfs. When Lake Walcott and Milner Reservoir are being filled, or when diversions begin, flows passing Milner are reduced to virtually zero.

During very dry years little flow passes Milner in the early irrigation season. However, in recent years Idaho Power Company has used its American Falls storage (approximately 45,000 acre-feet) plus water obtained from the rental pool to raise flows to the range of 600 to 1000 cfs in late June or early July. Flows of this magnitude have then been maintained as long as available storage permitted or until diversions end in the fall. When the Milner power plants begin operation in late 1992, Milner Reservoir will be kept full and a target flow of 200 cfs will be released, if available.

During non-drought years flows at Milner are substantially greater throughout the year. Typical late summer flows (low flow) are generally in the range of 1000 to 2000 cfs. In the winter or spring, flows of 2000 to 10,000 cfs occur as flood control space in upstream reservoirs is maintained or increased in anticipation of possible springtime floods. In 1984, the year of greatest

total runoff on record, flows greater than 10,000 cfs occurred from November through early February and again from late March through late June. The peak flow was 21,300 cfs on June 14.

Downstream from Milner flows increase substantially from ground water discharge, irrigation returns, and tributaries. Flows at downstream gages largely reflect those at Milner, both in their year to year and seasonal patterns, but from progressively higher base levels. Long term average annual flows at gages in the reach illustrate the magnitudes of these gains:

At Milner	3430 cfs
Near Kimberly	3800
Near Buhl	5450
Near Hagerman	9280
At King Hill	11020

Average daily discharges at the five operating USGS gages in the reach are illustrated for the period 1947 to 1991 (Fig. 6), and for the period 1988 through 1991 which corresponds to the current drought period (Fig. 7). Discharge patterns and magnitudes are significantly different for the drought period compared to the 1947-91 period of record. Conspicuously absent from the 1988-91 record are the higher flows in April, May, and June at all stations. The 1988-91 records show near zero flows at Milner for this period compared to long term average flows of nearly 5000 cfs. The seasonal flow patterns for the drought period show continually receding flows at all stations after the irrigation season. The seasonal flow patterns for the Buhl gage are representative of all gaging stations in the study reach and show the lack of higher early season flows and the declining winter-time flow. July through September flows are very similar for the two periods, reflecting the base flows supported primarily by ground water returns from the northside and southside springs.

TRIBUTARIES

Numerous small tributaries enter the Snake River in the Milner to King Hill reach. Nearly all of them carry substantial amounts of irrigation return flow and/or ground water discharge. The four largest tributaries are Rock Creek, Salmon Falls Creek, the Malad River, and Clover Creek. Rock Creek originates in mountains southeast of Twin Falls. Head-water runoff is probably in the order of 40,000 to 50,000 acre-feet per year. At its mouth the flow averages roughly 150,000 acre-feet per year as a result of irrigation return flows. Salmon Falls Creek is fully regulated by Salmon Falls Creek Reservoir near Rogerson. Salmon Falls Creek contributes about 120,000 acre-feet per year, in surface water and subsurface return flow from irrigated areas, to the Middle Snake reach.

The Malad River is the largest tributary in the reach. In years of below normal runoff it is composed entirely of irrigation returns and ground water discharge. However, in wetter years excess mountain runoff reaches the mouth. Long term average annual runoff is about 190,000 acre-feet at

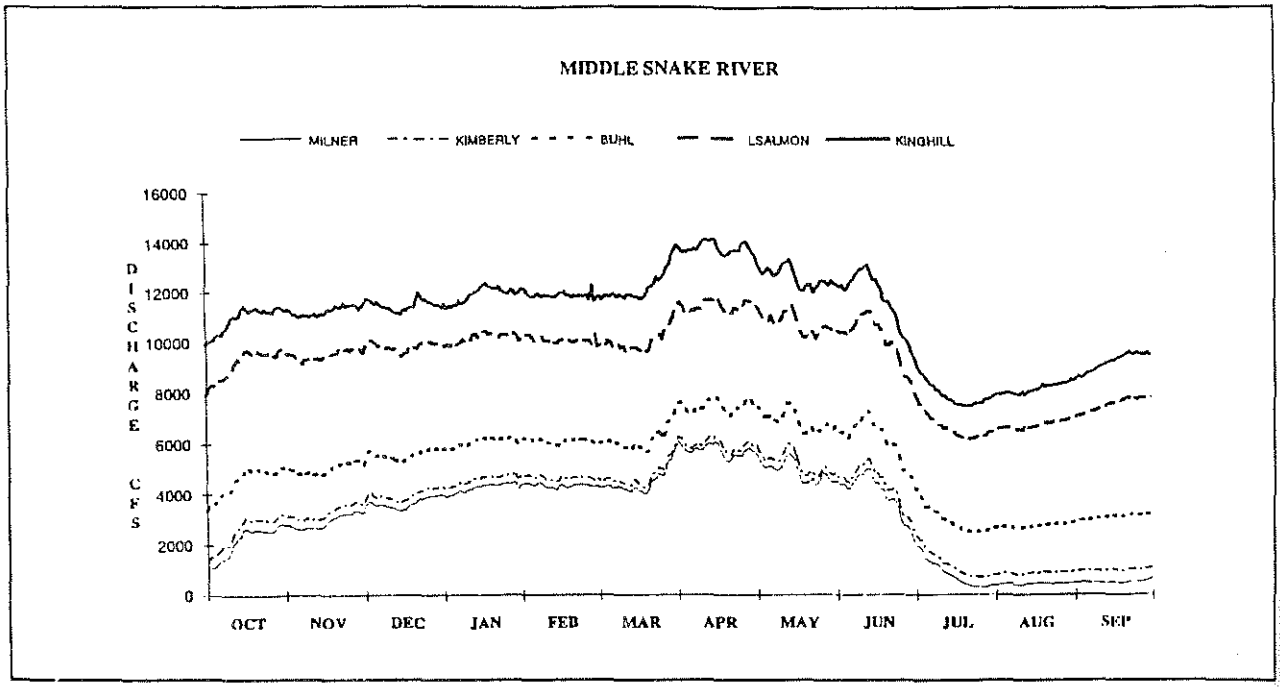

Figure 6. Average daily discharge 1947-1991.

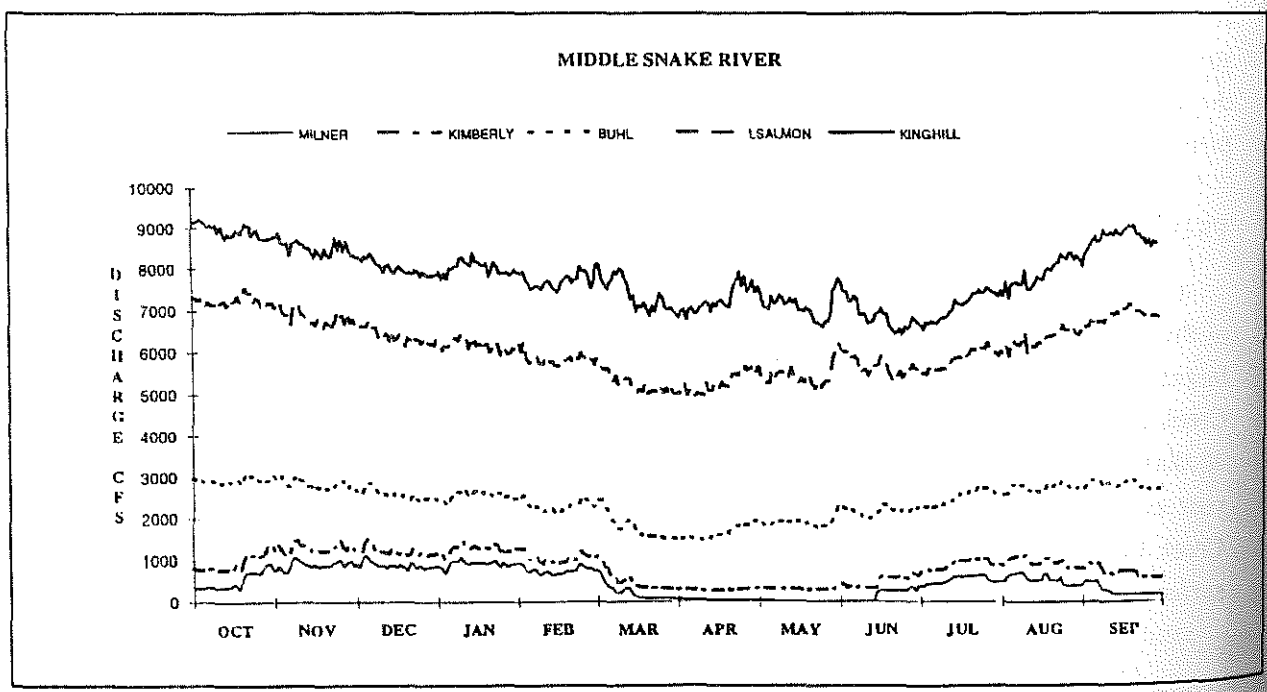

Figure 7. Average daily discharge 1988-1991.

the Gooding gage. Ground water discharge and irrigation return flow in the lower canyon adds nearly 900,000 acre-feet to that amount. About 850,000 acre-feet per year reach the Snake via Idaho Power Company's Malad power flume and power plant downstream from the mouth of the river. Clover Creek enters the Snake River one mile upstream from the King Hill gage. Its' flow is highly variable, but probably averages less than 100,000 acre-feet per year.

GROUND WATER FLOW

The largest inflow to the Middle Snake reach is from the scores of springs that issue from the Snake River Plain Aquifer on the north and east sides of the canyon. A second significant source is from the aquifer underlying the Twin Falls tract, which discharges about 500 cfs (Kjelstrom, 1986). Water in these aquifers is principally stored in and transmitted through fractures, gas-bubble voids, and lava tubes formed during the flow and cooling of molten volcanic rock, and permeable ash and soil interbeds deposited between flows. The Snake River Plain Aquifer, one of the largest ground-water systems in the United States, underlies the Snake River Plain from the vicinity of St. Anthony, Idaho, to the western terminus of the Middle Snake reach. Ground water moves through the aquifer in a general southwest direction. The aquifer is recharged by seepage from the Snake River and streams entering or crossing the plain, by the percolation of irrigation water and precipitation, and underflow from tributary basins.

In general, the basalt on the south side of the river is much less permeable than the basalt north of the Snake River. The original depth to water on the south side is estimated to have averaged about 250 feet. Irrigation began on the south side in 1905 and the water table rose rapidly in some tracts. Waterlogged areas appeared by 1912, and many drains, tunnels, and drainage wells were constructed to alleviate seeped conditions (Mundorff et al., 1960). The depth of ground water may be as little as 35 feet near Murtaugh or as great as 500 feet on the south side (Bell Rapids). Depth to ground water varies on the north side from approximately 300 feet to less than 100 feet.

On an annual basis, over 50 percent of the total streamflow that is measured at King Hill is from ground-water discharge. The Snake River Plain Aquifer presently discharges an estimated 5700 cfs into the Middle Snake reach. Ground-water discharge in the Milner-King Hill reach has varied as recharge conditions have changed. The increase in ground-water discharge from 1902 to the early 1950s has been attributed to increased ground-water recharge in surface water irrigated areas north and east of the springs. It has been in a state of slow decline since the mid-1950's when it exceeded an estimated 6700 cfs. Withdrawals from the aquifer and increasing efficiencies in irrigation application by surface water users on the plain (a major recharge source) are expected to result in continuation of the decline (Fig. 8). When these stresses moderate at some relatively fixed level in the future, aquifer outflows will begin to approach equilibrium with inputs and upstream withdrawals. Seasonally, aquifer discharge varies only slightly. The highest flows occur in the fall as a result of

the cumulative effects of recharge by surface water irrigation. Low flows occur in April or May before the effects of the new irrigation season recharge become significant.

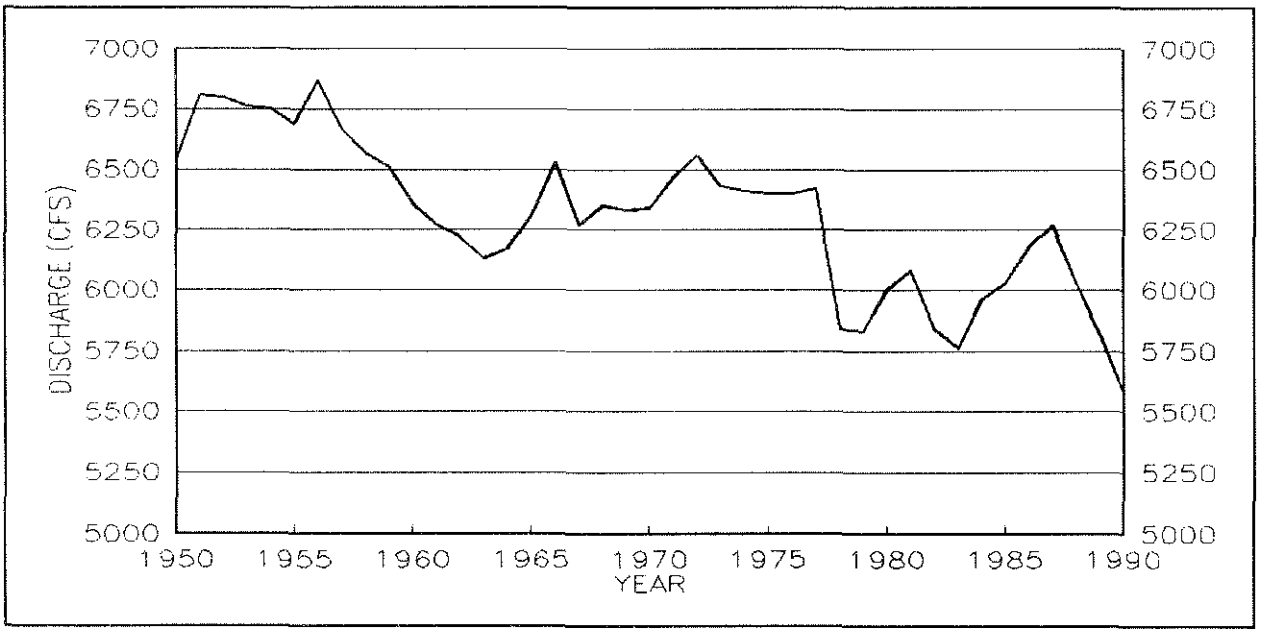

Figure 8. Average annual ground-water discharge from the north side of the Snake River from Milner to King Hill.

Springs

Discharge from the Snake River Plain Aquifer occurs throughout the Milner to King Hill reach, but the largest river gains from this source are between the Buhl and Hagerman gages. Springs issuing from the aquifer occur singly, in clusters, and in continuous zones along the Snake River canyon. The larger springs or groups of springs are named, but innumerable small springs and seeps are either unnamed or known only to local residents. Outflows from many of the springs fall almost directly into the river. Others form tributary streams, like Billingsley Creek, before entering the river. One of the largest spring groups occurs in the Malad River canyon (Table 8).

Geothermal Sites

Geothermal flow also occurs in the area. Developed uses total about 30 cfs in the Twin Falls and Banbury areas. Most of this developed water is discharged to the river after use. Some thermal water may leak upward into overlying cold water aquifers, to be discharged as part of those sources, to the river.

The geothermal resource of the Twin Falls-Banbury system is characterized by temperatures between 30° and 70°C (86° to 158°F) and shut-in well pressures of 14 to 250 pounds/square inch.

Table 8. Major Springs in Study Area

Spring Name	Approximate range of discharge (ft^3/s)
Blue Lakes Spring	180 - 260
Crystal Springs	430 - 580
Niagara Springs	200 - 360
Clear Lakes	470 - 540
Briggs Creek	105 - 115
Banbury Springs	95 - 140
Box Canyon Springs	350 - 480
Sand Springs	85 - 115
Thousand Springs	750 - 1,430
Malad Springs	1,220 - 1,360

The thermal water occurs in rhyolitic ash-flow tuffs and lava flows of the Tertiary Idavada Volcanic Group. Permeability of the reservoir rocks results from tectonic and cooling fractures, intergranular porosity of the non-welded tuffs, and voids left between successive flows. The system is recharged by rain and snow falling on the Cassia Mountains to the south. Northward dipping volcanic strata channel the water toward the center of the Snake River Plain and into northwest-trending structure zones which cross the area from Hollister to Banbury Hot Springs (Chapman and Ralston, 1970).

RETURN FLOW

Irrigation return flow occurs via numerous wasteways on both sides of the river. Although many of these have been measured, no clear separation of surface return from ground-water flow has been made. In some cases measuring sites were downstream from substantial ground-water inflows. Irrigation wasteways typically have highly varying flows as canal operations change from day to day, and generally cease flowing when canal diversions stop. Irrigation wasteways with seep water flow year round.

Water Quality

Agricultural water supply, cold water biota, salmonid spawning, and primary and secondary contact recreation are the designated uses of the Snake River from Milner Dam to King Hill. Primary and secondary recreation in the locality include fishing, boating, and swimming in limited areas. The Middle Snake reach from Milner Dam to King Hill has been assessed as not fully supporting all beneficial uses. Primary and secondary recreation as well as salmonid spawning and cold water biota are not supported or only partially supported (IDHW, 1989; 1991). By the most recent nonpoint source assessment, agricultural water supply is potentially at risk. Vineyard Creek, Clear Springs, Crystal Springs, Thousand Springs Creek, and Blind Canyon Creek are also evaluated as not fully

supporting these beneficial uses. The Snake River from Shoshone Falls to Lower Salmon Falls Reservoir has been listed as water quality-limited. Water quality in this reach does not meet applicable state standards (Fig. 9).

Idaho water quality criteria state that "waters of the State must not contain. . . floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may adversely affect designated beneficial uses" (IDAPA 16.01.2200,04). The general water quality criteria further state that "waters of the State must not contain. . . excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated or protected beneficial uses" (IDAPA 16.01.2200,05). Specific water quality criteria for waters designated for cold water biota must exhibit "dissolved oxygen concentrations exceeding 6 mg/l at all times" (IDAPA 16.01.2250,04.a).

A water quality-limited segment is any segment where it is known that water quality does not meet applicable standards or is not expected to meet applicable water quality standards even after the application of effluent limitations required by Section 301 of the Clean Water Act. The determination that segments of the Middle Snake reach are "water quality-limited" requires the development of a Total Maximum Daily Load (TMDL) for the river. A TMDL quantifies pollutant sources and allocates allowable loads to the contributing point and nonpoint sources so that the water quality standards are attained for that waterbody (IDHW, 1991).

The Snake River has historically been a biologically productive system. As early as 1811, the Wilson Hunt party observed that the river was a "light pea-green color." Since that time the watershed has undergone significant development and the river has undergone major physical modifications. Water quality in the Middle Snake reach has been effected by diminished stream flows, nutrient inflows, and sediment. Irrigated crop production, fish rearing facilities, municipal sewage treatment plants, animal holding areas, urban development, and range activities all impact the water quality of the Middle Snake reach. In addition, flow alteration brought about by hydrologic modifications hinder waste assimilation and flushing; the ability of the river to absorb these nutrient and sediment inflows has been severely hampered for the last five years by extremely low flows.

One of the repercussions of excessive sediment and nutrient loading coupled with flow modification is excessive aquatic plant growth. During the summer, high nutrient levels, low flows, and high water temperatures promote the occurrence of algal blooms in low gradient reaches of the river. In some slow-flowing stretches of the area, detached benthic algal growth form floating mats, and shallow sediment deposits support extensive beds of rooted aquatic plants (IDHW, 1991). Dissolved oxygen measurements in deep holes between Twin Falls and Hagerman fall below 4.0

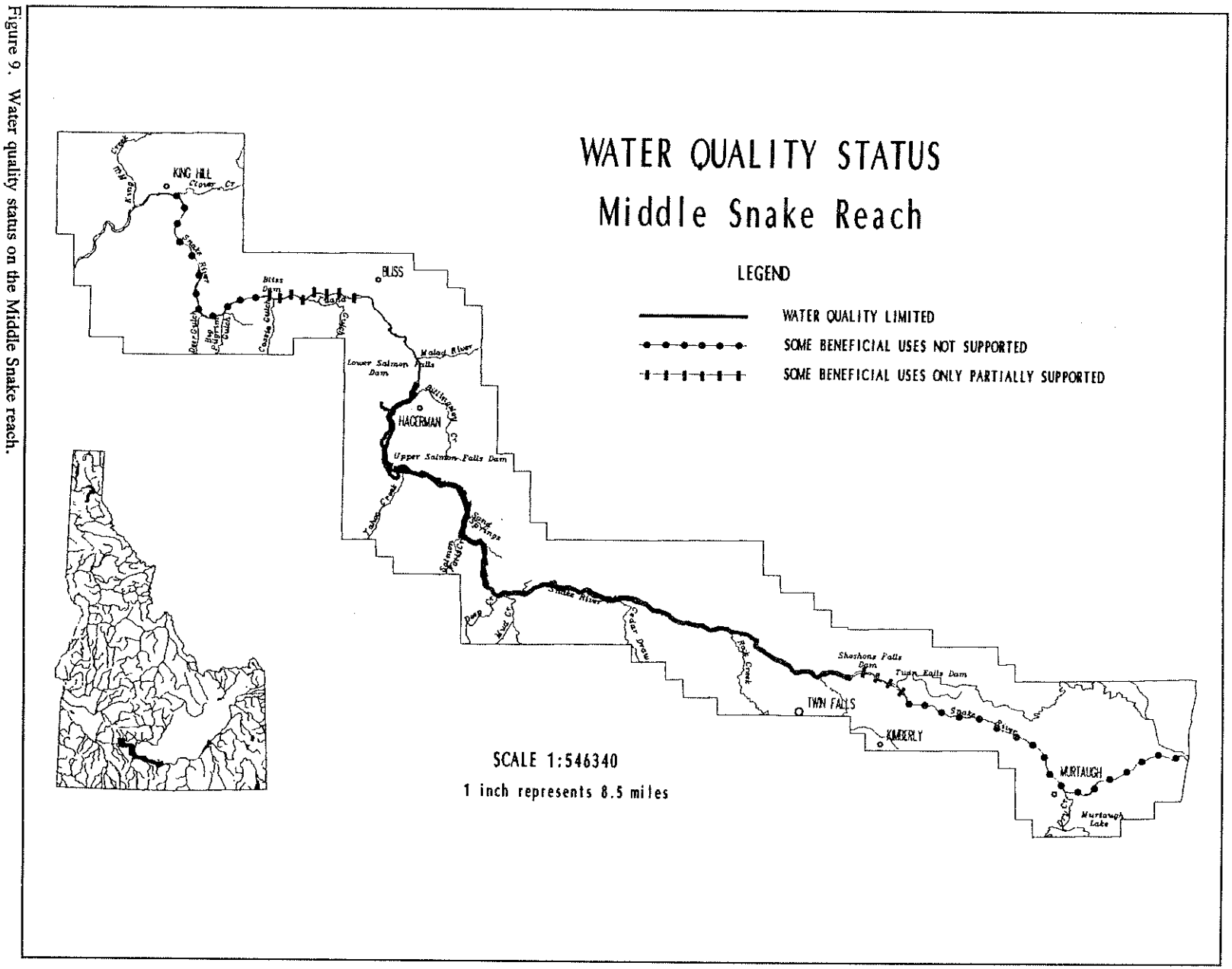

Figure 9. Water quality status on the Middle Snake reach.

parts/million at night and pools are stagnant with considerable organic waste build up which act as sediment sinks (Hill, 1991).

Several evaluations of water quality conditions in the Snake River system have been undertaken since the early 1970s. In 1975, the Environmental Protection Agency (EPA) prepared a river basin water quality status report for the Upper and Middle Snake River. The study found that nutrient concentrations in tributaries to the Snake above King Hill, for the most part exceeded the "algal bloom potential levels." In addition, the total phosphorus load at King Hill exhibited an increasing trend and ground-water inflow in the Hagerman reach was found to be a significant source of nitrate and nitrite (U.S. EPA, 1976a). A study conducted by the EPA in October 1976 focused on nonpoint sources. The *Upper Snake River Basin Nonpoint Source Basin Status Evaluation* concluded that phosphorus, nitrogen, and bacteria levels between Milner and King Hill were not acceptable and nitrate nitrogen, metals, and pH levels were objectionable. Additionally, low, hot summer flows, turbidity, silt, pesticides, nutrients, and low dissolved oxygen detrimentally affected beneficial water uses. Blooms of blue-green algae and diatoms during the spring, summer, and fall were also noted as a problems.

In 1979 a water quality study was performed by Parametrix, Inc. and Tetra Tech, Inc. for the state Division of Environmental Quality (DEQ). The major objective of this study was to identify, quantify, and assess the importance of the sources of nitrogen and phosphorus impacting the Snake River. The study found that 74 percent of the nitrate within the Middle Snake reach is contributed to the reach below Twin Falls, primarily from spring influx, and 14 percent comes from the Snake River above Milner. The three major tributaries (Rock Creek, Salmon Falls, and the Malad River) contributed nine percent. The study found the contributions from the five municipal sources to be insignificant. For total phosphorus, spring influx in the reach contributes about 20 percent, with the Snake River at Milner Dam contributing 60 percent (or 32 percent when the diversions are accounted for), the three tributaries eleven percent, and municipal sources about seven percent. All other sources contributed less than 5 percent each. One limitation of these numbers is that the ultimate nonpoint sources of nutrients, especially with respect to the springs, have not been identified. These unidentified sources include surface runoff, irrigation return flows, and effluent from aquaculture facilities.

The Idaho Division of Environmental Quality initiated a water quality monitoring study in 1990 to evaluate the cumulative impacts of existing and proposed activities. Concurrent sampling of 55 sites, including 13 instream sites, effluent from 10 fish hatcheries, 19 irrigation return flow streams, and 13 tributary streams, was conducted for the period June 1, 1990 through July 25, 1991. The study data will be utilized in a river water quality model being developed by the U.S. Environmental Protection Agency.

Findings from the study indicate that concentrations of nitrate plus nitrite nitrogen and total phosphorus, and water temperature exceed guidelines or adopted water quality criteria for the designated beneficial uses in the main stem of the Snake River (Brockway and Robison, 1992). Low river flows at Milner and decreased spring inflow during the last five years have exacerbated the water quality, algae, and macrophyte problems in the reach. The Middle Snake reach transports up to 30 tons/day of nitrate+nitrite nitrogen, two tons/day of phosphate phosphorous, and 350 tons/day of suspended solids. During the Brockway study, over 12,500 tons of sediment settled in the reach.

Average total nitrogen concentrations increase from 1.7 mg/l at Milner to 2.6 mg/l at the Clear Lakes Bridge. Average concentrations then decrease to 1.8 mg/l below Lower Salmon Falls Dam, and remain relatively constant to King Hill. Total nitrogen contributions for the study period were 4,500 tons from the nine measured tributaries, 2,600 tons from measured fish facilities, and 310 tons from irrigation return flows. Total nitrogen loads in the main river increase from approximately 570 tons at Murtaugh to over 13,000 tons at the King Hill gage (Brockway and Robison, 1992).

Irrigation return flows from the south side of the river often contain ground water from shallow field drains. The average concentration of total nitrogen in these return flows was reported at 2.6 mg/l. The average concentration of total nitrogen in north side return flows, consisting primarily of surface runoff, was 0.6 mg/l. Samples from tributary streams averaged 2.6 mg/l, and measured fish hatchery effluent entering the river averaged 2.4 mg/l. Samples of effluent from a trout processing plant near Blue Lakes averaged over 52 mg/l total nitrogen.

Average concentrations of total phosphorus in samples from the Snake River ranged from 0.07 mg/l to 0.17 mg/l. Concentrations of total phosphorus declined from 0.15 mg/l at Murtaugh to 0.7 mg/l near Shoshone Falls, then increased to 0.17 mg/l below Warm Creek. Average concentrations then declined again to 0.09 mg/l at Gridley Bridge, to 0.08 mg/l below Lower Salmon Falls dam, and then remained at that concentration throughout the remainder of the reach. The increase in the average total phosphorus concentration in the Shoshone Falls to Warm Creek section may be attributed to inflow from the Twin Falls sewage treatment plant. Reductions in total phosphorus concentrations in the Murtaugh to Shoshone Falls and the Warm Creek to Lower Salmon Falls Dam reaches likely indicate nutrient uptake by algae in the reservoirs and slow-moving segments.

Average total phosphorus concentrations were 0.24 mg/l in samples from irrigation return flows, 0.11 mg/l in tributary streams, and 0.10 mg/l in measured fish hatchery effluent. Reported water quality criteria for total phosphorus for aquatic life range from 0.025 to 0.10 mg/l (U.S. EPA, 1976b; Bauer and Smith, 1978).

Total phosphorus loads for the monitoring period (June, 1990 through July, 1991) in the Snake River increase from 60 tons at Murtaugh to over 600 tons at the King Hill station (Brockway and Robison, 1992). Total phosphate loadings were 219 tons from measured tributary streams, 112 tons from measured fish hatcheries, and 37 tons contributed from measured irrigation return flows. Most phosphorus is adsorbed to fine sediments, and therefore enters the river through surface sources

Suspended sediment loads in the main river increase from less than 10 tons per day at Murtaugh Bridge to as much as 350 tons/day at the King Hill gaging station (Brockway and Robison, 1992). Total loading to the river from measured sources was nearly 80,000 tons during the study period (June 1990 - July 1991). The nine measured tributaries contributed 53,000 tons, the 18 measured irrigation return flows added 21,000 tons, and the hatchery discharges contributed 6,000 tons of sediment. The sediment load entering the study area at Murtaugh was estimated at 3,400 tons, and the load leaving the study area was estimated at 70,000 tons. Based on these estimates, at least 13,000 tons of suspended sediment were deposited in the Murtaugh to King Hill reach of the Snake River during the study period.

Nutrient and sediment concentrations in the main river reflect seasonal regimes and the inflow of spring water from the Snake River Plain Aquifer. Computed seasonal loadings for suspended solids and phosphates in irrigation return flow streams show elevated values during the irrigation season; however, total nitrogen concentrations in perennial irrigation return flow streams are highest during the winter because of increased percent contribution of shallow groundwater from subsurface drains. Total nutrient loads in effluent from fish facilities are relatively constant throughout the year. Nutrient and sediment levels in tributary streams reflect the integrated effects of irrigation and ground-water returns, and aquacultural activities (Brockway and Robison, 1992).

Once in the river, sediments are deposited wherever the current slows. The nutrient-rich sediments speed the growth of aquatic plants, which further slow water velocity. When the plants die, the decay process consumes oxygen and contributes to nutrient and sediment build-up on the bottom of the stream bed.

POLLUTANT SOURCES

Water quality of the Snake River is being degraded by numerous sources which may meet state water quality standards on an individual basis. The Middle Snake reach is impacted by return flows from irrigated agriculture, runoff from confined animal feeding operations (CAFOs), hatchery effluent, hydroelectric development, and point source discharges. These contributions become critical during the summer when flow levels are low. The parameters of concern include sediment and temperature, with phosphorus being the critical limiting nutrient (IDHW, 1989).

Hatchery Effluent

Because of the high quality of the spring water issuing from the Snake River Plain aquifer, the Middle Snake reach is ideal for fish farming. It is estimated that 80 to 90 percent of the spring flow in the reach is utilized for fish production. Ninety-eight active commercial facilities are located adjacent to the Snake River or its tributaries in the planning area (Agte, 1992). There are also four state and federal hatcheries located along the reach. Waste materials associated with the hatchery operations include uneaten and undigested food, fecal matter, and metabolites which exist in soluble, colloidal, or suspended forms (IDHW, 1991). The accumulated waste materials are periodically removed by various types of raceway cleaning methods. The unsettled, resuspended and soluble waste materials are continuously discharged in the raceway effluent.

Decomposition of fecal and feed solids depletes the dissolved oxygen concentration in the receiving water, and results in the release of dissolved nutrients. Moreover, aquaculture wastes support a diverse population of micro-organisms which also contribute to oxygen depletion, and may be deleterious to other aquatic species. The addition of phosphorus from fish hatcheries to aquatic habitats can also present serious, long-term pollution problems. The biologically available fractions of phosphorus and nitrogen in fish farm discharges contribute to the enhancement of algal and vascular plant growth, thereby exacerbating eutrophication of the receiving water. Currently, commercial aquaculture facilities are authorized by permit to discharge a total of 117,500 pounds of suspended solids per day to the Snake River (IDHW, 1991).

Livestock Operations

A significant number of dairies and confined animal feeding operations are located in the planning area. Dairy cattle produce an estimated 85 pounds of manure (feces and urine) per day per 1,000 pounds of live weight. Jerome County has an estimated 17,500 pounds of waste per cow per year, which is above the state average. The manure contains 9.3 pounds of solids, 0.37 pounds of nitrogen, 0.069 pounds of phosphorus, and 0.27 pounds of potassium. In one year a 500 cow herd of 1,000 pound cows can produce about 7,750 tons of manure containing 850 tons of solids with 34 tons of nitrogen, 6 tons of phosphorus, and 25 tons of potassium.

In addition to the manure wastes, the washing of tanks, pipelines, equipment, cows, parlor, and milk house floors can produce 735 to 2,600 gallons per day of additional liquids (IDHW, 1991). The manure produced by a dairy operation contains about 43% more liquid with about the same amount of solids per 1,000 pounds live weight as do feedlots. This, coupled with the liquids from the washing operations, means that dairies require more storage, handling, and lot management than do feedlots.

Feedlot cattle produce an estimated 62 pounds of manure per day per 1,000 pounds of live weight. The manure contains 8.9 pounds of solids, 0.43 pounds of nitrogen, 0.09 pounds of phosphorus and 0.23 pounds of potassium. A 500 head lot can produce about 6,900 tons of manure per year with 810 tons of solids, 39 tons of nitrogen, 8 tons of phosphorus, and 21 tons of potassium (IDHW, 1991).

Irrigation Return Flows

During the irrigation season, 13 perennial streams and over 50 agricultural drains contribute irrigation tailwater to the Snake River.

A 1969 study of the 203,000 acre Twin Falls Canal Company irrigation project indicated that 50 percent of all the irrigation water for the project area became subsurface drainage water; evapotranspiration accounted for 36 percent and the remaining 14 percent was surface runoff. Thus 64 percent of the total water input became irrigation return flow into the Snake River (Carter et al., 1971). The study also indicated that the mean concentrations of all ionic components measured in subsurface drainage water exceeded those in the input water diverted at Milner Dam except for phosphorus. Results showed that more water was used than was necessary to maintain a salt balance in the soil and considerable leaching took place. The net output of soluble salts from the project was about one ton per acre (Carter et al., 1973). Estimates of irrigation erosion by the Soil Conservation Service (SCS) identify substantial areas of serious erosion on surface-irrigated lands in Jerome and Twin Falls counties. Furrow irrigated crops on slopes greater than 2 percent will erode 50-60 tons of soil per acre per year (U.S. Soil Conservation Service, 1991).

The Twin Falls Canal Company has excavated horizontal drainage tunnels under shallow perched water tables. Tunnels were terminated when fractures in the basalt carrying significant amounts of water were intercepted. The tunnels then served effectively as drainage channels to convey excess water into surface drains, or natural channels. Approximately 50 drainage tunnels ranging from 0.25 to 1.5 miles long were excavated before the practice was replaced by relief wells connected by tile drains in the 1930's. These relief wells were 35 to 70 feet deep, and tile drainage lines connecting them were 3.5 to 10 feet below the soil surface. These wells flow from hydrostatic pressure, and water is conveyed to natural surface drains by the tile lines. This practice also proved effective in lowering the water table, and it is still used today .

Other Sources

Rangeland and dryland farming, urban nonpoint sources and stormwater runoff, impacts from development and road construction, and sand and gravel operations also impact water quality in the Middle Snake reach. The impacts are compounded by associated stream channel alterations.

Municipal sewage treatment plants discharge directly or indirectly into the Snake River and its tributaries. The Twin Falls and the Hagerman sewage treatment plants discharge directly into the Snake River.

Agriculture

The Middle Snake region historically has built its economic base around agricultural operations. Grain, hay, beans, and potatoes, along with beef, dairy, and fish operations are the primary agricultural commodities. These commodities provide the raw products for food and seed processing plants located throughout the area. In 1990 the estimated market value of crops, livestock, and fish produced in Gooding, Jerome, and Twin Falls counties totaled $450 million.

CROP IRRIGATION

Approximately 500,000 acres of cropland are irrigated with water from the Snake River diverted at Milner Dam into the Twin Falls, North Side, Milner-Gooding, and the Milner Low-Lift canals. Irrigation diversions are also made from Snake River tributaries and springs, and farmers irrigate roughly 150,000 acres in the area from deep wells (Fig. 10). The existing network of irrigation companies in the planning area is extensive. Two-thousand six-hundred miles of irrigation canals serve the upland area bordering the Middle Snake reach (Map: Diversions and Canals). Irrigation organizations are listed in Table 9, which also lists irrigated acreage by county and water source.

There are 2,740 irrigated farms in Gooding (621), Jerome (768), and Twin Falls (1,351) counties covering 515,432 acres (Fig. 11; 1987 Census of Agriculture, U.S. Bureau of the Census). Average farm size is 300 acres, and 99 percent are individual or family owned. About 47 percent of the irrigated acreage is in furrows, and 53 percent is watered by sprinklers. Irrigated acreage represents 52 percent of all farm acreage, and 84 percent of total cropland in the three counties.

The primary crops are hay and alfalfa, cereal grains, beans, and potatoes. The irrigated soils have qualities that dictate the growing of close-growing crops and legumes, such as alfalfa or grass hay, at least 50 percent of the time. Pasture and alfalfa are more prevalent on the north side of the river due to rougher terrain and shallower soils, and comprise 70 percent of the crop production in Gooding County (UI, 1991a). Jerome County had more acreage in cereal grains than any other crop, however, beans, potatoes, and sugar beets are important crops in the central and eastern portion of the county (UI, 1991b). Beans are the main commodity in Twin Falls County, but potatoes, sweet corn, sugar beets, seed crops, barley, wheat, hay, and alfalfa are also planted in significant quantities (Idaho Agricultural Statistics Service, 1991). Climate and low humidity have made the Magic Valley the world's major snap bean seed producer, sustaining approximately 90 percent of supply.

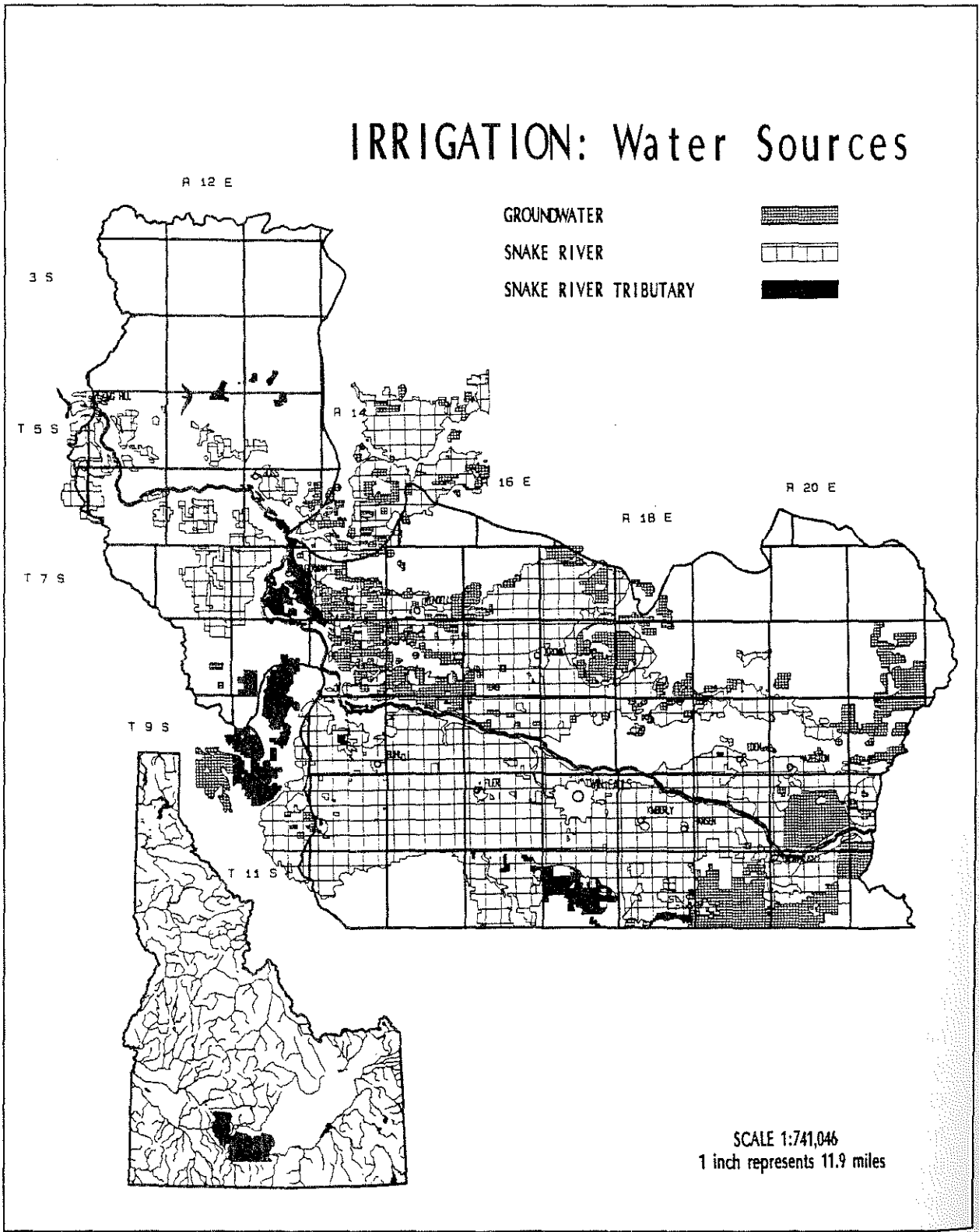

Figure 10. Map of irrigation acreage and water source.

Table 9. Irrigated Cropland Acreage by County

	Twin Falls	Jerome	Gooding	Elmore
Ground-water Source	32,396	54,442	42,648	
Surface Water Source	280,679	134,314	85,318	
Snake River Diversions	234,236	134,314	75,378	11,200
Snake River Tributary Diversions	9,853		1,996	
Salmon Falls Creek Diversions	42,790			
Thousand Springs Diversions			7,268	
Malad River Diversions			676	
Combined Ground Water and Surface Water Diversions	18,313		1,797	
TOTAL	337,588	188,756	129,763	11,200
Irrigation Organization				
Private Ground Water	32,396	45,233	44,445	
Private Snake River Diversions	424			
Milner Irrigation District	13,500			
Twin Falls Canal Co. (Snake River)	202,030			
North Side Canal Company		102,887	39,177	
North Side Pump Company		12,158		
American Falls Reservoir District No. 2		10,037	36,201	
A & B Irrigation District - Ground Water		9,209		
A & B Irrigation District		9,232		
King Hill Irrigation District				11,200
Bell Rapids Mutual Irrigation Co. (Snake River)	20,820			
Private Snake River Tributary Diversions	2,173		9,264	
Private Salmon Falls Creek Diversions	10,852			
Magic Water Corporation (Salmon Falls Creek)	7,120			
Salmon River Canal Co. (Salmon Falls Creek)	36,591			
Cedar Mesa Canal Co. (Snake River Tributary)	5,783			
Mud Creek Water User's Association	543			
Rock Creek Water District	5,356			
Private Malad River Diversions			676	
TOTAL	337,588	188,756	129,763	11,200

Source: IDWR, 1978; Bright, 1992.

Between Milner Dam and King Hill the Snake River is deeply entrenched below the surface of the Snake River Plain and has limited irrigation use. There are about 8,000 acres irrigated along the river in the canyon bottom, most of which are in the Hagerman Valley. Most of these lands are irrigated from various tributary creeks and springs rather than from the Snake River proper. Hay, grain, and forage crops predominate, but the high summer temperature and a comparatively long growing season allow for a wide crop selection in the canyon. Watermelons, cantaloupes, and tree fruits are successfully grown. Orchards are found along the canyon bottom between Twin Falls and the Buhl Bridge. An enterprise new to the Snake River bottom lands is the wine industry. Rose Hill winery has recently begun operations in Hagerman.

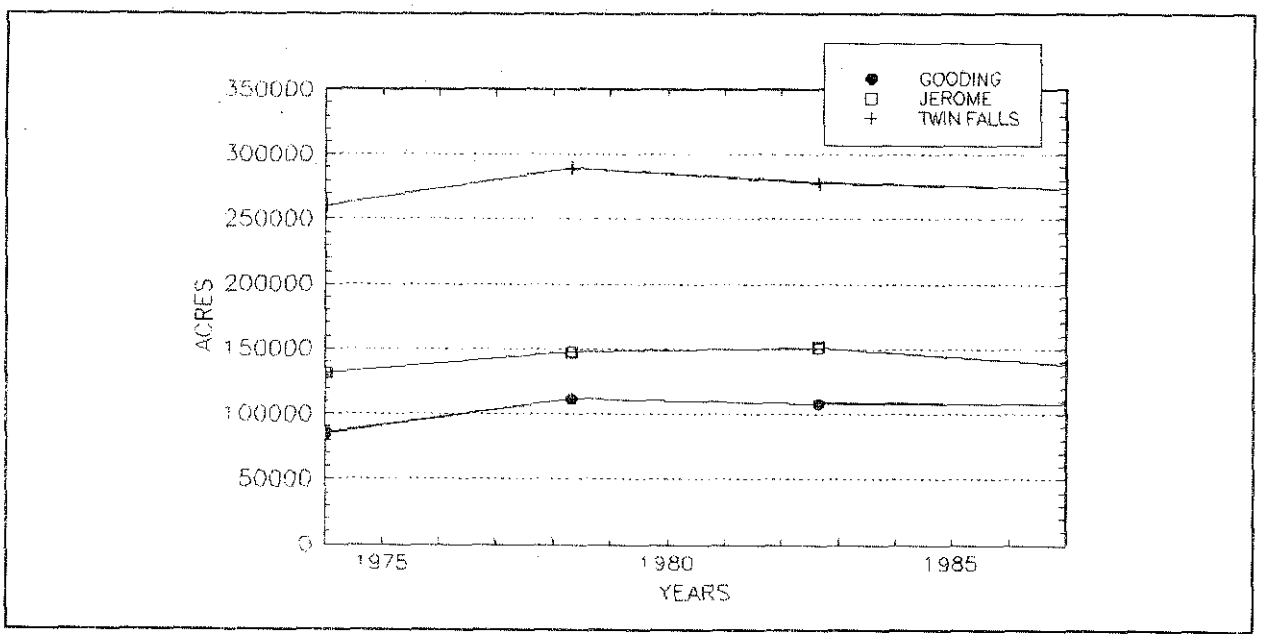

Figure 11. Irrigated acreage in Gooding, Jerome, and Twin Falls counties 1974 to 1987 (Source: 1987 Census of Agriculture).

Crop consumptive use of water varies with crop type and location. Generally, alfalfa, potatoes, and sugar beets have the highest consumptive-use rates at all locations (Table 10). Row crops such as corn, small vegetables, and beans use less water. Average crop consumptive irrigation requirements at Twin Falls are 18 inches per year. Irrigation requirements vary from year to year, depending on temperature and the amount and seasonal distribution of precipitation. Winter, spring, and fall precipitation will reduce irrigation-water withdrawals if adequate soil moisture delays the start of irrigation in the spring or hastens its end in the fall. Scant precipitation during summer months has less effect on irrigation-water withdrawals.

Table 10. Average Rates of Consumptive Water Use for Crops (Twin Falls)

Sugar Beets	21.9 acre-inches/acre
Dry Beans	15.6
Corn Silage	16.8
Spring Grain	13.2
Potatoes	21.3
Winter Grain	19.2
Alfalfa	23.2
Grass/Pasture	18.3
Orchard	18.9

Source: Corey, G.L. and R. Sutter, 1971. *Agricultural Water Needs: Consumptive Irrigation Requirements.* Idaho Water Resource Board, Water Planning Studies No. 5.

The amount of water applied to crops generally exceeds irrigation-water requirements because of on-farm losses. Water evaporates from exposed water surfaces in gravity-distribution systems. Runoff and seepage occur when more water is applied than can be evapotranspired or absorbed and retained by the soil. Water also seeps from unlined ditches. The U.S. Soil Conservation Service (1977) estimated that about 40 percent of water diverted for irrigation in the Snake River Basin is lost to evaporation, runoff, and seepage.

Early irrigation development was limited to the Snake River canyon and several of the tributary streams. Large scale irrigation began in the early 1900s with effective use of provisions of the Carey Act of 1894 and the Reclamation Act of 1902. Federal legislation facilitated the transfer of public lands to individuals for private reclamation projects. The new federal involvement provided coordination and funding for construction of dams, reservoirs, and canals, which in turn, stimulated expansion of irrigated acreage. The Twin Falls Project was one of the largest projects developed under the Carey Act.

In 1900 the Twin Falls Land and Water Company obtained a permit to appropriate 3,400 cfs of natural flow from the Snake River and received a segregation of 244,026 acres of desert land. In 1903 the project began with the construction of the Low Line Canal and Milner Dam on the Snake River. The first water deliveries were made in the spring and summer of 1905. In 1910, the operating company was turned over to the project settlers.

On the north side of the Snake River canyon, the Twin Falls North Side Land and Water Company initiated Carey Act projects. The North Side project was designed to divert water from the Snake River at Milner Dam into two offstream storage reservoirs enabling lands in Jerome, Gooding, and Elmore counties to be irrigated. The original plan proved to be infeasible when difficulties were encountered with the offstream storage reservoirs. The developing company then contracted with the U.S. Reclamation Service for the enlargement of the dam at Jackson Lake, Wyoming. The first water deliveries were made in 1909. In 1920, the irrigation system, consisting of 100 miles of main canal and 800 miles of laterals, was completed and turned over to the settlers for operation as the North Side Canal Company.

Water rights for most unregulated flow in the Snake River were decreed by 1908, and in low water years supplies were inadequate. Supply was augmented by federally financed construction of additional dams and reservoirs in the Upper Snake Basin. When demand for irrigation water increased after World War II, ground water was the logical source of supply.

Since the 1960s, total area irrigated with sprinklers has increased. This is due, in part, to development of lands unsuitable for gravity irrigation, but increasing energy costs associated with

pumping water have also made efficient water-distribution systems more economical. On the north side tracts, sixty to seventy percent of the acreage under irrigation is watered by sprinklers (Alberti and Diehl, 1992). On the south side changes are being made in irrigation methods, but at a much slower rate. Only about 20 percent of irrigated acreage on the south side is watered by sprinklers (Hauman, 1992). The rapid change in irrigation methods on the north side is attributed to improved productivity with sprinklers on the north side's rougher terrain.

The increasing number of sprinkler irrigation systems has reduced water demand but has increased canal system control problems. The canal systems were designed for gravity delivery and flood or furrow irrigation. When pumps shut down, the smaller lower laterals and ditches cannot handle the increased water volume. Sprinkler operators are usually asked to continue diverting at a constant rate.

The Department of Water Resources has 1,400 water rights on file for the diversion of surface water for irrigation in Gooding, Jerome, and Twin Falls counties. Aside from the primary canal company diversions, many of the surface water rights and permits are for miscellaneous drains and ditches in the area northwest of Buhl. A total of 1,579 water rights are on file with the Department for the diversion of ground water for irrigation in the three counties. The centers for this development are Hazelton Butte and Flat Top Butte in Jerome County, land south of Wendell in Gooding County, and the Dry Creek area, south of Murtaugh.

Milner Dam Diversions

The Twin Falls Canal Company delivers water to approximately 203,000 acres of irrigated cropland in Twin Falls County, through a system consisting of 110 miles of main canals and over 1000 miles of laterals and drains (Hauman, 1992). Because the company has the water rights to divert most of the natural flow at Milner, it has not purchased much upstream water storage. The flow rights allow the diversion of 3,000 cfs with a priority date of 1900 and 600 cfs with a priority date of 1915. Following original project construction, the canal company augmented water supplies with storage purchases in Jackson Lake and American Falls Reservoir. They currently hold 96,000 acre-feet at Jackson Lake, and 150,000 acre-feet at American Falls.

The average annual diversion (1971-1991) for irrigation by the Twin Falls Canal Company is 1,113,700 acre-feet of water, an average of 5 acre-feet per acre. Construction charges have been paid and maintenance charges are approximately $16.00 per acre for each individual land owner for all the land in the legal description. Water is in the canal system from about April 1 through November 15 in a normal year. Canal flows during the early spring and fall are considerably lower than during the peak irrigation season of June, July, and August because some crops do not require early spring and fall irrigation. Most crops are irrigated by small furrows. In the early spring the

tract usually has good water supplies as natural flows are high. When flows recede in July and August, and with little upstream storage, water supplies are vulnerable.

Sprinkler installations on the tract are centered in the Murtaugh area, and in the Balanced Rock Soil Conservation District (SCD) on the western margin. The Balanced Rock SCD is providing funds for sprinkler conversion.

The North Side Canal Company distributes water to approximately 161,000 acres of agricultural land located in Jerome, Gooding, and Elmore counties. The Northside Canal Company holds water rights to 300,000 acre-feet of natural flow from springs at American Falls, and 800,000 acre-feet of upper river reservoir storage. Storage rights include Palisades, 116,000 acre-feet; Jackson Lake, 312,000 acre-feet; and American Falls, 397,470 acre-feet. They also have a 15 cfs right on the Big Wood River (1890), and Snake River rights on filings of 300 cfs, (1900); 2,250 cfs, (1905); 350 cfs, (1908); 1,260 cfs, (1920); and 300 cfs, (1915). During years with a small snowpack, and consequently low reservoir levels upstream, the company must reduce its water deliveries.

The average annual diversion is approximately one million acre-feet, or an average of 6.5 acre-feet per acre. Conversion to sprinkler systems has been particularly rapid over the last 3-5 years on the North Side tract. Approximately 70 percent or over 100,000 acres of the project are irrigated by sprinklers. Some piping of canals is being done to allow for the installation of pivots.

The Milner-Gooding Canal was constructed by the Bureau of Reclamation from 1928 to 1932 as part of its Minidoka project. The 70 mile long canal was built to supply Snake River and reservoir storage water to 65,000 acres in the Shoshone and Gooding areas. The Milner-Gooding Canal is operated by American Falls Reservoir District No. 2. An average of 474,000 acre-feet of water, mostly from reservoir storage, is diverted annually by the Milner-Gooding Canal. The District has 400,000 acre-feet of storage in American Falls Reservoir.

In the eastern portion of Twin Falls County 13,500 acres are served by the Milner Irrigation District. The District was formed in 1921. Annual diversions average 60,000 acre-feet, an average of 3.7 acre-feet per acre. Thirty percent of the District is irrigated with sprinklers (Bright, 1992).

Diversions Below Milner

Below Milner, 90 percent of irrigation withdrawals from the Snake River are pumped. From Milner to near King Hill, the river is entrenched several hundred feet. Water is withdrawn along this reach by large, high-lift pumps that supply water to tracts on the canyon rim and by smaller pumps

that supply water to canyon bottom lands. Large pumping stations typically have several pumps that feed one or more penstocks that discharge into a canal system on the canyon rim.

The Bell Rapids project, a private development in northwestern Twin Falls County, involves about 28,000 acres. The first crop year for the Bell Rapids project was 1971. Irrigation water is pumped from the Snake River in the Lower Salmon Falls Pool. Some of the land is currently under the Conservation Reserve Program.

The Cottonwood development totals 5,000 acres on Black Mesa in eastern Elmore County. Annual diversions are 3,500 acre-feet.

The King Hill Irrigation District provides water to 11,200 acres in Elmore County. The District has a water right from the Malad River with a priority date of 1902. Eighty-five percent of the district irrigates with sprinklers. In 1979 the District transferred its Malad River water right to the Snake River and currently diverts water at three pumps along the Middle Snake reach: Wiley, Black Mesa, and King Hill. Average annual diversions above King Hill (1979-1991) are 31,700 acre-feet.

Ground-Water Irrigation

Development of ground water for irrigation on the Snake River Plain began in the mid 1940's. South side ground-water development began in the mid 1950's in an area west of Buhl known locally as Blue Gulch. The Snake River Plain Aquifer is readily accessible with pumping lifts ranging from 100 to 500 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 isolated locations or 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. More than 300 irrigation wells are interspersed in surface-water irrigated areas in Jerome and Gooding counties.

LIVESTOCK OPERATIONS

Livestock and trout account for half the market value of agricultural products in Gooding, Jerome, and Twin Falls counties. A significant number of dairies and confined animal feeding operations are located in the three county area. The USDA 1992 estimate for all cattle and calves in the area was 303,500 head. Lambs and sheep are estimated at 43,000 head (Table 11). Very few

sheep are raised in farm flocks; most are raised in the upland, mountain areas. Poultry operations account for 298 farms, and 153 farms raise hogs and pigs in the three counties (1987 Census of Agriculture, U.S. Bureau of the Census).

Table 11. Livestock Numbers by County 1992

	All Cattle	Milk Cows	Lambs and Sheep
Gooding	98,500	26,000	16,500
Jerome	90,500	32,500	11,000
Twin Falls	114,500	16,500	15,500
Total	303,500	75,000	43,000
Percent of State Total:	17%	42%	16%

Source: Idaho Agricultural Statistics Service, 1992.

Beef industry cow/calf numbers have declined steadily over the last five years due to low profit margins. However, the number of dairy cows in Jerome and Gooding counties has increased at a steady rate because of the abundance of both land and feed. Cow-calf operators have enjoyed two years with prices at or near record levels. This has been helpful since feed costs have also risen. The availability of cheap forages has declined due to the growth of the dairy industry. The dairy industry and the beef industry both draw from the same supply of alfalfa hay since there is little grass hay available (UI, 1991b).

Beef cattle graze rangelands, both public and private, primarily in the northern and western portions of the north side counties, and south of the Twin Falls irrigation tract in Twin Falls County. Most of the rangeland is public land administered by the U.S. Bureau of Land Management. At least 80 percent of the range users also feed their livestock on locally produced hay (UI, 1991b).

The Bureau of Land Management leases lands to 10 permit holders for livestock grazing in the canyon bottom. The grazing season for these allotments typically runs from August through March. Rangeland is valued at $1.92 per animal unit month (AUM), while irrigated pasture is valued at between $12 and $17 per AUM (Barnum, 1992; Vodraska, 1992).

In 1990, the three-county area contained 40 percent of the state's milk cows, a proportionately large number (Fig. 13). The dairy industry has expanded rapidly over the last few years and shows indications of continued growth. The trend toward increased dairy output is evidenced by new processing facilities, expansion of existing facilities, general favorable milk to feed cost ratios, and favorable lands costs.

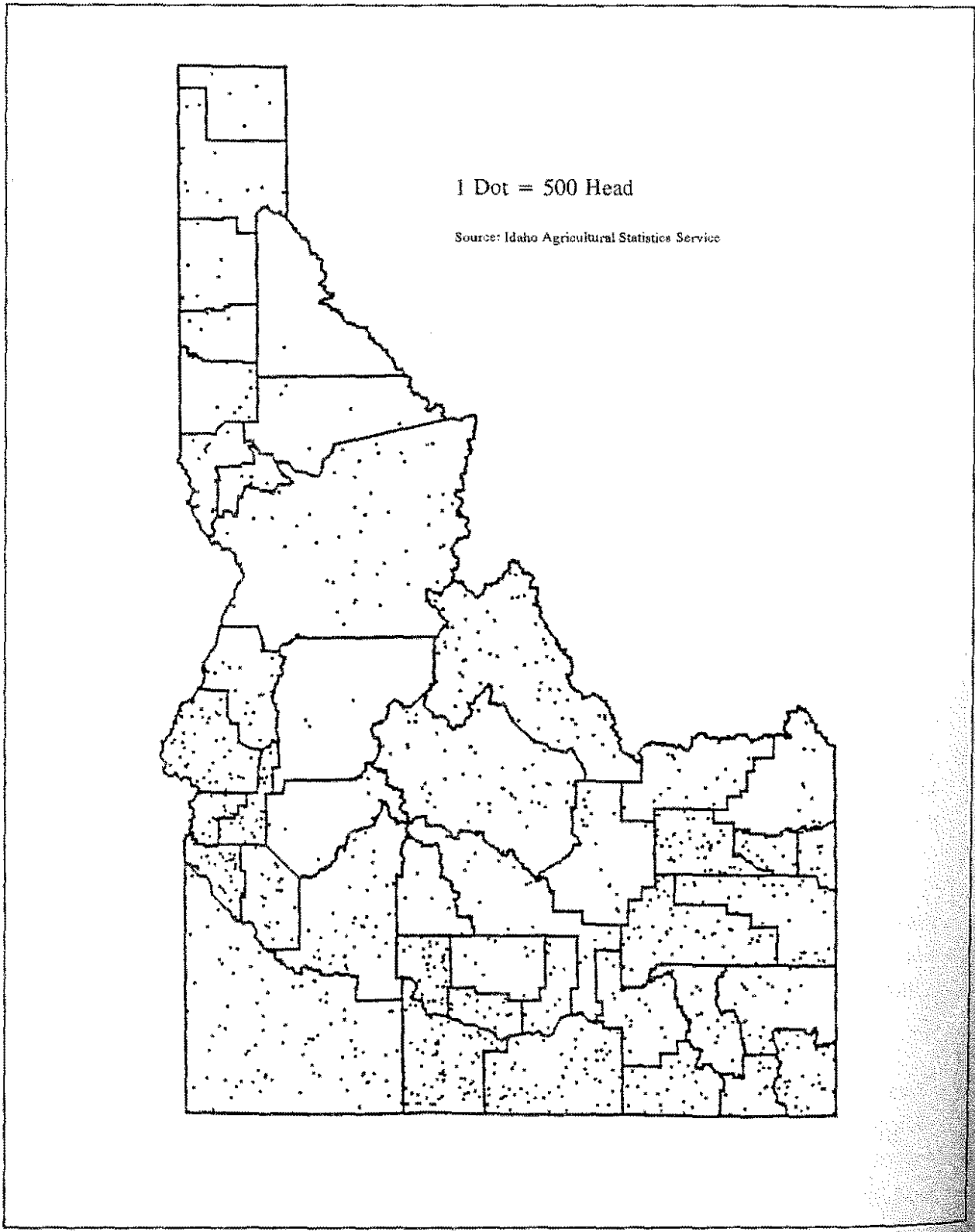

Figure 12. Beef cow distribution, January, 1992.

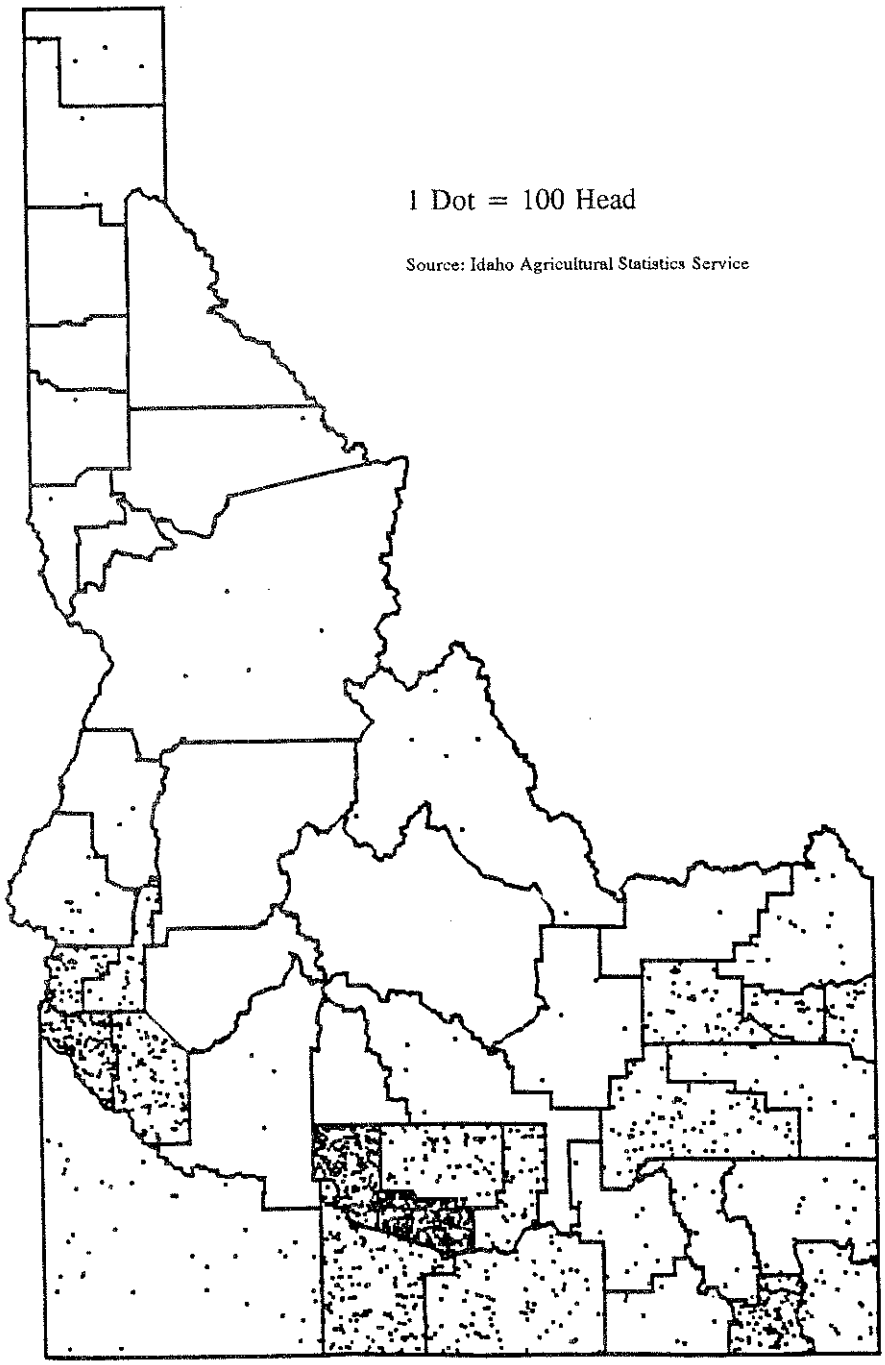

Figure 13. Distribution of Milk Cows, January, 1992.

Avonmore, Inc., an Irish firm, has established a cheese manufacturing plant near Gooding. Jerome Cheese Company will complete a new 2.1 million pound per day cheese plant in Jerome in 1992. The combined production of the Jerome and Gooding plants will require three million pounds of milk per day. In the past few years, expanding dairies have been sending about a million pounds of milk per day outside the area for processing into cheese.

A major problem within the local dairy industry is labor. Dairymen complain that good trained labor is not readily available and a large amount of time must be spent in training after the employee goes to work. There are good incentives for those in these positions by way of high pay ($1,700-$2,000 per month) and in some cases workers are given a cow per year which they may place in the herd (UI, 1991b).

The Department of Water Resources has 503 water rights on file for the diversion of surface water for livestock in Gooding, Jerome, and Twin Falls counties. The average surface water appropriations for stockwater are 0.28 cfs and 11.6 acre-feet. A total of 381 water rights are on file with the Department for the diversion of ground water for livestock in the three counties. Average appropriations for ground-water are 1.4 cfs and 14.5 acre-feet.

AQUACULTURE

The constant flow of clean, cool (59°F) spring water, tributary to the Middle Snake reach, makes this area ideal for aquaculture. In 1991, Idaho Fish and Game had 98 active commercial fish culture permits on file for facilities adjacent to the Snake River, or its tributaries, in the planning area (Map: Aquaculture Facilities). With few exceptions, the fish raising segment of Idaho's aquaculture industry is headquartered within a few miles of Buhl. Usable springs and wells for fish rearing can be found outside the Middle Snake planning area, but they are often not artesian, not of high volume, or are of poorer temperature or water quality (Klontz and King, 1975). Four state and federal hatcheries also operate along the Middle Snake reach, and fifty-five private ponds, which raise fish for personal consumption or non-commercial use, are located in the region.

The phenomenal growth of this industry in the planning area is attributed to the availability of large quantities of water optimally suited for raising both rainbow trout and channel catfish, the major fish species raised for human consumption in the United States. It is estimated that 80 to 90 percent of the spring flow along the Middle Snake reach is utilized for fish production. The larger fish farms use water from springs emerging from the Snake River Plain Aquifer along the north-east canyon wall. About 25 percent of the fish produced in the planning area are raised on small farms. Many of the smaller farms use water from springs arising south and west of the river, or water from seep tunnels, creeks, or canals (Lemmon, 1992).

The Idaho aquaculture industry ranks as the third largest food-animal producing business in the state (Brannon and Klontz, 1989). The majority of the fish raised are sold as processed fish. The Idaho industry has not targeted trout sales to private recreation establishments. In 1991 the commercial food fish industry in the planning area produced an estimated 40 million pounds of rainbow trout, or about 65 percent of the nation's production of processed trout (Irving et al., 1992). The local channel catfish industry contributed over 600,000 pounds to local production (Ray, 1992). Aquaculture revenues are estimated at $60 million annually, with an industry payroll of 750-900 people (Johnson, 1992). Fish feed sales and a growing fish-culture equipment manufacturing industry are value-added businesses that add significantly to industry receipts.

Devils' Corral Spring, near Shoshone Falls in Jerome County, was the site of the first commercial fish farm in Idaho. Started in 1909, the fish farming operations were discontinued one year later. The site remains today virtually unchanged. In 1919 a commercial fish farm began operation on Rock Creek, in the city of Twin Falls. By the 1920s Snake River bottomland was opened to homesteading, and in 1928 the Snake River Trout Farm at Clear Lake, the first modern raceway farm, began operation. Four trout farms were in production by 1935 and eight in 1950. The early 1970s saw an explosion in aquaculture facilities development and expansion adjacent to the Middle Snake reach. While there are about 96 licensed trout producers in the planning area, most of the production comes from about half a dozen major facilities (UI, 1991c).

Rainbow trout, which have been farmed since the 1880s, are the dominant trout stock, although aquaculture managers experiment with all trout species. Rainbow trout are preferred because they are more resistent to stress and extremely adaptable to domestication. Brood farms are located primarily in California and Washington, although there are a few Idaho establishments that supply local hatcheries. Trout typically attain a market weight of 10 to 14 ounces in 10 to 11 months. The aquaculture industry, however, has not limited itself exclusively to rainbow trout. Sources of cooler water and geothermal waters have been used to raise cutthroat trout, coho salmon, catfish, and tilapia. The hot water is mixed with cooler spring water for catfish and tilapia culture. Catfish average 12 to 16 months to processing with a typical market weight of 2 to 3 pounds.

Farm pond operations are an important part of the local aquaculture industry. Landowners with water resources on their property build ponds for raising fingerlings and then raise the fingerlings themselves for sale to the processors, or lease their facilities to larger farms or companies. Locally raised fish are slaughtered, packaged, and marketed from several local processing facilities. The fish are shipped fresh or frozen. The planning area has three large processing plants (over 10 million pounds), two medium-sized processors (3-4 million pounds), and two small processors (Campbell, 1992).

Over 1,700 ponds or raceways, with a water capacity of approximately 17 million cubic feet, are used to raise food fish in the planning area. Production averages over 15 pounds/gallon per minute (gpm), and with the serial reuse of water up to 80 pounds/gpm is possible (Brannon and Klontz, 1989). Assuming 10 months for rearing, trout require 5,400 gallons of water per pound of fish. No two individual fish raising facilities are alike in pond design, water utilization, fish density per unit of water volume, or fish husbandry methods. However, most of the commercial fish hatcheries in the region are a series of flow-through raceways that continuously pass water through the units.

High water turnover rates, between one and two changes per hour, help alleviate chronic ammonia levels; ammonia being the main form of nitrogen excreted by fish. Ammonia, even at low concentrations, will impair the growth and stamina of fish. The majority of the raceways are designed for the multiple use of water before it is discharged. Under the operating design of most farms, water passes serially from raceway to raceway, effectively reused up to five times.

The Department of Water Resources has 224 decrees, claims, licenses, or permits on file for the diversion of surface water for fish rearing in the planning area. The median diversion rate is 14 cfs. A total of 23 permits or licenses are on file for the diversion of ground water with a median filing of 2 cfs.

Domestic, Commercial, Municipal, and Industrial Uses

Ground water supplies approximately 60 percent of the domestic, commercial, municipal, and industrial needs in the planning area. The cities of Hagerman and Twin Falls rely on readily available spring sources in the Snake River canyon. Domestic uses include drinking, food preparation, washing, and lawn and garden watering. Public uses include schools, fire departments, and municipal parks. Most commercial establishments also use public supplies. Industrial water use incorporates manufacturing processes, cooling, and employee sanitation.

Public supply systems provide 25 percent of domestic and commercial water. There are 15 community water systems in the planning area which provide water of culinary quality to residents of Elmore, Gooding, Jerome, and Twin Falls counties. These systems are managed for the most part by the communities or by mutual non-profit water companies. Management consists of development of a source, construction and maintenance of some type of conveyance facilities, water purification treatment, periodic sampling, compliance with state and federal water quality requirements, distribution to local users, collection of revenues, repayment of capital costs, and payment of operation, maintenance, and replacement costs. These management responsibilities must be carried

out in such a way that the water system complies at all times with specified public health regulatory standards.

Table 12 profiles community water use, Table 13 estimates public-supply water use by county, and Table 14 estimates rural domestic and livestock water use. Exact water use quantities are difficult to define because approximately three-quarters of the communities do not have individual domestic or business water meters, and many do not have functioning meters on their city wells. Solley et al. (1983) estimates average rural domestic use at 98 gallons per day per person.

Food processing is the primary industrial use of water in the planning area (Table 15). Municipalities provide all industrial water within city limits. Food-processing industries withdraw relatively large volumes of water for meat packing; fruit, vegetable, and fish preparation and preservation; and beet sugar refining. Withdrawals for food processing have a distinct seasonal pattern. Water use for sugar refining and potato processing is highest from September through March. Water use for canning and freezing of fruits and vegetables peaks from July through October. Water use for milk- and meat-processing industries is relatively constant throughout the year.

The Department of Water Resources has 401 decrees, claims, licenses, or permits on file for the diversion of surface water for domestic, commercial, or municipal use, and 5 water rights for industrial use in Gooding, Jerome, and Twin Falls counties. Filings for the diversion of ground water for domestic, commercial, municipal, and industrial use total 621, 163, 43, and 24 respectively. Domestic diversion rates average 0.11 cfs. Water rights for the industrial use of ground water in the three county area average 0.2 cfs.

Well depths in the planning area vary from 50 to 400 feet. The ground water is of high quality, and up to the present time, very little contamination has occurred. Recent studies have shown an increase in nitrates as the water flows through agricultural areas. Current nitrate levels average 3 parts per million, well below the 10 ppm limit for drinking water (McMasters, 1992).

GEOTHERMAL RESOURCES

Thermal water has been used in Idaho since prehistoric times. Current uses in the planning area are for resorts, fish rearing, and greenhouses. Several resorts using thermal water are operated in the canyon, and greenhouse operations using geothermal energy are located near Bliss and Banbury Hot Springs. Much of the thermal water discharged through wells and springs is of low temperature ($< 100°C$). The hottest wells (65°C) in the planning area are at Banbury Hot Springs northwest of Buhl, and White Arrow Hot Springs near Bliss. The greatest potential, as far as present knowledge of the resource in Idaho is concerned, is for space heating and greenhouse use. Annual withdrawal of

Table 12. Municipal Water Supply and Waste Disposal

County Code	City	1990 Population	Population Served	Water Source	Water Supply		Method of Waste Treatment/Disposal	Average Discharge	
					Water Right	Capacity		Winter	Summer
GD	Bliss	185	64	2 City wells	0.2 cfs	1.40 mgd	Septic Tanks	----	
TF	Buhl	3516	1800	4 City wells	7.5 cfs	3.60 mgd	Lagoon - unnamed creek - Snake River	0.55 mgd	0.62 mgd
TF	Castleford	179	96	2 City wells	1.0 cfs	0.36 mgd	Total containment lagoon	----	
JR	Eden	314	130	2 City wells	3.0 cfs	0.28 mgd	Lagoon - waste ditch - Snake R.	Unquantified	
TF	Filer	1511	625	4 City wells	3.0 cfs	1.70 mgd	Lagoon - (Winter) Cedar Draw to Snake R., - (Summer) land application	0.03 mgd	----
GD	Gooding	2820	1200	2 City wells	11.0 cfs	3.60 mgd	Lagoon - (Winter) Little Wood River, - (Summer) land appplication	.25 mgd	.75 mgd
GD	Hagerman	600	350	Big Spring & Potter Spring	4.0 cfs	3.30 mgd	Lagoon - Snake R.	.20 mgd	.25 mgd
TF	Hansen	848	320	3 City wells	2.5 cfs	1.80 mgd	Lagoon - unnamed creek - Snake R.	0.07 mgd	
JR	Hazelton	394	243	3 City wells	1.3 cfs	0.97 mgd	Lagoon - land application	Unquantified	
JR	Jerome	6529	3500	4 City wells	16.5 cfs	7.50 mgd	Sewage treatment plant - Jerome Canal - Snake R. or treatment plant irrigation	0.60 mgd	----
TF	Kimberly	2367	1028	4 City wells	5.5 cfs	3.80 mgd	Trunkline to TF sewage treatment plant	0.27 mgd	
EL	King Hill	60	36	2 City wells	0.3 cfs	0.06 mgd	Septic Tanks	----	
TF	Murtaugh	134	30	1 City well	0.5 cfs	0.46 mgd	Lagoon - subsurface drainfield	Unquantified	
TF	Twin Falls	27,591	10,000	Alpheus Cr. Spring	52.4 cfs	27-28 mgd	Sewage treatment plant discharges to Snake R.	6.67 mgd	6.67 mgd
				2 wells-S. Side	8.5 cfs	6.00 mgd			
GD	Wendell	1963	853	3 City wells	4.6 cfs	2.10 mgd	Lagoon - land application	Unquantified	

EL=Elmore
GD=Gooding
JR=Jerome
TF=Twin Falls

g/d=gallons per day
mgd=million gallons per day

Table 13. Estimated Nonindustrial Public-Supply Water Use by County, 1980

County	Population Served by Public Supplies	Withdrawal for Public Supply (acre-feet per year)	Water Source GW = Ground water SW = Surface water
Gooding	5880	1400	GW/SW
Jerome	8630	2200	GW
Twin Falls	33340	3800	GW/SW

Source: Goodell, 1988.

Table 14. Estimated Rural Domestic and Livestock Water Use by County, 1980

County	Rural Population	Rural Domestic Withdrawal (acre-feet)	Livestock Withdrawal-Surface Water (acre-feet)	Livestock Withdrawal-Ground Water (acre-feet)
Gooding	4000	400	400	400
Jerome	6200	700	400	300
Twin Falls	6200	700	400	200

Source: Goodell, 1988.

Table 15. Estimated Industrial Water Use by County, 1980

County	Total Withdrawal (acre-feet)	Ground Water (acre-feet)	Surface Water (acre-feet)	Public-Supply Systems (acre-feet)
Gooding	1790	1700	0	90
Jerome	100	40	40	20
Twin Falls	10900	5100	900	4900

Source: Goodell, 1988.

the thermal Twin Falls - Banbury Aquifer is estimated to be 23,600 acre-feet per year, (4,364 acre-feet for the immediate Twin Falls vicinity and 19,326 for the Banbury area).

In Jerome County thermal water at 43°C is discharged from a well located beside the Snake River. Subsurface temperatures are predicted at 89° and 93°C. No other thermal water is known in Jerome County and the potential for further prospects is unknown. Thermal water in Twin Falls County is widely scattered, occurring principally in the northwestern and eastern part of the county. There are 56 thermal water occurrences with surface temperatures of 20°C or above. Low temperature (20-30°C) thermal wells are located within one mile of King Hill. Prospecting for more thermal water in this area may prove fruitful, and the prospect of hotter water at depth is possible (Mitchell et al., 1980). Most of the thermal water is associated with known faults or linear features thought to represent some type of rock fracture. Recharge to the fracture-controlled systems could be

anywhere along their length and interbasin ground water transfer may be associated with those that are regional in length.

Mining

The Snake River, in the planning reach, has cut into the eastern Snake River Plain, a downwarped and downfaulted structural basin filled with basalt. The basaltic lava flows may overlay older rhyolites, granites, gneiss, or sedimentary rocks. Exposed rocks in the planning area range in age from early Tertiary volcanics to modern sediments being deposited by streams, rivers, and wind. Most rock outcrops are of basaltic composition.

Alluvial deposits of sand, silt, and gravel, with some boulders and cobbles, commonly form bars and terraces in the Snake River and on the canyon rim. Early Pleistocene Tuana Gravel is associated with canyon cutting and consists of pebble and cobble gravel interbedded with sand and silt. It is extensive downstream of Twin Falls, and is overlain only by recent alluvium. Melon gravels, or rounded boulders and cobbles of local basalts, are located throughout the reach and are associated with the Bonneville Flood. As the flood swept down the canyon, it picked up boulders and smaller rocks in the torrent and deposited them in terraces, backwaters, and eddys. Alluvium in the canyon consists of sands and gravels that occur intermittently in the river channel and in major tributaries, and fine-grained flood-plain deposits adjacent to the Snake River.

There are few precious metal occurrences and no known deposits of base metals in the planning area, however, there are several deposits of industrial minerals. Sediments of the Idaho and Snake River Groups contain important deposits of diatomite and silica sands. Sand and gravel are also readily available along the Snake River (Map: Mining Prospects, Claims, and Leases). Some of the mineral deposits, which include clay, diatomite, pumice, and dimension stone for use in the construction industry, contain significant quantities of high quality materials (U.S. Bureau of Mines, 1991).

Water is essential in mining and processing minerals, however, total water requirements of the industry are small. The primary use of water by the mining industry is in mineral processing. The Department of the Interior has estimated that the mining industry consumes less than one-half of one percent of all diverted water, and recycles the same water several times (USGS, 1990). Since total water requirements of the industry are relatively small, water supplies for mining should be adequate.

GOLD

In the late 1800's miners and settlers prospected the Snake River for gold. Below the Blue Lakes Country Club the river was mined for gold during the late 1880s, and again during the Depression. Snake River placers produced 23,000 ounces of gold in Cassia, Minidoka, and Jerome counties (Idaho Bureau of Mines and Geology, 1964). Since the 1930's no major gold mining has occurred along the reach. Recent commercial mining attempts have failed financially.

Snake River gold is a fine "flour" gold associated with gravels at various localities along the river. Much of the placer material is probably of glaciofluvial origin. The gold can be panned with some care and is about 93 percent pure. Gold placer prospects and mined claims are located on the Mining Prospects, Claims, and Leases Map.

INDUSTRIAL MINERALS

Diatomite (diatomaceous earth) - Diatomite has been mined at several sites in the planning area. There is a large deposit located on the upper portion of Clover Creek in Gooding County, and smaller deposits are located near the Snake River in Elmore County between Pasadena Valley and Big Pilgrim Gulch, and in Twin Falls County near Banbury Hot Springs. The quality of the diatomite deposits varies from noncommercial, with considerable impurity, to good (U.S. Bureau of Mines, 1991; Strowd et al., 1981; Idaho Bureau of Mines and Geology, 1964). Deposits are usually mined by open-pit methods and are seldom free of other sediments and organic debris, so most diatomite requires treatment after mining to prepare it for industrial use.

The primary use of powdered diatomite is as a filter aid in the separation of suspended solids from water, beer, wines, liquor, fruit and vegetable juices, dry-cleaning fluids, raw sugar liquors, etc. Other uses are as a filler for paint, paper, or rubber, a carrier for pesticides and hazardous liquids, as various additives, in insulation, and as a marker.

Clay - A small quantity of silty (common) clay is being mined by Snake River Pottery near Hagerman, for use in decorative pottery products and to make custom kitchen and bath tile. There is also some clay associated with a diatomite deposit near the Snake-Salmon Falls Creek confluence. Clay production is not a major component of economic activity in the planning area. The best known use of clays is in the manufacture of fired ceramic products which consume about two-thirds of all industrial clay. Clay could be used in the future to seal settling ponds.

Pumice - Pumice deposits in Idaho are large enough for the state to rank fourth in national production. Current production comes from three commercial operations in southeastern Idaho, and a quarry near Fairfield. Pumice has been mined on the north side of the Snake River in Jerome County

(U.S. Bureau of Mines, 1991). The major use of pumice is in the construction industry, where it is used in concrete aggregate and admixtures, building block, and as plaster aggregate. Cinder cones have been exploited for road building.

Dimension stone - Dimension stone is any stone which is quarried, cut, shaped and possibly polished for structural, architectural and ornamental applications. Basalt near the confluence of Deep Creek and the Snake River has potential for dimension stone (U.S. Bureau of Mines, 1991). The basalt is usually gathered from where it lies loose on the ground, loaded onto flatbed trucks, and shipped to local and regional building supply dealers.

Uranium - There is one reference to a uranium prospect near the Hagerman Fossil Beds (Strowd et al., 1981; U.S. Bureau of Mines, 1991). No mining has taken place at this site, nor is it likely to be developed due to the proximity to the Hagerman Fossil Beds National Monument.

Sand and Gravel - Sand and gravel production comprises the largest mineral industry in the planning area and deposits are readily available throughout the length of the Middle Snake reach (Map: Mining Prospects, Claims, and Leases). Major production is from alluvial gravels. High-purity silica for specialized use in the electrochemical industry may be found in the sand and sandstone of the Idaho Formation in the southwestern part of the State. The formation is found on the west side of the Snake River northwest of Buhl.

One large sand and gravel dredge has been in operation in the Middle Snake reach downstream from Niagara Springs for four years. Due to low flows for the past two years and the eight foot draft of the floating dredge, there has been little production, though the operator indicates demand for sand and gravel for construction concrete is increasing. He would ordinarily be producing 20,000 tons per year (Sligar, 1992). The Idaho Department of Transportation and the County Highway Districts are the largest consumers of natural and manufactured aggregates.

OIL, COAL, OR GAS

Commercial quantities of oil, coal, or natural gas have not been produced in Idaho. Like most of Idaho, the Middle Snake planning area is underlain by rocks that are not favorable either as source rocks or reservoir sites for oil or gas; the lithologic, structural, and environmental conditions of deposition are all generally adverse. Widespread volcanism and faulting of the rock materials is incompatible with the accumulation of oil and gas (U.S. BLM, 1982; Idaho Bureau of Mines and Geology, 1964). Tertiary sedimentary rocks comprise the more favorable potential oil or gas sources and reservoirs. However, these deposits are fluviatile and lacustrine in origin and not marine, as is the case in large producing fields. There are no filings for oil and gas leases in the planning area (Idaho Department of Lands, 1992).

Timber

There is no commercially harvestable timber in the Snake River canyon or along the rim of the canyon in the Middle Snake reach. The nearest suitable timber for commercial and private harvest is located approximately 40 miles southeast of Twin Falls, on the Twin Falls and Burley Ranger Districts of the Sawtooth National Forest (Todd, 1992).

Power Development and Energy Conservation

Unlike other forms of energy used in Idaho, large quantities of electrical energy are produced within the State. The State has historically relied on hydropower as its principal source of electricity. Private and public utilities, along with the federal government, own and operate the hydroelectric system which provides approximately 60 percent of the State's electrical needs. Idaho currently has no in-state thermal generating capacity, other than limited cogenerating facilities which utilize forest products and waste from food processing.

Idaho's three major private electric utilities: Idaho Power Company, Utah Power and Light, and Washington Water Power, supplied the State with 1826 average megawatts of electricity in 1990. Currently planned additions by these utilities total 307 average megawatts through the year 2000 (Conservation Monitor, 1992). The major utilities are engaged in interstate operation. Power needs are supplied from generating facilities through transmission interconnections that make the most economic use of the overall power supply of the region.

Electricity, supplied by Idaho Power Company, is available for all homes and businesses in the Middle Snake region. The predominate heating fuels are oil and natural gas. The City of Twin Falls and most of the smaller cities and towns are served by Intermountain Gas Company.

Per capita, Idaho uses an above average amount of electrical energy (U.S. DOE, 1992). This probably results from the low cost of hydro-produced electricity. Idaho Power's quarter million residential customers paid 4.7 cents/kwh in 1990. The nationwide average rate is 8 cents/kwh, nearly twice that paid by most Idahoans (IPUC, 1991).

In 1990, the number of electric power customers in Idaho increased 1.9 percent. At the same time, average residential consumption decreased 1.4 percent. The decline in per-customer use may be related to increased conservation measures, or the dramatic decline in natural gas prices and the resulting decisions of consumers to use natural gas instead of electricity for space and water heating.

As much as 20 average megawatts of conservation has been purchased by Idaho Power in previous conservation programs, and is reflected in the company's current loads (IPC, 1989).

Over the decade, consumption per residential customer has decreased slightly. In 1990, consumption per residential customer was 14.34 megawatt hours in the Idaho Power service area, down from 14.77 megawatts hours in 1980 (IPC, 1990; IPC, 1991b). Forecasts project it to continue to decline to approximately 13.5 megawatt hours by the year 2000, and 13.0 megawatt hours by 2010 (IPC, 1991b).

Electric power consumption per commercial customer has dropped dramatically; from 79 megawatt hours/customer in 1978 to 56.5 megawatt hours in 1990 (IPC, 1990; Finn, 1980). Figures 14 and 15 show the distribution of electricity consumption for commercial and industrial customers. Industrial sales have grown steadily in the Idaho Power service area over the last decade. Food processing accounts for over 50 percent of Idaho Power's industrial demand for electricity.

The intensity to which electricity is used in irrigated agriculture has been changing over time (Table 16). Irrigation power consumption is comprised of horsepower growth, with total irrigated acres remaining constant, or an increase or decrease in total electricity-using irrigated acres. Growth in new irrigated acreage has slowed considerably since 1978. However, growth in supplemental acres may reflect the number of conversions from gravity methods of water application to sprinkler application methods.

More than half of the total drop of the Snake River, between Heise and Weiser, is in the 92-mile Middle Snake reach. The river drops 1,570 feet between Milner Dam and King Hill (Fig. 16). The steepest gradient is 32.4 ft/mile between Milner and Kimberly (Kjelstrom, 1986). Consequently, hydroelectric facilities have been attracted to this reach. Today, six hydroelectric dams are located on the Snake River between Milner and King Hill, and forty percent of the State's hydroelectric power facilities are located on the Snake River, its tributaries, or adjacent canal systems in the planning region (Map: Hydropower Sites - Middle Snake Reach). The 63 facilities, however, comprise only eight percent of installed capacity and average annual generation within the State (FERC, 1988).

About 300 megawatts of hydropower capacity have been developed in the Middle Snake region. Five hydroelectric projects, owned and operated by Idaho Power Company, operate as run-of-river plants with some storage used for peaking purposes (Table 17). Company projects at Thousand Springs, Clear Lakes, and the Malad River utilize flows collected from springs emerging from the canyon walls.

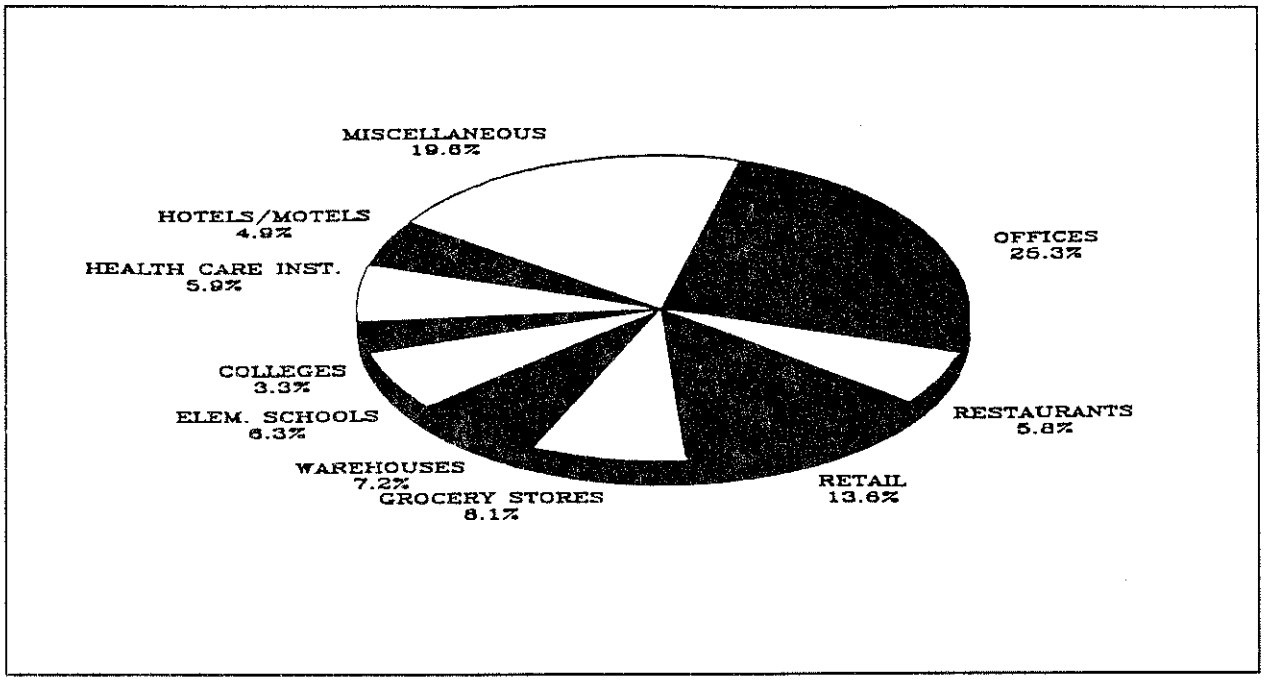

Figure 14. Estimated percentages for commercial electric consumption (IPC, 1991e).

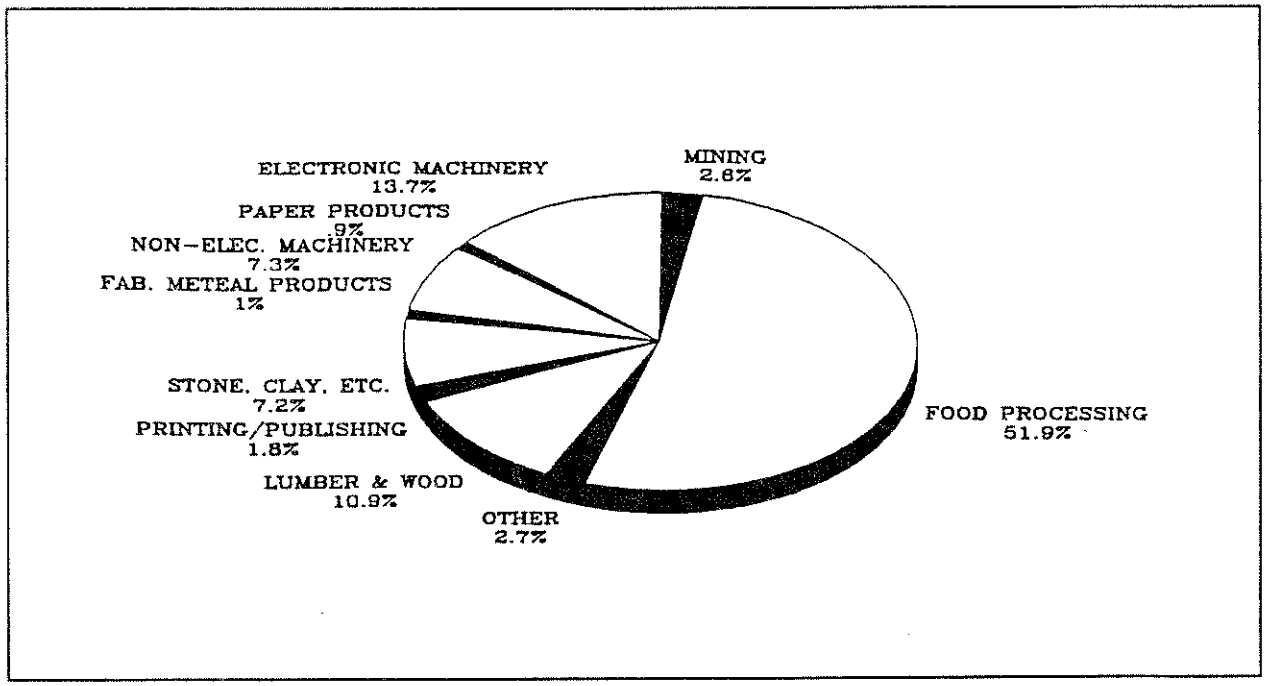

Figure 15. Composition of industrial electric consumption (IPC, 1991e.)

Table 16. Idaho Power Company Historical Irrigation Data 1970-1989

YEAR	NEW ACRES ADDED	SUPP'L ACRES ADDED	TOTAL ACREAGE (000)	TOTAL MWH (000)	TOTAL HP (000)	MWH/ACRE	MWH/HP	HP/ACRE
1970	35,029	21,006	1,095.4	816.4	581.5	.745	1.404	.531
1971	26,177	20,530	1,142.1	892.6	616.4	.782	1.448	.540
1972	28,220	24,954	1,195.3	995.3	648.0	.833	1.536	.542
1973	43,144	31,058	1,269.5	1,132.4	731.8	.892	1.547	.576
1974	66,672	54,407	1,390.6	1,382.5	845.0	.994	1.636	.608
1975	43,406	71,642	1,505.6	1,301.9	938.4	.865	1.387	.623
1976	37,760	61,723	1,605.1	1,381.3	994.7	.861	1.389	.620
1977	25,623	48,682	1,679.4	1,661.1	1,031.1	.989	1.611	.614
1978	20,807	49,709	1,749.9	1,463.9	1,102.8	.837	1.327	.630
1979	9,043	51,694	1,810.6	1,773.5	1,358.9	.979	1.305	.750
1980	7,691	39,734	1,858.1	1,500.3	1,237.6	.807	1.212	.666
1981	13,672	43,051	1,914.8	1,773.9	1,295.1	.926	1.370	.676
1982	7,345	31,456	1,953.6	1,532.7	1,317.3	.785	1.164	.674
1983	3,428	11,497	1,968.5	1,340.6	1,292.4	.681	1.037	.657
1984	3,986	13,865	1,986.4	1,343.2	1,290.7	.676	1.041	.650
1985	5,111	12,726	2,004.2	1,552.4	1,365.7	.775	1.137	.681
1986	5,084	7,446	2,016.7	1,436.7	1,351.1	.712	1.063	.670
1987	3,593	10,768	2,031.1	1,577.7	1,216.3	.777	1.297	.599
1988	7,248	15,941	2,054.3	1,669.1	1,210.0	.812	1.379	.589
1989	4,870	30,174	2,089.3	1,627.7	1,324.3	.779	1.229	.634

Source: IPC, 1991b.

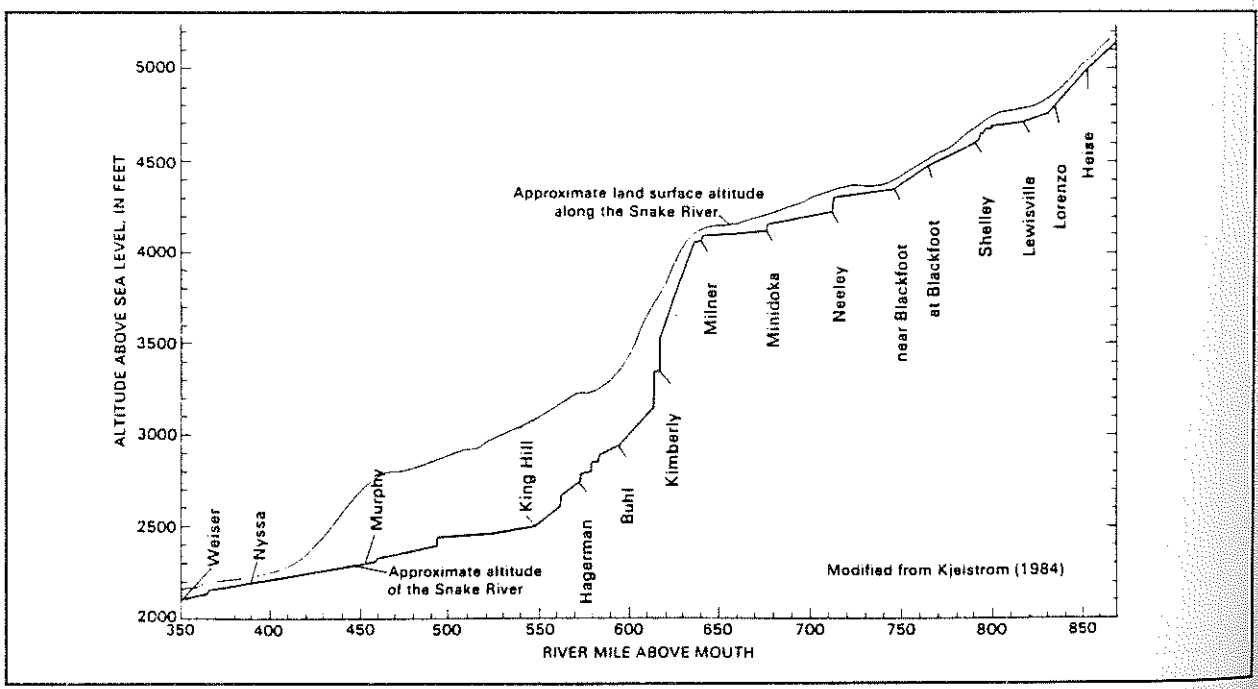

Figure 16. Snake River gradient from Heise to Weiser, Idaho (Kjelstrom, 1986).

Table 17. Existing Hydropower Facilities

	Generating Capacity (MW)	Capacity Rating (CFS)	Avg. Generation (MW Hours)	Water Used (acre-feet)
Gooding County				
Bliss	75.0	15,000	400,000	7,247,000
Clear Lake	2.5	500	18,000	314,000
Lower Malad	13.5	--	120,000	863,000
Upper Malad	8.3	--	65,000	594,000
Lower Salmon	60.0	14,000	280,000	5,164,000
Thousand Springs	9.0	900	62,000	414,000
Small Hydro	5.5	--	30,000	---
Jerome County				
Shoshone Falls	12.0	1,000	95,000	538,000
Small Hydro	19.9	--	70,000	---
Twin Falls County				
Twin Falls	10.0	1,000	65,000	504,000
Upper Salmon	34.5	6,500	280,000	7,169,000
Milner	57.5	--	--	---
Small Hydro	28.5	--	137,000	---

Source: Sipe, 1992; FERC, 1988; Goodell, 1988.

Idaho Power, in conjunction with the Northside and Twin Falls Canal companies, has added power generating facilities at Milner Dam and constructed a second power house 1.6 miles downstream. The Company is significantly increasing the generating capacity of their Twin Falls and Upper Salmon Falls facilities, and proposes to upgrade their project at Shoshone Falls. Generating capacity at Twin Falls will go from 10 MW to 52 MW, Upper Salmon will increase capacity from 34.5 MW to 48 MW, and the potential at Shoshone could add up to 119 MW (Sipe, 1992).

In addition to the mainstem power projects, numerous small hydroelectric plants have been located on and are proposed for the canals and tributaries which feed the Middle Snake reach. Prolific activity in small-scale hydropower development traces its origins to the oil crisis of the 1970's and subsequent federal and state economic incentives aimed at accelerating the development of domestic energy supplies. Small scale power generation is encouraged by a 1978 federal law, The Public Utilities Regulatory Procedures Act (PURPA), requiring major utilities to buy power from small generators. Since 1978 more than 42 small hydropower plants have been built in the area, and 18 projects are proposed.

Idaho Power generates an average 1.2 million megawatt hours in Gooding, Jerome, and Twin Falls counties. Small hydropower producers account for an additional 230,000 megawatt hours. In 1989 the region used 2.26 million megawatt hours: 32 percent in residential billings, 33 percent industrial and commercial, and 35 percent went to irrigation (IPC, 1991c). Figure 17 shows that

regional power use peaks in the winter with heating, and again in the summer with cooling and irrigation pumping demand.

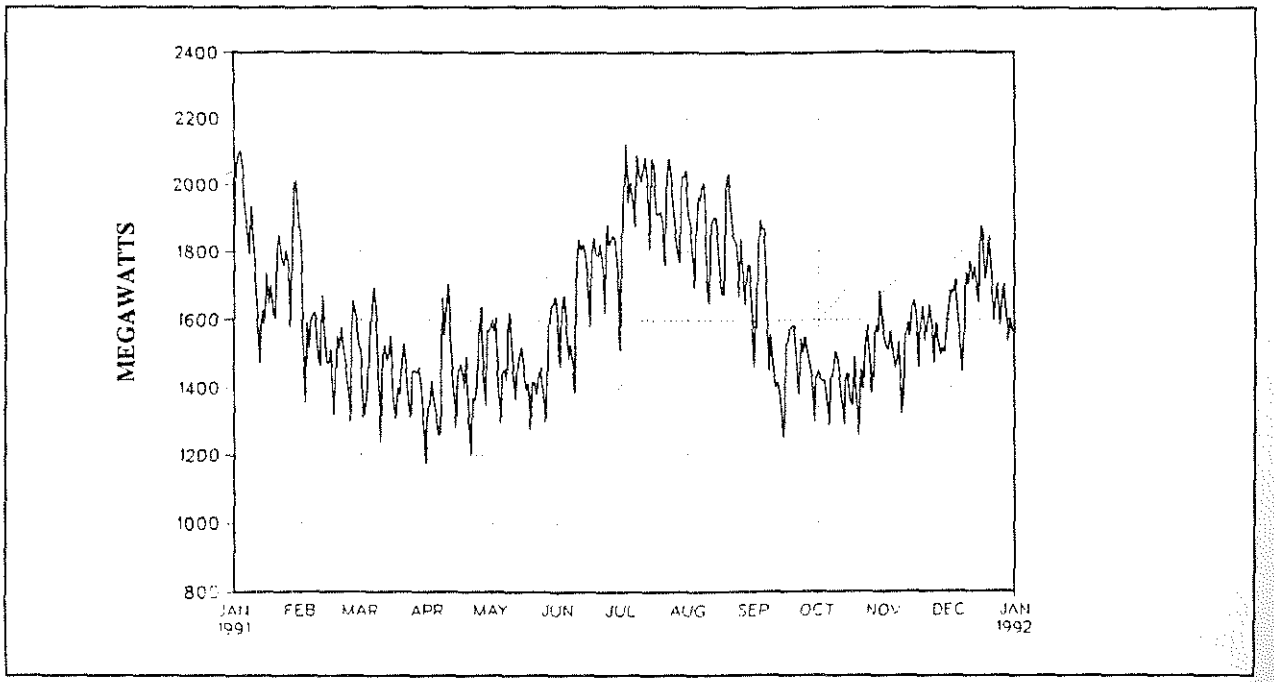

Figure 17. Idaho Power Company 1991 Daily Peak System Load (Fuhrman, 1992).

NEW HYDROPOWER PROJECTS

Seven new hydropower projects are proposed for the Snake River in the Middle Snake reach. The projects have active preliminary permits or license applications on file with the Federal Energy Regulatory Commission (FERC), and Auger Falls has been licensed for construction.

Star Falls (FERC #5797) - B&C Hydro, Inc. submitted an application for license to the FERC on August 11, 1992, for a hydropower project at Star Falls. The current application proposes a 400-foot-long, 20-foot-high concrete overflow dam/weir that would span the Snake River approximately 1,000 feet upstream of Star Falls. The dam/weir and upstream pool would stand approximately 7.5 feet above the existing high water mark of the Snake River. The pool would extend 3.3 miles upriver. The current configuration of the Snake River for the first 3.3 miles upstream from Star Falls is slack water pools. The normal maximum water surface area would be 135 acres. A minimum bypass flow of 300 cfs is proposed, and applicants say the project would have the capability of drawing down the pool to pre-project conditions. A low flow outlet/penstock intake structure would be located at the right abutment of the dam. The project would have two powerhouses, with the main powerhouse underground, approximately 800 feet downstream from Star Falls. A small bypass

powerhouse, with an installed capacity of 0.5 MW rated at 300 cfs, is proposed below the right abutment of the dam.

The main power plant would be an automated, run-of-the river plant with a peak capacity of 6,100 cfs. The main powerhouse would have one turbine with an installed capacity of 19.2 MW rated at 4,600 cfs, and a second turbine with an installed capacity of 7.6 MW rated at 1,600 cfs. The minimum flow usable by the 7.6 MW turbine would be approximately 375 cfs. The average annual plant factor for the main powerhouse is calculated at 44 percent for an estimated average annual 104,400 megawatt-hours. The main plant does not have any "dependable" capacity. The average annual plant factor for the bypass powerhouse is evaluated at 90 percent for an estimated average annual 3,000 megawatt-hours.

Auger Falls (FERC #4797) - Cogeneration Inc. was licensed by the FERC on March 29, 1991, to construct a low dam and diversion structure above Auger Falls and the Snake River's confluence with Warm Creek, (below the Jerome Country Club). The proposed project utilizes topographic features of the river without the need for a reservoir. The diversion structure consists of an 18-foot-high, 340-foot-long concrete weir/dam, and a canal just under two miles in length. Water would be diverted down the canal to a powerhouse below the falls (River Mile 609).

In the powerhouse, three generators are rated at 43.6 MW under turbine flows of 5,000 cfs, at a rated gross head of approximately 127 feet. The plant would produce an estimated 150,000 megawatt-hours per year. The instream maintenance flows vary seasonally between 350 and 1,200 cfs.

Boulder, Empire, and Kanaka Rapids (FERC #10772, 10849, 10930) - LB Industries submitted applications for license to the FERC on May 29, June 5, and June 19, 1992, for three run-of-the-river hydroelectric projects proposed for a five mile segment between Cedar Draw and Deep Creek. Boulder Rapids is located at River Mile (RM) 597, Empire Rapids at RM 594.5, and Kanaka Rapids at RM 592. The designed hydraulic capacity of each powerplant is 3,000 cfs, and the minimum instream flow in the bypass reach for each project would be 1,000 cfs.

At Boulder Rapids a wetlands peninsula, extending 320-feet into the river, would divert flow of the Snake River into a 2,331-foot canal which leads to the powerhouse below the rapid. The canal is unlined and follows the route of an existing high flow channel for the first 1,313 feet. The powerhouse would house four turbines and two generators. The proposed installed capacity is 4.9 MW with an estimated average annual generation of 25,250 megawatt-hours.

The Empire Rapid project would divert flow from the Snake River with a side channel turnout just upstream from the Buhl-Wendell Bridge. The turn-out would be a 640-feet-long earth-lined canal at an existing high-water channel that follows the north bank. The powerhouse, approximately 1,000 feet downstream of the bridge on the north bank, incorporates multiple generating units with an installed capacity of 3.1 MW, operating under a head of 12 to 18 feet. The estimated average annual generation is 18,767 megawatt-hours.

At Kanaka Rapids a side channel turnout on the south side of the river and a natural rock sill on the north side would divert flow from the Snake River to a 2,400-feet canal. The canal would extend from the turnout to the powerhouse below the rapids; the first 800-feet would not be lined and would follow the route of an existing high flow channel between a seasonal island and the south bank. The powerhouse would house four turbines and two generators. Proposed installed capacity is 6.3 MW, with an estimated average annual generation of 40,923 megawatt-hours.

A.J. Wiley (FERC #11020) - Idaho Power received a preliminary permit for study of the Wiley site in September, 1991. Based upon preliminary studies for a previous FERC licensing application, the hydropower proposal consists of a 100-feet-high dam, 1,150 feet long, located on the Snake River about one mile southwest of Bliss, Idaho. The resulting reservoir would back up water to the base of Lower Salmon Falls Dam, about 8 miles upstream, and store 13,500 acre-feet. Operation of such a hydropower facility would be constrained by, or impact, the operation of Lower Salmon and Bliss dams. Total gross head available for development between the tailwater of the Lower Salmon project and the maximum operating level of Bliss Reservoir is approximately 80 feet. Estimated average annual generation is 494,500 megawatt-hours.

Dike (FERC #10891) - Bart M. O'Keeffe of Dike Hydroelectric Partners of Sacramento, CA received a preliminary permit to study the feasibility of a 66 MW hydropower project near Bancroft Spring on July 16, 1990. The project entails a 500-foot-long and 70-foot-high roller compacted concrete dam. The dam would create a 560-acre reservoir with a storage capacity of 19,000 acre-feet. Two 33 MW turbines would operate under a rated head of 67 feet and a design flow of 15,000 cfs. Estimated annual generation is 360,000 megawatt-hours.

Canal Companies - Many small hydropower systems are now being installed on irrigation canals, even though water may flow only part of the year. These projects can often be cost effective because construction costs are usually less than projects built on natural streams. Also, because of the absence of fish populations, the canal projects do not present environmental conflicts. The Twin Falls and Northside Canal companies are looking at six new hydropower projects which could produce 40 megawatts of electricity during the irrigation season. The fall in the Northside canal system could develop 100 megawatts of power during irrigation season operation (Diehl, 1992).

GEOTHERMAL RESOURCES

Low to moderate temperature geothermal sites are extensive on the Snake River Plain. Aquifers in the study area are within a zone of regionally high heat flow which extends from northern Nevada to Yellowstone National Park. Heat flow values within the area are between 2.2 and 2.5 Heat Flow Units based on data from thermal gradients derived from bottom hole temperature evaluations. Subsurface temperatures in the area are, however, below temperatures for potential power generation (Mitchell et al., 1980). The thermal anomaly over the region is believed to be related to the Cordilleran Thermal Tectonic Anomaly and local thinning of the crust associated with Basin and Range extension (Street and DeTar, 1987).

Navigation

There is no commercial navigation, defined as moving commodities by water, on the Middle Snake reach. Under the Idaho Admissions Act and the Idaho Constitution, the State claims title to all bodies of water that are navigable. State title applies to the main stem of the Snake River above and below Shoshone and Twin Falls (Idaho Department of Lands, 1986).

Outfitters use the Snake River for commercial floating expeditions. To date, six outfitters are licensed to operate on the Middle Snake reach by the Outfitters and Guides Licensing Board. Twelve permits are listed for four segments: Murtaugh Bridge to Twin Falls Reservoir, Twin Falls to Lower Salmon Falls Reservoir, Lower Salmon Falls Dam to Bliss Reservoir, and Bliss Dam to C.J. Strike Reservoir.

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APPENDIX C

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I. FISH AND WILDLIFE

The Middle Snake reach has an unusual and varied fish population. Game fish include the white sturgeon, rainbow trout, cutthroat trout, the rainbow-cutthroat hybrid, channel catfish, smallmouth bass, largemouth bass, yellow perch, and mountain whitefish. Spawning of game fish in the main river is limited to the white sturgeon, channel catfish, and possibly smallmouth bass.

The Idaho Department of Fish and Game reports that with the exception of spawning areas, trout habitat in the main Snake River is good throughout most of the free-flowing reaches where large amounts of spring flow are discharged into the river (IDFG, 1991). However, natural reproduction in the main river is limited by fluctuating water levels, lack of spawning gravels, heavy siltation and plant growth, and localized areas of poor water quality (Hill, 1991; FERC, 1990).

Thousands of ducks, geese, herons, and raptors utilize the canyon for winter habitat and nesting. Game and non-game birds in the vicinity of the river include the pheasant, chukar, Hungarian partridge, sage grouse, California or valley quail, and mourning doves. A variety of warblers, wrens, and sparrows are also present. Some bluegrouse, bobwhite, and mountain quail are also found. The birds of prey include hawks, falcons, golden eagles, occasionally bald eagles, great horned owls, barn owls, kingfishers, and possibly the osprey.

Resident deer are found within the canyon. Predators that converse the area are coyotes and bobcats; furbearing animals are primarily the muskrat, mink, weasel, otter, and raccoon. Non-game or small mammals are the jackrabbit, marmot, pygmy rabbit, cottontail rabbit, badger, and other small rodents.

Biological Communities

The biological communities of most desert canyons, such as the Middle Snake reach, frequently harbor tremendous biological diversity due to a heterogeneous and less stressful environment. The river usually remains open and ice free throughout the winter, and the canyon provides shelter from extreme temperatures and winds.

Aquatic and River Channel Communities

The river channel is characterized by communities of free-floating and attached algae, which provide food and cover for invertebrates and fish (Murphey et al., 1991). These algal communities respond to nutrient loading and increased light and temperature in the summer, and have become a

problem in the Middle Snake, particularly in the slower flowing stretches and reservoirs. On the other hand, the eutrophication has provided increased food supply for dabbling ducks, particularly around the Niagara and Hagerman Wildlife Management Areas.

The benthic invertebrate diversity and abundance can be quite rich and varies with the type and degree of pollution and flow characteristics. As a general rule, the slower moving waters support crustaceans, mollusks, and midges, while the fast moving waters support caddisflies and mayflies. While native fish, such as the salmonids, sturgeon, and sculpin still exist in the Middle Snake, and in some reaches do well, non-game species such as the carp, largescale sucker, and squawfish have thrived largely because of eutrophication and reduced dissolved oxygen levels throughout most of the reach. The aquatic communities of the Middle Snake frequently have established populations of river otter, mink, and muskrat.

Currently, what exists on the Middle Snake are two different ecosystems: the reservoir or lake (lacustrine) ecosystem, and the free-flowing or riverine ecosystem. There are physical differences between the two ecosystems, and consequently, the biota are also distinct. Studies done by Idaho Power Company compared benthic invertebrate fauna of a riverine reach with a reservoir and found a significant difference in abundance and diversity (IPC, 1981). In the riverine reach, samples contained 576 individuals representing 19 taxonomic families compared to 82 individuals representing 13 families in the reservoir. In contrast, planktonic (free-swimming) invertebrates should have a higher diversity and standing crop in the still waters of the reservoirs than in the free-flowing reaches.

Riparian Communities

The floodplain and surrounding springs, where plants can access surface water or ground water, support healthy vegetative communities. The riparian communities vary from emergent wetlands, typically associated with the numerous springs and seeps along the Middle Snake, to deciduous woodlands. Some studies in this section of the Snake identify as many as 11 distinct riparian communities (IPC, 1991b). The wetlands are dominated by sedges, horsetails, cattails, and rushes. Springs and seeps frequently contain watercress. The dominant tree canopy may include several species of willow, cottonwood, juniper, water birch, netleaf hackberry, Russian olive (introduced), chokecherry, and black locust (Bowler and Bowler, 1991). The canopy understory shrubs are frequently squawbush, golden current, dogwood, wood's rose, nettle, and Solomon's seal.

Riparian communities provide an array of habitats for a wide range of birds: waterfowl, wading, shore, and diving birds (herons, commorant, ducks, white pelican), songbirds (robin, flicker, sparrows), and raptors (red-tailed hawk, kestrel). These groups are well represented in both abundance and diversity throughout most of the Middle Snake reach.

The most common small mammals in the riparian commonties include the cottontail rabbit, shrew, deer mouse, coyote, and an occasional bobcat (Cogeneration, Inc., 1983; Murphey et al., 1991). Mule deer are found throughout the canyon and on the rim, and are known to utilize channel islands for fawning, feeding, and resting (IPC, 1991b). Lizards, including the side-blotched lizard, western whiptail, and western fence lizard, and snakes such as the gopher snake, rubber boa, and western rattlesnake are the more common reptiles in the riparian and slope communities (IPC, 1990).

Upland and Slope Communities

Above the riparian communities, on slopes and benches in the canyon, the sagebrush-grassland community prevails. Big sagebrush is usually the dominant shrub, but both green and gray rabbitbrush, shadscale, and greasewood are frequently associated with it (Murphey et al., 1991). The Rocky Mountain juniper is the dominant tree species. The cliff and talus slopes are sparsely vegetated.

The Middle Snake's canyon walls and larger trees provide excellent nesting sites for a diversity of raptors. The nesting raptor list would include the red-tailed hawk, golden eagle, prairie falcon, northern harrier, American kestrel, and great-horned owl (Murphey et al., 1991). Bald eagles and rough-legged hawks have become relatively common winter visitors. Upland game birds, such as quail and chukar, inhabit the sagebrush-grassland slopes. Mule deer and pronghorn move along the rim, particularly during the winter, feed in the pastures on the rim and grasses on slopes, and may move down into the riparian communities to rest.

Sensitive Species

White sturgeon - Until fairly recently, little was known about the white sturgeon *Acipenser transmontanus* in Idaho (Lukens, 1981). In the Middle Snake segment, the healthiest population of sturgeon exists downstream of Bliss Dam. That population is considered viable and stable. A second population, in the Hagerman reach, is not as successful, and their status is probably declining (Reid, 1992; Partridge, 1992). Sturgeon have been caught throughout the Middle Snake reach, from Shoshone Falls to Lower Salmon Falls, but the Department of Fish and Game does not consider the numbers sufficient to represent a population, but rather isolated individuals. The white sturgeon is listed by the U.S. Fish and Wildlife Service (USFWS) as an Endangered Species Act candidate (C1) species, which means there is sufficient information to list them as threatened or endangered (Moseley and Groves, 1992). The Conservation Data Center considers their state status as being imperiled, but throughout their range, they are not considered to be currently in threat of extinction.

Shoshone sculpin - The Shoshone sculpin *Cottus greenei* is a species of fish endemic to Idaho waters and currently distributed in the Hagerman Valley. The fish is distributed in a number of springs and streams associated with the Thousand Springs formation, with an estimated total population size of 150,000 to 200,000 individuals (Wallace et al., 1982). Several of the springs, particularly Bickel Springs and Box Canyon, have concentrations of 20,000 individuals. The U.S. Fish and Wildlife Service lists the Shoshone sculpin as a Endangered Species Act candidate (C1) species (Beck-Haas, 1992), and the Conservation Data Center considers their global and local population status to be imperiled (Moseley and Groves, 1992).

Snails - Populations of five mollusc species designated as endangered or threatened by the U.S. Fish and Wildlife Service are found in the Middle Snake reach and its tributaries. The Snake River Physa *Physa natricina*, Idaho springsnail *Fontelicella idahoensis*, Utah Valvata *Valvata utahensis*, and the Banbury Springs limpet *Lanx sp.* are listed endangered. The Bliss Rapids snail, an undescribed monotypic genus in the family Hydrobiidae is listed as threatened.

The Utah Valvata existed continuously along the Snake until the Bonneville Flood 15,000 years ago caused their isolation (Taylor, 1985). The Bliss Rapids snail was historically found on boulder bars from King Hill to Lower Salmon Falls and in Box Canyon Spring (Federal Register, 1990). The Snake River Physa snail, a relict from Pleistocene lakes in the area, historically has ranged from Indian Cove (River Mile 524) to Salmon Falls Dam (Taylor, 1988; Federal Register, 1990). The Idaho springsnail, has been reduced to 80 percent of its original range (Federal Register, 1990). The Banbury Springs limpet was discovered in 1988 at Banbury Springs and a second population was discovered the next year in nearby Box Canyon Springs (Federal Register, 1990).

Established snail populations are dependent on clean, well-oxygenated, rapidly flowing rivers or large spring habitats (USFWS, 1991). Only eleven known sites in the Middle Snake reach support remnant populations. The factors limiting the snail populations today include fluctuating flows associated with hydropower generation, water quality, and competition from the introduced New Zealand mudsnail *Potamopyrgus antipodarium* (Frest and Johannes, 1992).

Birds - The Conservation Data Center (CDC) has identified two bird species that are federally listed by the USFWS. This includes the bald eagle *Haliaeetus leucocephalus* and long-billed curlew *Numenius americanus*. The bald eagle, listed endangered, is a migrant winter visitor throughout the entire reach. Data collected in the winter of 1991 and 1992 suggests a few bald eagles use the Hagerman to King Hill reach consistently and may be winter residents. Loggerhead shrikes and ferruginous hawks are present between Salmon Falls Creek and King Hill. Both bird species have a federal C2 classification, indicating endangered or threatened listing may be appropriate but further research and study is needed. Nesting loggerhead shrikes were observed in the same segment

(Carson, 1993). The long-billed curlew, with a 3c status (taxon is more abundant than previously thought), has a known population of 15-20 nesting pairs in the Hagerman segment. In addition to the federally listed species, the blue grosbeak *Guiraca caerulea*, and American white pelican *Pelecanus erythrorhynchos* are all species of concern in the state, but not throughout their distribution. The blue grosbeak has been found along Deep Creek in the Kanaka Rapids segment and the white pelican is found in large numbers throughout the Middle Snake but is not known to nest here (Trost, 1985).

Plants - Of the eight sensitive plant species listed by CDC, only one, the Snake River Milkvetch *Astragalus purshii var. ophiogenes* has USFWS status as a category C3, which is the weakest ESA candidate listing it can receive. This milkvetch is recorded as occurring from Kanaka Rapids to King Hill. The seven other plants are species of concern either locally and/or globally, according to the CDC appraisal, and occur in the Snake River canyon:

- Owyhee mourning milkvetch *Astragalus atratus var. owyheensis*
- Malheur cryptantha *Cryptantha propria*
- giant helleborine *Epipactis gigantea*
- large-flowered gymnosteris *Gymnosteris nudicaulis*
- Torrey's blazing star *Mentzelia torreyi var. acerosa*
- Janish's penstemon *Penstemon janishiae*
- tall dropseed *Sporobolus asper*

The study area contains seven areas that are on the list of Idaho Priorities for Wetland Acquisition prepared by the Idaho Department of Parks and Recreation.

Segment Descriptions

Milner Segment - The Milner segment extends from Milner Dam to Murtaugh Bridge. It is dewatered for much of its length during the irrigation season but regains some water as it approaches Murtaugh Bridge because of spring recharge and irrigation return flows. It is designated as water-quantity limited by DEQ. The segment has large rapids alternating with long pools, and passes through a narrow canyon with steep cliffs on both sides (B&C Energy Inc, 1992). The shoreline consists of rock shelves with boulders on sand. There are limited gravel areas and stands of riparian vegetation occur where the slope of the shore is more gradual.

The Milner segment is described as a cold-water fishery with modest hatchery rainbow and wild cutthroat trout populations in watered sections, and spawning potential in tributary springs (IDFG, 1991a; Partridge, 1992). IDFG believes that bypass flows at the Milner Dam powerhouse will allow further development of a trout fishery in this segment (Partridge, 1992).

B & C Energy, Inc., in their impact assessment for the proposed Star Falls hydropower project (1992), found limited spawning and rearing in the affected stretch of the river, and concluded that the segment does not seem to support coldwater gamefish species, except mountain whitefish. A few nongame species (dace, sculpin) were found in this segment. Benthic sampling revealed a low density and diversity of invertebrates (only Tubifex worms and Chironomid larvae). They also found most of the river bottom covered with a thick layer of silt, and riparian cover was lacking.

Wildlife habitat in the Milner segment is considered good, except for the lack of water in the river. Wintering migrant bald eagles utilize the Milner segment as they do the entire Middle Snake reach (Steenhof, 1992).

In the 1970s, shells of ESA listed mollusks, Utah valvata and Snake River Physa, were collected in the Milner segment (IPC, 1983). Utah Valvata may be expected to occur here as it prefers a silt bottom substrate (FERC, 1990). Other sensitive species that are expected to occur in the segment but have not been documented, include the Swainson's hawk, Ferruginous hawk, long-billed curlew and bobcat (IPC, 1983).

The Milner segment seems to have a high diversity of birds, but any comparison to the other segments may be misleading because of data inequities. In a 1983 study of breeding songbirds cited by B&C Energy Inc., the investigators found 288 birds/10 acres in the brushy riparian and wetland habitats. In their 1992 study, they found 61.6 birds/10 acres in the riparian/wetland habitat type compared to 82 birds/10 acres in sagebrush habitat. The most common birds encountered in winter in the project area were the robin, song sparrow, and Townsend's solitaire.

In the cited 1983 study, the investigators found 6 occupied raptor nests in the cliffs in the project area. This included 2 kestrel, 2 prairie falcon, 1 red-tailed hawk, and 1 golden eagle. Again in 1992, 4 raptor nests were found, which included 2 kestrel, 1 red-tailed hawk, and 1 great horned owl. Other raptors observed in 1992 in the area included bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, Swainson's hawk, golden eagle, prairie falcon, and rough-legged hawk. B & C Energy found 700 pairs of cliff and rough-winged swallow nests in the canyon walls and 600 breeding pairs of barn swallows. In the riparian system along the river, the same study identified 50 roosting pheasants. The FERC (1990) listed prairie falcon, raven, red-tailed hawk, northern harrier, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, and mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie in an inventory encompassing the segment.

In the area of impact of the proposed Star Falls hydropower project, B&C Energy, Inc. found 0.24 pairs of Canada geese per river mile and only 5 pairs of dabbling ducks. In a waterfowl survey

done in 1984, they counted 250-300 Canada geese, 300-400 mallards, 100-125 common mergansers, 5-10 lesser scaup, 5-10 white-winged scoters. IDFG found 12 waterfowl/mi. during the winter in the project area. In a 1991 IDFG winter waterfowl count, no Canada geese were found in the Milner segment and 45 total waterfowl of other species (IDFG, 1991c). These figures may be compared to 147 Canada geese and 7027 waterfowl counted in the Murtaugh to Thousand Springs stretch.

Other vertebrate species identified in the 1992 B&C Energy inventory included cottontail rabbit, mule deer, river otter, mink, western fence lizard, sagebrush fence lizard, and western garter snake.

A population of tall dropseed grass *Sporobolus asper* has been identified in an area approximately 100 ft. by 200 ft. below Milner Dam (Popovich, 1992). This species of grass, common to the midwestern grasslands, had not previously been documented for Idaho. This is the only plant species documented for the segment (Moseley and Groves, 1992).

Four distinct plant communities have been identified in the segment. The communities include willow/forb wetland, cattail/rush emergent wetland, riparian shrub, and mixed upland shrub/rock. The willow and forb wetland occurs along the river's edge below a basalt ledge on the south side of the canyon; the cattail and rush wetland is above the willow wetland and perched behind the basalt ledge; the riparian shrub occurs above the basalt ledges and extends up the canyon walls; and the upland shrub exists on the steep slopes anywhere from the river's edge to the canyon rim (B&C Energy, 1992).

The benches and moderate slopes are dominated by sagebrush and rabbitbrush, cheatgrass, and a mix of other grasses and forbs (IPC, 1983). In the basalt rock areas shaggy fleabane, a cactus, is common. The most common community in the segment is the mixed upland shrub/rock community, which is dominated by sagebrush, rabbitbrush, grasses (mainly cheatgrass), and scattered junipers (FERC, 1990). The wetland areas are dominated by rose, golden currant, willows, Russian olive, chokecherry, black hawthorne, and water birch. Eighty percent of the Milner segment is designated as Idaho Priority Wetland (IDPR, 1989). The SCORP describes this wetland as scrub-shrub and emergent wetland types with spring systems.

Murtaugh Segment - The Murtaugh segment is a free-flowing stretch that extends from Murtaugh Bridge to the backwaters of Twin Falls Reservoir. This section is dewatered at times during the irrigation season. The stretch is characterized by long, deep pools and rubble riffles. The segment is considered to closely approximate prehistoric habitat conditions (Partridge, 1992). Cutthroat, rainbow, and cutthroat/rainbow hybrids delineate this segment as a cold-water fishery (IDFG, 1991a). No hatchery stockings are made in the reach in an effort to protect the existing wild fish population.

The river habitat is described by IDFG personnel as outstanding to the backwaters of Twin Falls Reservoir (Partridge, 1992).

In all probability, bald eagles use this stretch of the Snake extensively in the winter. In the 1970s, blue heron and snowy egret colonies were known to exist in the Murtaugh segment, but their current status is not known (Trost, 1985). Birds listed for this segment include prairie falcon, raven, red-tailed hawk, northern harrier, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie (FERC, 1990).

Habitat similarities with the Milner segment would suggest that this reach contains populations of ESA listed mollusc species. However, supporting investigations have not been undertaken.

The vegetation communities of this segment are not chronicled, probably due to its inaccessibility. The only sensitive plant documented for the segment, the giant helleborine, *Epipactis gigantea*, was collected near Hansen Bridge (Moseley and Groves, 1992; FERC, 1990).

Twin Falls Reservoir --This short (1.0 mi.) reservoir is described as a mixed fishery containing rainbow trout, largemouth bass, channel catfish, black crappie, and bluegill (IDFG, 1991a). The reservoir is also known to contain smallmouth bass and an occasional walleye pike (Partridge, 1992). Walleye are not stocked because of the possible competition with other species in the Snake River system (Partridge, 1992). Vineyard Creek, an outstanding spawning tributary for wild cutthroat and rainbow trout, enters the reservoir less than a mile upstream of the dam (Reid, 1992).

The Twin Falls relicensing study (IPC, 1983) listed the bald eagle, long-billed curlew, and white-faced ibis, as sensitive species documented for the county, but no records sight these species around the reservoir (Moseley and Groves, 1992). None of the ESA listed mollusks have been confirmed for this segment of the river, but the Utah Valvata is expected to occur here because it prefers a silt bottom substrate (FERC, 1990).

Birds listed for this segment include prairie falcon, raven, red-tailed hawk, northern harrier, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, and mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie (FERC, 1990).

The yellow belly marmot, beaver, porcupine, raccoon, and skunk roam the shores of the reservoir, and the bobcat is considered a potential inhabitant (IPC, 1983).

The giant helleborine, *Epipactis gigantea*, is reported in the Vineyard Creek area (Moseley and Groves, 1992). The vegetation around the reservoir is predominantly a shrub/grassland type, dominated by sagebrush, greasewood, shadscale, four-wing saltbush, and annual grasses (IPC, 1983).

Twin Falls relicensing study documented the palustrine scrub-shrub wetlands containing cottonwood, hackberry, willow, and skunkbush in the study area. Vinyard Creek, a tributary of the reservoir, is both an Area of Critical Environmental Concern (BLM) and an Idaho Priority Wetland (IDPR, 1989).

Devil's Corral Segment --This is a short (approximately 1.0 mi.) free-flowing stretch that extends from the Twin Falls Dam to the backwaters of Shoshone Falls Reservoir. This segment of the river contains one important tributary, Devil's Corral, which enters about a mile below Twin Falls Dam.

The fishery is described as mixed, containing rainbow and cutthroat trout and smallmouth bass (IDFG, 1991a). An IDFG Stream Habitat Condition evaluation (1986-1987) rated the habitat excellent for spawning (value of 21, highest possible). The habitat is described as superior, with no single limiting factor. Devil's Corral represents one of the few remaining undeveloped spring systems in south central Idaho (Grunder et al., 1987).

Wildlife habitat is ranked high by the Idaho Department of Fish and Game (IRIS). Birds listed for this entire stretch of the river include prairie falcon, raven, red-tailed hawk, northern harrier, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, and mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie (FERC, 1990). A golden eagle nest was identified about 0.5 miles below the Twin Falls Dam (FERC, 1990).

Habitat similarities with the Milner segment indicate that this reach may contain populations of ESA listed mollusc species.

The Devil's Corral segment is short but contains a good population of giant helleborine *Epipactis gigantea*, below the dam and on the north side of the river (Moseley and Groves, 1992). Devil's Corral is designated as an Idaho Priority Wetland, although the vegetation has suffered from grazing and recreation (IDPR, 1989).

Shoshone Falls Reservoir --Like Twin Falls, this is a short reservoir (approximately 1.0 mi.), with a mixed fishery sporting rainbow and cutthroat trout, and smallmouth bass (IDFG, 1991a).

The relicensing study for the Shoshone Falls project identified the ferruginous hawk, long-billed curlew, white-faced ibis, Townsend's big-eared bat, and spotted bat as sensitive species that

may occur in the project area (IPC, 1991b). None are recorded in the CDC database as occurring in the segment (Moseley and Groves, 1992). The terrestrial habitat surrounding the reservoir is primarily desert. Three big-game species, mule deer, elk, and pronghorn, have been reported in the area (IPC, 1991b). The reptile diversity is relatively high: 8 lizard species, 8 snake species and even 7 amphibian species (IPC, 1991b).

Birds listed for this stretch include prairie falcon, raven, red-tailed hawk, northern harrier, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, and mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie, common loon, white pelican, trumpeter swan, upland sandpiper, Swainson's hawk, merlin, burrowing owl, osprey, short-eared owl, screech owl, and double-crested commorant (FERC, 1990; IPC, 1991b).

Auger Falls Segment --This segment runs from Shoshone Falls Dam to the mouth of Rock Creek. One significant tributary, Perrine Coulee, drains the community of Twin Falls. This segment has water year-round. Water-quality is considered fair for fishery development; habitat limitations are related to low summer flows (Partridge, 1992).

This stretch is a mixed fishery consisting of yellow perch, large and smallmouth bass, channel catfish, whitefish, rainbow and brown trout, and some sturgeon (IDFG, 1991a). The IDFG stocks this segment with hatchery rainbow trout, and there are two white sturgeon planting sites in this segment. Spawning is limited, but IDFG considers the habitat potential outstanding due to ample cover and pools (Partridge, 1992).

Tiedemann (1989) observed winter migrating bald eagles in the Auger Falls area, but also concluded that because the cottonwoods were declining, eagle perch sites were disappearing in the segment. There were no wintering bald eagles counted from 1980 to 1986 (FERC, 1990). The ESA candidate mollusks have not been found in this segment, but the Utah Valvata is expected to occur here as it prefers a silt bottom substrate (FERC, 1990).

In the early 1980s, Sather-Blair and Howard (1982; 1983) did a nesting raptor study from Shoshone Falls to Kanaka Rapids, focusing on three species: the prairie falcon, golden eagle, and red-tailed hawk. They compared their results to the known nesting densities in the Snake River Birds of Prey Natural Area (SRBPNA). The nest density of the three species in the Auger Falls segment was 0.6 nests/river mile compared to 2.0 nests/river mile in the SRBPNA. The authors concluded that the canyon habitat in the Auger Falls segment is similar to the SRBPNA, but a deficient prey base cannot support a higher density of raptors. Harriers, kestrels, and turkey vulture nests were also found (Sather-Blair and Howard, 1982; Howard and Sather-Blair, 1983).

Other birds listed for this stretch include raven, great horned owl, rough-legged hawk, grey partridge, chukar partridge, California quail, and mountain quail, robin, Hudson warbler, Oregon junco, flicker, and black-billed magpie (FERC, 1990). IDFG waterfowl surveys between 1977 to 1986 found 33.4% mallard, 3.5% goldeneye, 3.8% mergansers, and 0.9% Canada geese (FERC, 1990).

Scattered, resident mule deer populations are reported to exist from Star Falls to Auger Falls (FERC, 1990; USACE, 1983). Otters are regularly seen in this segment.

Habitat similarities with the Milner segment indicate that this reach may contain populations of ESA listed mollusc species.

One sensitive plant is documented for the Auger Falls segment. A population of large-flowered gymnosteris, *Gymnosteris nudicaulis*, is located in the canyon at the point where Highway 93 crosses it above Twin Falls (Moseley and Groves, 1992).

Vegetation is a mixture of upland and riparian communities (Cogeneration Inc, 1983). Willow, cattail, hackberry, alder, and cottonwood dominate the riparian areas, while sagebrush, rabbitbrush, cheatgrass, foxtail and wild rye dominate the upland. Sather-Blair and Howard (1982) identified five habitat types in the segment: hydric deciduous, mesic woodland, mesic shrubland, xeric shrubland, and herbaceous wetland. An Idaho Priority Wetland has recently been designated between Auger Falls and the mouth of Rock Creek (IDPR, 1989).

Kanaka Rapids Segment --This segment extends from the mouth of Rock Creek to the backwaters of Upper Salmon Falls Reservoir. Springs and tributaries, important for spawning, are tributary to the stretch, but the water quality of the river is poor below Rock Creek (Partridge, 1992).

Yellow perch, large and smallmouth bass, channel catfish, whitefish, rainbow and brown trout, and some sturgeon delineate a mixed fishery (IDFG, 1991a). There are both hatchery and wild rainbow trout in this section (Reid, 1992). Trout escapement from several fish hatcheries add to the fishery in this section. Fishing for trout is generally limited to the areas near spring inflows. IDFG has a Put-and-Take fishery established for hatchery rainbow at Crystal Lake with a 1.0 fish/hour catch rate goal (IDFG, 1991a). The habitat potential is considered outstanding, particularly for rainbow trout production, despite water quality limitations (Reid, 1992).

A remnant sturgeon population exists in this segment, and IDFG has stocked the stretch; however, the population is declining (Partridge, 1992). Northside springs create unique sturgeon habitat for food and temperature (54°F.) (Lukens, 1981). Briggs Springs, which enters the Snake

upstream of Kanaka Rapids, has a moderate population of shoshone sculpin (*C. greenei*) (Wallace, et al., 1982).

The Kanaka Rapids segment possesses wildlife habitat for a wide diversity of species. This is due in large part to the diversity of land uses in the segment, which include the Niagara Springs Wildlife Management Area (WMA), Kanaka Rapids, Clear Lakes, and Crystal Springs. Sensitive species that utilize the segment are the bald eagle and blue grosbeak (Moseley and Groves, 1992). The blue grosbeak *Guiraqca caerulea*, a species of concern in Idaho but not threatened globally, is recorded in only one location near the Middle Snake, about a mile up Deep Creek (Moseley and Groves, 1992).

Raptor nesting density is 0.6 nests/river mile (Sather-Blair and Howard, 1982; Howard and Sather-Blair, 1983). The U.S. Army Corps of Engineers (1983) identified seven golden eagle nests, Cooper's hawk, northern harrier, long-eared owl, osprey and several bald eagles wintering in the large cottonwoods. Between Niagara Springs and Crystal Springs, a distance of 0.25 mile, 100 great blue herons were counted in a survey done in the early 1980s on the north bank talus slopes, in addition to large flocks of Lazuli buntings (USACE, 1983). Species richness is highest, as expected, in the riparian habitats, and lowest on the talus slopes (USACE, 1983).

Waterfowl densities are high, particularly around Niagara Springs WMA and Boulder and Kanaka Rapids (Musil, 1992). A waterfowl census at the Niagara WMA in 1983 estimated 14,500 individuals, most of which were mallards. The segment supports a density of waterfowl 200-300 percent higher than the Auger Falls segment attributed to the abundance of islands (USACE, 1983). Waterfowl harvested during the 1991 hunting season at Niagara Springs WMA include mallard, widgeon, gadwall, Canada goose, green-winged teal, common and goldeneye (Musil, 1992). The U.S. Army Corps of Engineers (1983) study also found common loons, double-crested cormorants, and whistling swans in the area.

Habitat similarities with the Milner segment would suggest that this reach contains populations of the ESA listed mollusc species. However, supporting investigations have not been undertaken.

Four sensitive plant species are recorded for the Kanaka Rapids segment: Torrey's blazing star *Mentzelia torreyi var. acerosa*, Malheur cryptantha *Cryptantha propria*, giant helleborine *Epipactis gigantea*, and Snake River milkvetch *Astragalus purshii var. ophiogenes* (Moseley and Groves, 1992). Torrey's blazing star is the only species of the four with more than a single occurrence. A population of blazing star is documented on the south side of the canyon below Deep Creek.

Thousand Springs Segment --This five mile, flat water segment runs from Banbury Springs to the Upper Salmon Falls Dam. Channel catfish, large and smallmouth bass, and rainbow trout comprise a mixed fishery in this segment (IDFG, 1991a). Tributary springs provide excellent spawning (e.g., Box Canyon, Blind Canyon, Banbury Springs, and Sand Creek, etc.). Electrofishing in Blind Canyon Creek in 1990 yielded 27 wild rainbow, 3 hatchery rainbow, 2 chiselmouth chub, 6 dace, and 15 sculpin (Partridge and Corsi, 1991).

The greatest concentrations of Shoshone sculpin exist in the Thousand Springs area (Wallace, et al., 1982). This sculpin is sympatric with the mottled sculpin, *Cottus bairdi*, in a number of springs, but where that situation exists, Shoshone sculpin is found in the headwaters and mottled sculpin is found in the lower segments. According to Wallace significant populations of shoshone sculpin may be found in Bickel Springs, Sand Springs, Blue Heart Springs, Box Canyon Springs, Blind Canyon Springs, and Banbury Springs. Wallace assessed sculpin populations as moderate at Tucker Spring and Thousand Springs. The highest sculpin densities were observed at Bickel Springs and the lower section of Box Canyon.

Data collection on snails is extensive for the Thousand Springs segment. The Thousand Springs Nature Preserve is considered a refuge for all ESA listed taxa and has the largest known occurrence of Bliss Rapids snail (Frest and Johannes, 1992). Taylor (1985) found the greatest mix of mollusks in Box Canyon: the Bliss Rapids snail, giant Columbia River limpet, Banbury Springs limpet, and the Utah Valvata (Federal Register, 1990; U.S. BLM, 1985). The Banbury Springs limpet is known only from two locations, Box Canyon and Banbury Springs (Federal Register, 1990).

Alcove ecosystems and the presence of the Hagerman Wildlife Refuge provide numerous and diverse wildlife habitat adjacent to the Snake River. Songbird densities in the willow and mixed riparian habitat ranged from 98 to 234 birds per 10 acres, compared to 118 per 10 acres in the vicinity of Twin Falls (B&C Energy, 1992). Nesting raptors include the prairie falcon, golden eagle, red-tailed hawk, great gray owl, and barn owl (Boccard, 1980). Two established large heron rookeries occur in this segment, one at the mouth of Salmon Falls Creek, the other on an island near Banbury Springs (Smith, 1992). Both rookeries contain blue and black-crowned night herons.

The Hagerman Wildlife Management Area has one of the higher waterfowl concentrations on the Snake River. The IDFG 1991 winter waterfowl count from Upper Salmon Falls through the Murtaugh segment was 7027 ducks and 147 geese.

There are four sensitive plants recorded for the Thousand Springs segment. The Malheur cryptantha and the large flowered gymnosteris nudicaulis occur in the Hagerman WMA. Giant helleborine and Torrey's blazing star are documented at several locations in the canyon, with a well-

established population of giant helleborine in Box Canyon (Moseley and Groves, 1992). Three Idaho Priority Wetlands are in the Thousand Springs segment: 1) Box Canyon/Blueheart Springs, 2) Sand Springs, and 3) Salmon Falls Creek (IDPR, 1989).

Dolman Rapids Segment --This short (1-2 mile), multi-channeled section of the river below Upper Salmon Falls Dam, is dewatered in portions of the channel during the irrigation season (Partridge, 1992). Flow through this segment is controlled by releases from Upper Salmon Falls Dam.

The Dolman Rapids stretch is a mixed fishery, with abundant hatchery rainbow trout (Partridge, 1992). There is no known spawning of wild rainbow, and if sturgeon are found in this stretch it is because they have moved down from upper segments (Partridge, 1992). IDFG considers the Dolman Rapids stretch to have excellent fishery potential. Current limiting factors are water level fluctuations for power generation, and water quality.

Dolman Island and the rapids area has well-developed woodland riparian vegetation, that supports upland game birds, mule deer and probably wintering bald eagles. Waterfowl densities from Lower Salmon Falls Reservoir to Dolman Rapids are high, but less than densities found between Thousand Springs and Murtaugh (IDFG, 1991c).

Lower Salmon Falls Reservoir --This reservoir extends approximately 7 miles from Upper Salmon Falls to the Lower Salmon Falls Dam. Billingsley Creek is the major tributary. During the summer, there is a considerable build-up of aquatic macrophytes in both Lower and Upper Salmon Falls Reservoirs (Bowler and Bowler, 1991).

The reservoir provides a mixed fishery with rainbow trout, largemouth bass, channel catfish, black crappie and bluegill. The reservoir is stocked annually with hatchery rainbow trout (Partridge, 1992; IDFG, 1991a). Over eighty percent of the fish in the reservoir are nongame species: chiselmouth, carp, dace, largescale sucker, mottled sculpin, northern squawfish, peamouth chub, Utah chub and redside shiner (Partridge and Corsi, 1991).

Sensitive species documented for the area are the peregrine falcon and bald eagle (IPC, 1990). The only ESA candidate snail species collected to date in the mainstem or tributaries is the Utah Valvata (Duke, 1992). Vegetation around the reservoir is predominantly sagebrush. Because of the dominance of desert scrub habitat, there is a fairly good diversity of reptiles: the western whiptail and western fence lizards, gopher snake, rubber boa, and western rattlesnake (IPC, 1990). Upland game birds are abundant and including chukar, pheasant, partridge, quail and mourning dove (IPC, 1990).

The golden eagle population is greater downstream of Lower Salmon Falls Dam, than upstream (Smith, 1992). Raptors that are likely to occur around the reservoir are: Coopers hawk, northern harrier, long-eared owl, western screech owl, short-eared owl, great-horned owl, and the barn owl. The winter waterfowl count in 1991 was 3466 ducks and 9 geese (IDFG, 1991c).

Three sensitive plant species have been collected about one mile west of the reservoir: Owyhee mourning milkvetch, Torrey's blazing star, and Malheur cryptantha (Moseley and Groves, 1992).

Hagerman/Wiley Segment --The Hagerman segment is an eight mile stretch that extends from Lower Salmon Falls Dam to the backwaters of Bliss Reservoir. The Malad River is tributary to this segment. The segment is a mixed fishery containing white sturgeon, rainbow and brown trout, whitefish, channel catfish, smallmouth and largemouth bass and yellow perch (IDFG, 1991a). IDFG considers this stretch the best segment of the Middle Snake reach for trout. The IDFG has documented natural reproduction, good growth rates, and good recruitment from the Malad River (Partridge 1992; Reid, 1992).

The number of hatchery rainbow captured in the Snake River above the mouth of the Malad exceeds wild rainbow better than 3:1, but below the Malad, wild rainbow populations exceed hatchery populations (IDFG, 1991). The segment is managed as a trophy trout fishery. Cochnauer, (1980), found 0.2 percent of the non-game fish species sampled in the Hagerman segment were Shoshone sculpin. Wallace, et al. (1982) found sculpin population densities moderate to very low in springs between Lower Salmon Falls Dam and Bliss Bridge.

Historically, the Hagerman segment contained large white sturgeon (1500 lb. sturgeon caught near Hagerman; Bowler and Bowler, 1991). The white sturgeon population in this segment is declining, due in part to severe over fishing before catch and release regulations were put into effect in 1970. There are three sturgeon planting locations in this segment, but the IDFG is not planting sturgeon in the stretch because the hatchery sturgeon have had problems with disease. There is also controversy regarding whether this segment is long enough to support a viable population.

Fish habitat in this segment is considered good by IDFG; dissolved oxygen is high and oxygen exchange rates are good. However, flow fluctuations below Lower Salmon Falls Dam limit spawning (Partridge 1992; Reid, 1992).

The Hagerman segment is used by winter migrating bald eagles, and the long-billed curlew, an ESA candidate, is known to nest on both sides of the river almost directly south of Bliss (Moseley and Groves, 1992). Two of the ESA listed snails, the Bliss Rapids snail and the Snake River physa

have been collected in the segment (Duke, 1992). Water level fluctuation for power generation and competition from the New Zealand mudsnail limit both species (Bowler and Bowler, 1991). Two additional species, the Idaho springsnail and the Banbury Springs limpet, may exist in the segment (IPC, 1991). In the Malad Gorge, about 3 miles north of Hagerman, two bat species, the western pipistrelle bat (*Pipistrellus hesperus*) and the pallid bat (*Antrozous pallidus*) have been found. Neither have federal status but both are considered species of concern in Idaho (Moseley and Groves, 1992).

Raptors, including golden eagles and prairie falcons, nest in the segment (Boccard, 1980). The peregrine falcon is considered to be a casual visitor during migration (IPC, 1991a). Habitat for mule deer and upland game birds is abundant in the canyon (Smith, 1992). Chukar, partridge, California quail, pheasant and mourning dove are fairly common (IPC, 1991a). The woody riparian habitat supports high densities of small mammals and the channel islands are considered important for mule deer fawning, feeding, and resting (IPC, 1991a). Occasional or seasonal visitors include the common loon, merlin falcon, double-crested commorant, white pelican, and snowy egret. Winter waterfowl counts are not particularly high for the Hagerman segment (IDFG, 1991c).

Six of the eight sensitive plant species documented for the Middle Snake reach are found in the Hagerman segment: the Owyhee mourning milkvetch, Snake River milkvetch, Malheur cryptantha, giant helleborine, large-flowered gymnosteris, and Torrey's blazing star (Moseley and Groves, 1992). Torrey's blazing star and Owyhee mourning milkvetch are represented by small populations, but the others are only documented at single collection points.

There are 11 riparian communities delineated along the segment (IPC, 1991a). Bocard (1980) states that the Hagerman segment contains one of the few remaining undisturbed riparian communities in the state. The Hagerman stretch contains many plant communities that are no longer present around reservoirs downstream of Thousand Springs (IPC, 1991). Bowler and Bowler (1991) state that the segment has some of the largest stands of river birch *Betula occidentalis* and hackberry *Celtis reticulata* in the state. River birch and hackberry communities may be considered rare (IPC, 1991a). The largest Idaho Priority Wetland along the Middle Snake reach runs from the Bliss Bridge to the point where the freeway crosses Malad Gorge (IDPR, 1989).

Bliss Reservoir --Bliss Dam impounds water approximately five miles upstream. Bliss Reservoir is a warmwater fishery containing largemouth and smallmouth bass, channel catfish, and black crappie (IDFG, 1991a).

The reservoir may provide some habitat for migrant wintering bald eagles. Raptor surveys done by BLM show fairly high densities of prairie falcons and red-tailed hawks on the north side of the canyon. Mule deer and pronghorns utilize Tuana Gulch regularly to access the main canyon

(Klott, 1992). Habitat in this portion of the canyon is considered good for upland game birds such as pheasant, Hungarian partridge and quail (Smith, 1992).

Two sensitive plants are recorded for the Bliss Reservoir segment, Torrey's blazing star and Snake River milkvetch (Moseley and Groves, 1992). All along the south side of Bliss Reservoir and into Tuana Gulch are numerous disjunct populations of Torrey's blazing star. A good population of Snake River milkvetch occurs just above Bliss Dam on the north side of the reservoir.

King Hill Segment --The King Hill segment extends slightly over 12.0 miles from Bliss Dam to Clover Creek. The Snake runs relatively fast and clear in the upper two-thirds of the section, and is described by Cochnauer (1981) as deep (10 m.), with intermittent holes and riffles, and numerous large boulders. Bancroft Springs, occurs about midway along the segment.

The fishery is mixed, and similar to the Hagerman segment in species composition: whitefish, channel catfish, largemouth and smallmouth bass, yellow perch, rainbow and brown trout, and white sturgeon (IDFG, 1991a). Cochnauer (1981) found 99 percent of the fish were nongame species.

Idaho Fish and Game believes this segment holds potential for an excellent sturgeon and hatchery rainbow trout fishery. Limited spawning on the mainstem may be possible because of the boulder and sand substrate (Partridge, 1992). Currently, the rainbow trout fishery is not considered exceptional. The spawning potential of tributary streams is not known.

The population of white sturgeon in this segment is second only to the Hell's Canyon population in reproduction within the state (Partridge, 1992). Wintering bald eagles occur in the segment. Other sensitive species that are thought to occur in the King Hill segment are: ferruginous hawk, long-billed curlew, blue grosbeak, Townsend's big-eared bat, and American white pelican. Three of the ESA listed snails are documented for this segment, the Banbury Springs limpet, the Bliss Rapids snail, and the Snake River physa (Moseley and Groves, 1992).

Upland game birds inhabiting the corridor include pheasant, quail, and chukar. A herd of 40-50 mule deer, and small numbers of pronghorn have been observed in the canyon and frequently utilize tributary canyons such as Tuana, and Big and Little Pilgrim Gulch (Klott, 1992). The Double crested commorant, marsh hawk, golden eagle, blue heron, black-crowned night heron, white pelican, and great horned owl have been observed along the segment. Additional vertebrates documented for the area include bobcat, river otter, spotted bat, prairie falcon, and osprey. Seasonal or occasional visitors include common loon, peregrine falcon and snowy egret (Boccard, 1980).

Winter waterfowl counts by IDFG in 1991 indicate that the segment supports a low density of waterfowl relative to other segments of the Middle Snake reach (IDFG, 1991c). Ninety-nine ducks and two geese were counted in the King Hill segment.

Snake River milkvetch and Torrey's blazing star have been collected from several locations along the King Hill segment, with several notable populations of Torrey's blazing star, particularly near the mouth of Big Pilgrim Gulch (Moseley and Groves, 1992). Janish's penstemonn, considered a species of concern statewide, occurs in Big Pilgrim Gulch. The dominant trees of the riparian zone are Russian olive, hackberry and willow. Much of the shoreline vegetation on public land has been severely overgrazed, but there are still some excellent stands of water birch (Boccard, 1980; Bowler and Bowler, 1991).

SPECIAL MANAGEMENT AREAS

There are several special management areas adjacent to the Middle Snake reach that are devoted to protecting fish and wildlife. These include:

Areas of Critical Environmental Concern (ACECs)--ACECs are designated and managed for protection by the BLM, because they possess unique biological features that are threatened or have the potential of being threatened. They may include unique biological communities or rare species or both. There are two ACECs adjacent to the Snake River in the planning reach: Box Canyon and Vineyard Creek. The values identified for these two include fish (Shoshone sculpin), scenic and geological features (BLM 1990 Annual Report).

Idaho Priority Wetlands--Along the Middle Snake reach are eleven (11) established Idaho Priority Wetlands. The list includes: the Wiley segment, Malad Gorge, Box Canyon/Blueheart Springs, Vinyard Creek, Devil's Corral, Star Falls, Salmon Falls Creek, the Milner segment, Thousand Springs, Sand Springs, and Auger Falls. Most of these are identified in the 1990 IDPR State Comprehensive Outdoor Recreation Plan (SCORP), but four have been added since 1990. Priority wetlands are in response to the Emergency Wetlands Resources Act of 1986 and the subsequent Idaho Wetlands Conservation Priority Plan (IWCPP). The IWCPP is to assist decision makers in focusing their protection efforts on the most vulnerable and important wetlands in Idaho (IDPR, 1989). Within these priority wetlands exist most of the sensitive species found in the Middle Snake.

Thousand Springs Preserve--The Nature Conservancy currently manages a 200 acre tract of land adjacent to the Idaho Power Thousand Springs facility. The preserve has one of the best remaining populations of Shoshone sculpin, habitat for the Utah Valvata snail and Giant Columbia River limpet, and nesting for golden eagles.

Wildlife Management Areas and River Channel Islands--There are three IDFG Wildlife Management Areas adjacent to the Middle Snake reach: Hagerman, Niagara Springs, and Billingsley Creek. Many of the stream channel islands are managed for wildlife, also by IDFG. The WMAs and the islands provide habitat for waterfowl and mule deer. Very likely, the highest concentrations of waterfowl are in these units.

Isolated wildlife tracts--These are parcels of land that exist on BLM property, but are cooperatively managed by both the BLM and IDFG. The main objective is to manage habitat for all wildlife, but particularly upland game birds. The tracts exist in the uplands south of the river between Salmon Falls Creek and Big Pilgrim Gulch. From Milner Dam to Kanaka Rapids these tracts are in the canyon and adjacent to the river.

Evaluation

DELINEATION OF ECOSYSTEMS

The IDFG 1991 Five Year Management Plan identified 11 segments in the Middle Snake reach. The management units that are identified are distinguished by whether they are reservoir or free-flowing. This delineation was modified, primarily based on fishery habitat.
The delineated segments are:

- Milner (from Milner Dam to Murtaugh Bridge, 8.5 miles)
- Murtaugh (Murtaugh Bridge to Twin Falls Reservoir backwaters, 9.5 miles)
- Twin Falls Reservoir (1.5 mile)
- Devil's Corral (Twin Falls Dam to Shoshone Falls Reservoir backwaters, 1 mile)
- Shoshone Falls Reservoir (1.5 mile)
- Auger Falls (Shoshone Falls Dam to Rock Creek, 8.5 miles)
- Kanaka Rapids (Rock Creek to Banbury Springs, 17 miles)
- Thousand Springs (Banbury Springs to Upper Salmon Falls Dam, 9 miles)
- Dolman Rapids (Upper Salmon Falls Dam to Lower Salmon Falls Reservoir backwaters, 1.5 miles)
- Lower Salmon Falls Reservoir (7 miles)
- Hagerman (Lower Salmon Falls Dam to Bliss Reservoir backwaters, 8 miles)
- Bliss Reservoir (5 miles)
- King Hill (Bliss Dam to Clover Creek, 12 miles)

METHODOLOGY

The fish and wildlife evaluation involved two steps: (1) delineation of biological ecosystems, and (2) evaluating the distinction of each unit. Segment boundaries define an area with similar characteristics, and for the most part are distinguished by whether they are a reservoir (lacustrine) or a free-flowing segment (riverine).

Physical and biological variables were identified to evaluate each segment as an ecosystem. The physical variables considered for each segment were:

1. Water Quantity
2. Water Quality
3. Springs or perennial tributaries with high spawning potential
4. Fish habitat
   (a) in a lacustrine environment--depth, shoreline, rocky substrate, and vegetation are evaluated
   (b) in a riverine environment--pool:riffle ratio, and cover are evaluated
   (c) water quantity
   (d) water quality

   If all other physical parameters for fish habitat are good, but current water quantity/quality problems limit populations and species, habitat was rated Intermediate.
5. Wildlife habitat; heterogeneity would provide more niche opportunities and therefore greater or potentially greater species diversity (riparian woodland, springs, cliffs, etc.).

The biological variables taken into consideration were:

1. Sensitive species presence - aquatic (sturgeon, sculpin, snails)
2. Sensitive species presence - terrestrial (raptors, bats, plants, etc.)
3. Spawning
4. Special management areas (WMA, ACEC, wetlands)
5. High species diversity represented by several trophic levels.

In order for a segment to be considered Outstanding, four of the five physical criteria must be met, and four of the five biological criteria must be met. The justification for this assumes that in order for an ecosystem to warrant an Outstanding evaluation, it must be relatively whole and relatively healthy, and consequently, meet the majority of the criteria.

Physical Habitat					
Segment Name	1) Water quantity currently sufficient	2) Water quality currently good	3) Perennial tributaries **or** springs	4) Fish habitat: good*	5) Wildlife habitat: good**
Milner	No	Yes	No	No	No
Murtaugh	No	Yes	Yes	Yes	Yes
Twin Falls Res.	Yes	Yes	Yes	Yes	No
Devil's Corral	Yes	Yes	Yes	Yes	No
Shoshone Falls Res.	Yes	Yes	No	No	No
Auger Falls	No	No	Yes	Yes	No
Kanaka Rapids	No	No	Yes	No	Yes
Thousand Springs	Yes	No	Yes	Yes	Yes
Dolman Rapids	No	Yes	No	Yes	No
Lower Salmon Falls Res.	Yes	Yes	Yes	No	No
Hagerman	Yes	Yes	Yes	Yes	Yes
Bliss Res.	Yes	Yes	No	No	No
King Hill	Yes	Yes	Yes	Yes	Yes
***Lacustrine fish habitat**: 1) Good--if it currently possesses following characteristics: good depth column, heterogeneous shoreline, rocky substrate, and vegetation cover. ***Riverine fish habitat**: Good--if it currently possesses following characteristics: good pool:riffle ratio, cover, etc. ****Wildlife Habitat**: 1) Good terrestrial habitat is of high quality and provides numerous wildlife niches.					
Species					
Segment Name	1) Sensitive aquatic species present (sturgeon, sculpin, snails)	2) Important spawning occurs	3) Sensitive terrestrial species present (raptors, bats, plants, etc.)	4) Special management areas: WMA, ACEC, isolated wildlife tracts (IWT), Idaho Priority Wetlands (IPW)	5) Unique species richness (high diversity, several trophic levels represented)
Milner	Unknown	No	Yes-plants	IWT, IPW	Yes
Murtaugh	Unknown	No	Yes-plants	IWT	No
Twin Falls Reservoir	No	Yes-salmonids	Yes-plants	IWT, ACEC, IPW	No
Devil's Corral	No	Yes-salmonids	Yes-plants	IPW	No
Shoshone Falls Res.	No	No	No	None	No
Auger Falls	Yes-sturgeon	No	Yes-plants	IPW	Yes
Kanaka Rapids	Yes-sturgeon, sculpin, snails	No	Yes-plants, blue grosbeak	IWT, WMA	Yes
Thousand Springs	Yes-sturgeon, sculpin, snails	Yes-salmonids	Yes-plants	WMA, IPW, ACEC	Yes
Dolman Rapids	No	No	No	None	Yes
Lower S.F. Reservoir	No	No	No	WMA	No
Hagerman	Yes-sturgeon, sculpin, snails	Yes-sturgeon, salmonids	Yes-plants, bats, long-billed curlew	IPW	Yes
Bliss Reservoir	No	No	Yes-plants	None	Yes
King Hill	Yes-sturgeon, snails	Yes-sturgeon	Yes-plants	None	Yes

Fish and Wildlife, Biological Communities Evaluation for the Middle Snake Reach

EVALUATION CLASS	CRITERIA	SEGMENTS
Outstanding	Four out of five physical parameters must be met and four of the five biological parameters must be met: **Physical Parameters** 1) Water quantity good **OR** reversible 2) Water quality good **OR** reversible 3) Perennial tributaries **OR** springs present 4) Fish habitat good 5) Wildlife habitat good **Biological Parameters** 1) Sensitive aquatic species present (sturgeon, sculpin, snails) 2) Important spawning occurs 3) Sensitive terrestrial species present (raptors, bats, plants, etc.) 4) Special management areas (WMA, ACEC, wetlands, etc.) 5) Unique species richness; several trophic levels represented	***Banbury Springs to Upper Salmon Falls Dam*** - water quantity good; water quality reversible; perennial tributaries and springs; wildlife habitat has good heterogeneity; sturgeon and sculpin present; salmonid spawning; sensitive plants; isolated wildlife tracts; Idaho Priority Wetland; Wildlife Management Area, Area of Critical Environmental Concern (BLM) ***Lower Salmon Falls Dam to Bliss Bridge*** - water quantity good; water quality good; perennial tributaries and springs; fish habitat = Good; wildlife habitat has good heterogeneity; sturgeon, sculpin present; spawning for sturgeon and salmonids; sensitive plants; Idaho Priority Wetland; several tropic levels are represented ***Bliss Dam to Clover Creek*** - water quantity good; water quality good; perennial tributaries and springs; fish habitat = Good; wildlife habitat has good heterogeneity; sturgeon present; spawning for sturgeon; sensitive plants; several tropic levels are represented

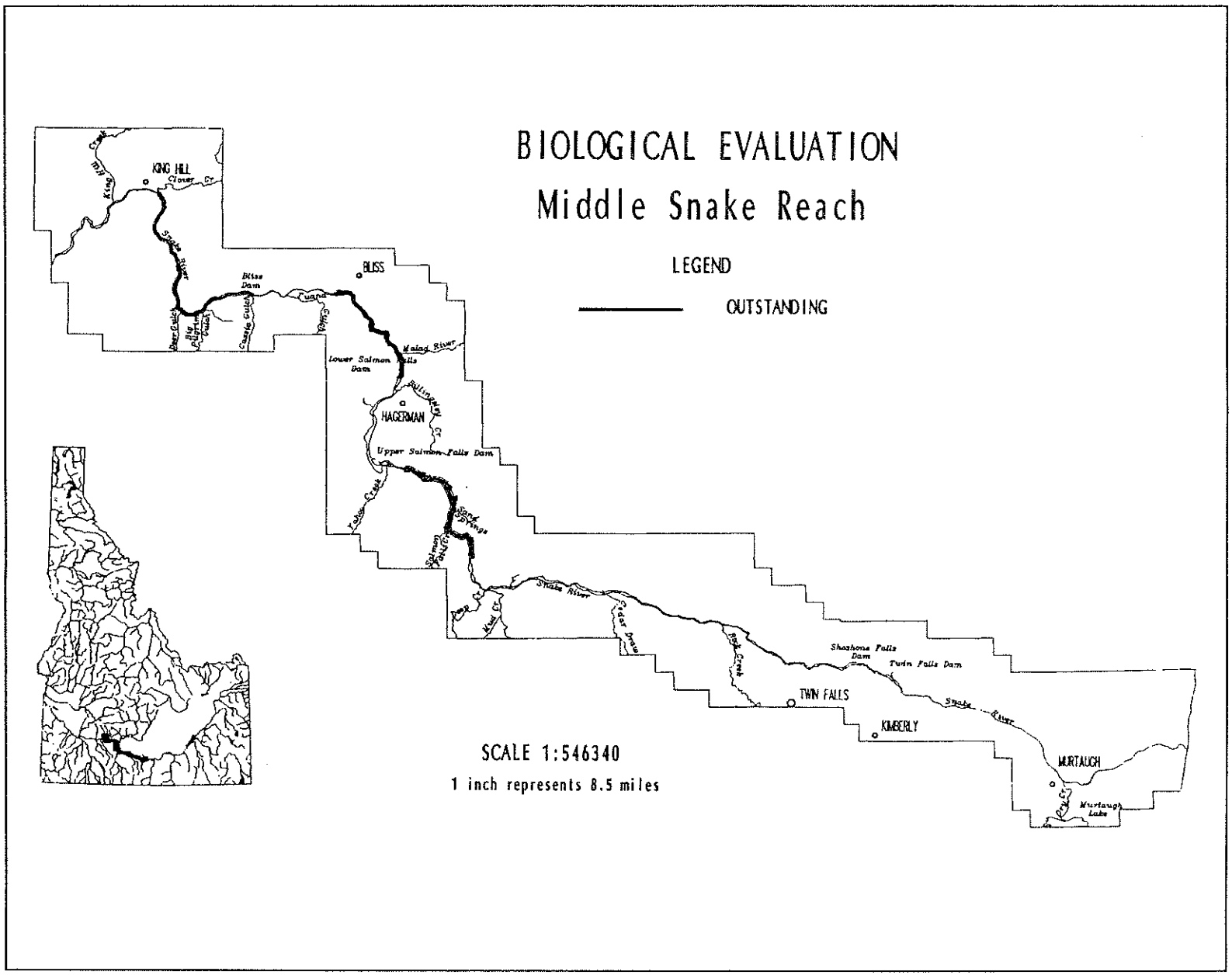

Figure 1. Fish and Wildlife Evaluation Map.

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II. SCENIC VALUES AND NATURAL FEATURES

Spectacular vistas and unique geologic features are practically commonplace throughout the Middle Snake reach. U.S. Highway 30 and State Highway 50 between Bliss and I-84 east of Twin Falls, with a spur on U.S. Highway 93 to I-84 north of Twin Falls, have been designated the Thousand Springs Scenic Route. Steep canyon walls, scabland features, springs issuing from the walls, the river itself, and at certain times of the year spectacular waterfalls at Twin Falls and Shoshone Falls are the principal natural attractions

The present aspect of the Snake River canyon below Milner is largely a relic of the Bonneville Flood (Malde, 1968). The Pleistocene flood widened the canyon and contoured the canyon floor throughout the Middle Snake reach. Abandoned channels, spillways, and scabland mark the flood path downstream to Twin Falls, and massive bars of boulders and sand that indicate a former stream of extraordinary size, litter the canyon further west.

Segment Descriptions

Milner Dam to Twin Falls Reservoir - Between Milner Dam and the Twin Falls Reservoir the Snake River follows a narrow basalt canyon with reactively smooth, straight walls. From Milner Dam to Dry Creek the canyon is about 600 feet wide and comparatively shallow (200 feet or less). River gradient in this segment is about 35 feet per mile, and the river environment below the rim remains in a relatively natural condition. Idaho Power Company is currently constructing a hydropower flume from the rim to the river 1.5 miles below Milner Dam. This site is a definite intrusion on the surrounding environment but is being built to minimize the amount of permanent visual impact. Star Falls, a 40 foot drop about a mile above Dry Creek, is the remaining undeveloped waterfall on the Snake River within the Middle Snake reach.

Downstream from the Murtaugh Bridge the canyon is remarkably uniform in width and depth, about 1,100 by 325 feet, with smooth vertical walls and a box-like cross section. The canyon floor descends steadily at a gradient of about 24 feet per mile. The Murtaugh segment is a deeper canyon than the Milner segment, and is largely undeveloped and in a primitive condition. The canyon is crossed by Highway 50 at Hansen Bridge, a major view point for tourists. The land above the rim has many private homes and roads paralleling the canyon.

Twin Falls to Upper Salmon Falls - Nearly 600 feet deep and 1,300 feet to a mile in width, this segment of the canyon exceeds the size of the canyon immediately above. Below Twin Falls the Snake River descends over outcrops of silicic volcanic rocks which make up the lower story of the

canyon. These outcrops form cataracts at Pillar and Shoshone Falls and represent impediments to canyon entrenchment.

Downstream of the Perrine Bridge, the Snake River canyon consists of a series of wide segments, that include relatively flat bottom lands not far above the river, connected by constricted canyon segments of variable length. In many areas the river flows in a trough below a bench. At Melon Valley, Deep Creek and Mud Creek have dissected the south rim into a rough and gullied terrain. This segment is characterized by a persistent line of springs about 150 feet below the north rim, and intermittent rapids.

Hagerman Valley to Bliss Reservoir - Hagerman Valley is a broad canyon segment about four miles wide, bounded on the west by barren cliffs of the Glenns Ferry Formation. There is a high degree of development between Hagerman and Bliss along the Snake River. Many private homes are situated on the rim or on bottomlands along the river, and there are many access roads.

Downstream from Hagerman Valley, the Snake River enters another long constriction. For the most part, this constricted segment is a two-story canyon in which the Snake River follows a narrow inner gorge, 400-800 feet wide and 200 feet deep, cut mainly into Banbury Basalt. Above the inner gorge is a bench about a mile wide from which canyon walls rise abruptly to a height 575 feet above the river.

Bliss Dam to King Hill - A unique visual and geologic feature of the Bliss Dam-King Hill section is the presence of several large sand dunes which rise up the rock cliffs from the river benches. Several roads, a railroad line, an old irrigation canal and an Interstate 84 crossing may impose on the segment, however, the level of development of visible structures along this section is low.

Geologic Features

SCABLAND

The term "scabland" was first used in 1923 to describe the eroded surface of basalt flows scoured by glacial flood-water in Washington (Malde, 1968). Scabland erosional features include coulees, dry falls (alcoves), and scoured channels distributed in such a manner as to cause a bizarre landscape. Minor features on the basalt bedrock include polished and fluted surfaces that indicate the direction of the flow. Features of this kind are found at places along the path of the Bonneville Flood through the Snake River Plain, particularly at Twin Falls.

The Milner segment is bordered by continuous scabland, indicating that the capacity of the canyon was exceeded by the Bonneville Flood. The canyon walls between Murtaugh Bridge and Hansen Bridge are nearly devoid of talus, and practically no detritus occurs along the floor. The

absence of scabland in this segment indicates the canyon below Murtaugh was capable of carrying that portion of the Bonneville flood-water that continued down the river channel.

Malde (1968) believes the most impressive erosion features produced by the Bonneville Flood are along the Snake River canyon near Twin Falls, where the Rupert channel joins the canyon at Devil's Corral (Geologic Features Map). The north rim, where floodwater entered from the Rupert channel, is embayed by several large alcoves (dry falls) at Devil's Washbowl, Devil's Corral, and Blue Lakes. Scouring of the river bed left crags of scabland that reach 200 feet above the river at Pillar and Shoshone Falls. The Blue Lakes Golf Course is constructed on a jagged mass of scabland that rises 200 feet above the canyon floor.

MELON GRAVELS

Rounded boulders of basalt form gigantic bars and large heaps of bouldery detritus along the Middle Snake reach. H.A. Powers recognized that these boulders were of catastrophic origin, and with Malde applied the name of Melon Gravel to the boulder deposits (Malde and Powers, 1962). They were inspired to use this term after observing a road sign in 1955 that called the boulders "petrified watermelons" (Maley, 1987).

Melon Gravels were deposited at places along the river canyon where the flood velocity was retarded, especially at the upper ends of local basins. The Melon Gravels deposited by the flood average three feet in diameter, but some range up to 10 feet. These boulders are composed almost entirely of basalt broken from nearby cliffs. They are strewn in deposits up to 300 feet thick, as much as one mile wide by 1.5 miles long.

The path of the Bonneville Flood downstream of Melon Valley is marked by numerous abandoned channels near the canyon walls. Most channels are bounded by bars of Melon Gravel on one side and by canyon walls on the other. The channels, which measure several miles long and 150 feet deep, were abandoned when the flood subsided.

Hagerman Valley was a major sediment trap for flood debris. The segment has a fair amount of talus and landslides younger than the Bonneville flood line. This section has some of the largest boulders found anywhere along the Snake River canyon. Boulders on a bench near the town of Bliss are about eight feet in diameter. These boulders match the lithology of rimrock along the north canyon wall and are probably pieces of talus that were rolled by the flood-water.

One mile downstream of Bancroft Springs chunks of basalt, 10-15 feet in the long dimension, plucked from the lava and tumbled a few hundred feet downstream, rest on the overtopped basalt 240 feet above the Snake River. The King Hill basin is situated where the Bonneville Flood first entered

relatively slack water. It holds more than half the Melon Gravel that was flushed down the canyon (Malde, 1968). Enormous bars of Melon Gravel fill the center of the valley around King Hill and form broad benches several hundred feet above the Snake River.

SPRINGS

A succession of springs, some of the world's largest, cascade down the talus-covered slopes of the canyon or well up in sparkling pools in reentrant alcoves along the Middle Snake reach. Springs occur singly, in clusters, and in continuous zones. The larger springs or groups of springs are named, but innumerable small springs and seeps are either unnamed or known only to local residents. Outflows from many of the springs fall almost directly into the river. Others form tributary streams, like Billingsley Creek, before entering the river. One of the largest spring groups occurs in the Malad River canyon.

Ten of the 65 largest springs (> 100 cfs) in the United States are located along the Snake River between Twin Falls and King Hill. Box Canyon is the 11th largest natural spring in the United States (Kjelstrom, 1992). The springs provide water with exceptional clarity and only a slight annual variation in temperature or volume. The water from the main group of springs is collected in flumes and used for power generation, agriculture, and aquaculture.

HAGERMAN FOSSIL BEDS NATIONAL MONUMENT

The Hagerman Fossil Beds National Monument possesses the greatest diversity and abundance of Pliocene Blancan vertebrate fossils in the world (IPC, 1990). Over 300 species of flora and fauna have been identified at the fossil beds. This is the site of the Hagerman horse excavation by the Smithsonian Institute. In November, 1988 the Hagerman Fossil Beds were added to the National Park System as a National Monument.

The area is located along the western slope of the Snake River canyon about two miles west of Hagerman, and covers 4,500 acres in Twin Falls County (Fig. 10). The fossil beds are distributed vertically through a 500-ft section of the Glenns Ferry formation; this stratigraphic distribution is of great value in tracing evolutionary trends. In November, 1988 the Hagerman Fossil Beds was added to the National Park System as a National Monument.

NATIONAL NATURAL LANDMARKS

The National Natural Landmarks (NNL) Program was established by the Secretary of the Interior in 1962, to identify and encourage the preservation of the full range of geological and botanical features that are determined to represent nationally significant examples of the Nation's natural heritage. Potential natural landmarks are identified through studies conducted by the National

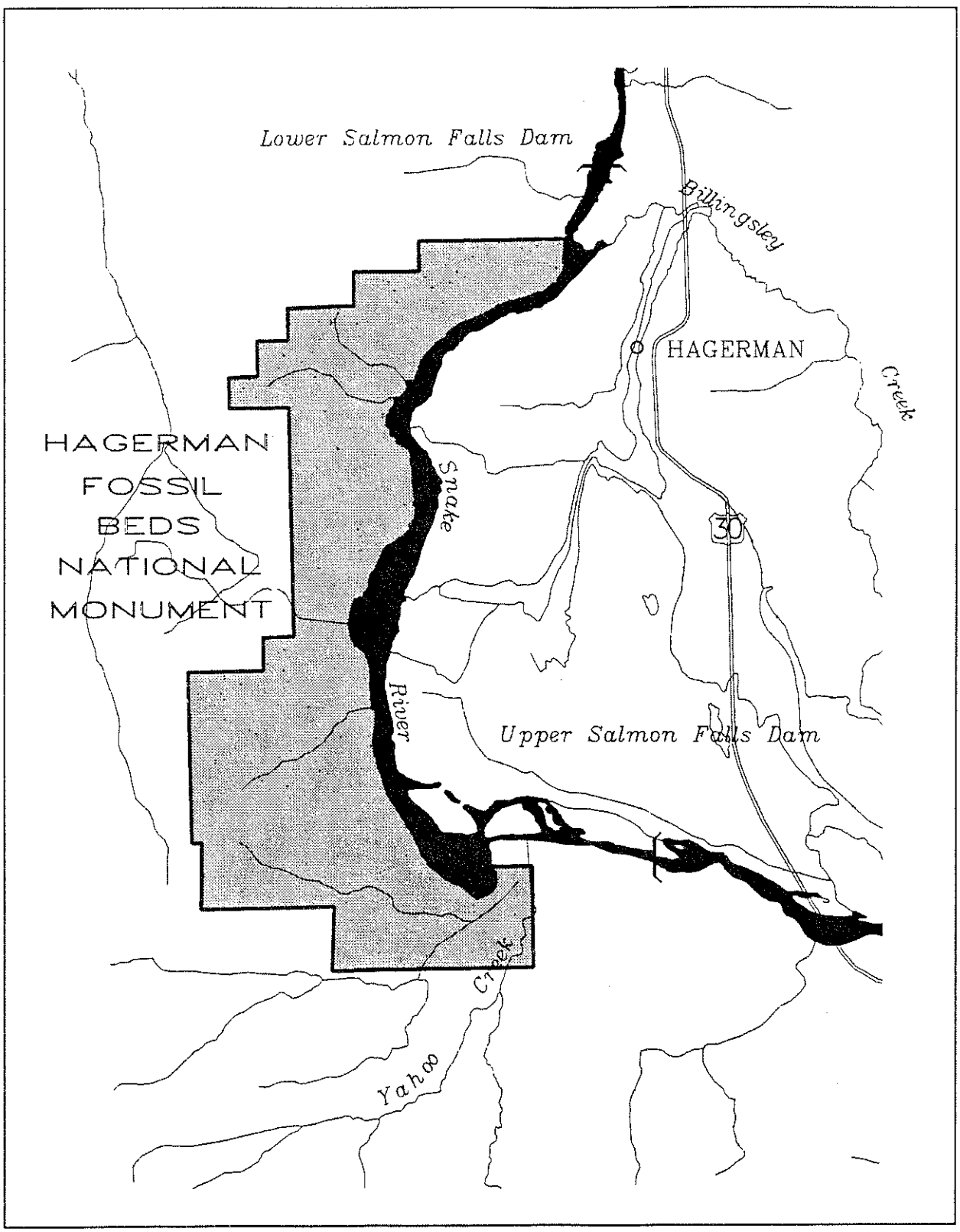

Figure 2. Hagerman Fossil Beds National Monument.

Park Service and other sources, evaluated by expert natural scientists, and, if determined nationally significant, designated as landmarks by the Secretary of the Interior.

Niagara Springs is a National Natural Landmark, designated as representative of the spring complexes; it is one of the largest spring complexes with only moderate development. The spring complex has an average flow of about 250 cfs. Several sites are under consideration as National Natural Landmarks: (1) Dry Cataracts, in the vicinity of Twin and Shoshone Falls, encompasses representative Bonneville Flood features such as blind canyons, terraces, plunge pools, and scabland, (2) Box Canyon, (3) Malad Canyon, and (4) Thousand Springs.

Scenic Evaluation

The objective of the scenic evaluation was to determine the distinctiveness or scenic quality of landscape settings. Data collection for the scenic value study involved review of visual resource inventory information available from other agencies, and photographic documentation of visual landscapes in the Middle Snake reach.

The planning area was previously inventoried for visual resource values by three Bureau of Land Management (BLM) Districts (Boise, Burley and Shoshone) as part of their resource management plans. 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), originally published in 1980 with revisions in 1984 and 1986 (U.S. BLM, 1986). Review of the visual inventory data available from the three BLM districts located in the planning area revealed differences in inventory dates, quantity of available data, and study scales. All districts had VRM class data mapped, but scenic quality classes were only available from one district. Given the varying inventory periods and differences in types of available data, it was determined that IDWR needed to conduct an independent evaluation.

Planning staff conducted a scenic distinction evaluation at a scale consistent with the planning area. The evaluation was conducted from November 1991 to September 1992. The scenic distinction evaluation involved two steps: (1) defining visual unit boundaries, and (2) evaluating the scenic distinction or scenic quality of each visual unit. Visual sensitivity levels and distance zones were not evaluated or delineated in this study. Visual unit boundaries define a landscape with similar spatial characteristics such as landform, vegetation, water form, or land use patterns (Tetlow and Sheppard, 1980). Significant or noticeable changes in any of these or other visual characteristics denote the boundary between visual units.

Visual unit boundaries were determined through extensive field reconnaissance and photographic documentation. The outermost boundary is defined by the edge of the canyon walls. Generally, visual unit boundaries mark the change from free flowing water to reservoirs, differences in canyon wall scale and enclosure, unique landforms, and/or changes in the degree or type of land use patterns. A total of 28 visual units were identified from Milner Dam to Clover Creek.

Boundaries were mapped on U.S. Geological Survey 7.5 minute quadrangles and then field checked to verify accuracy. Forms were completed in the field and through review of photographic documentation recording landform, vegetation, water character, cultural modifications and other characteristics for each unit.

Scenic distinction ratings were determined using the BLM's scenic quality model described in the agency's VRM manual. The model assesses the degree of variety a landscape possesses. All landscapes are considered to have some scenic worth, but landscapes with greater variety are rated higher (U.S. BLM, 1986). A numeric rating system is used to evaluate the degree of visual variety and harmonious composition of seven factors: landform, vegetation, water, color, adjacent scenery, scarcity and cultural modifications (U.S. BLM, 1986). Each factor was rated using a value of one to five (with the exception of cultural modifications which is rated -4 to 2) based on the amount of variety, contrast, harmony, or distinctiveness within the unit -- the higher the rating, the greater variety or more distinctive the feature.

A scenic distinction evaluation using the BLM model was completed for each of the 28 visual units identified in the Middle Snake reach. The numerical ranking system for determining scenic distinction has a maximum of 32 points. Landscapes with "Outstanding" or distinctive scenic values received scores of 32 to 19. Landscapes considered above average, but not outstanding, received scores of 18 to 12 and were rated "High" for scenic distinction. Landscapes with little visual variety received a score of 11 or less and were rated "Moderate to Low" for scenic distinction. Table 2 summarizes the results of the scenic evaluation for the Middle Snake reach. Evaluation forms describing landscape features and documenting the scoring for each visual unit are available at the Idaho Department of Water Resources.

Table 2. Scenic Distinction Evaluation for Middle Snake Reach.

SCENIC DISTINCTION CATEGORY	CRITERIA	MIDDLE SNAKE REACH
Outstanding	Landscapes with significant variety in landscape features; and/or possessing distinctive or unique, rare features (score of 32 to 19). Landscapes with vertical or steep canyon walls, strong enclosure and immense scale; variety in water forms characterized by whitewater, falls, and numerous springs; variety in vegetation pattern, texture and color with contrasts introduced by wetlands, riparian and spring-associated vegetation; cultural modifications adding visual variety and are generally harmonious to the visual unit as a whole.	***Downstream from Milner Bridge to Bickel Springs (near Gridley Island - Highway 30 Bridge)*** ***Bliss Dam to Little Pilgrim Gulch*** ***Bancroft Springs area***
High	Landscapes which provide above average variety in landscape features (score of 12 to 18). Areas where canyon is defined by dissected hills or canyon walls which are less vertical, enclosure and scale are not as distinct; whitewater is lacking or minimal; some variety in vegetation patterns and types; cultural modifications add little or no visual variety to landscape.	***Bickel Springs (near Gridley - Highway 30 Bridge) to backwaters of Bliss Reservoir*** ***Little Pilgrim Gulch to Bancroft Springs*** ***I-84 Bridge to Clover Creek***
Moderate to Low	Landscapes where characteristic features possess little variety (score of 11 or less). Areas where canyon walls are characterized by moderate to low hills; minimal variety in vegetation, usually one type.	***Milner Dam to below Milner Bridge*** ***Backwaters of Bliss Reservoir to Bliss Dam (Bliss Reservoir)*** ***I-84 Bridge vicinity***

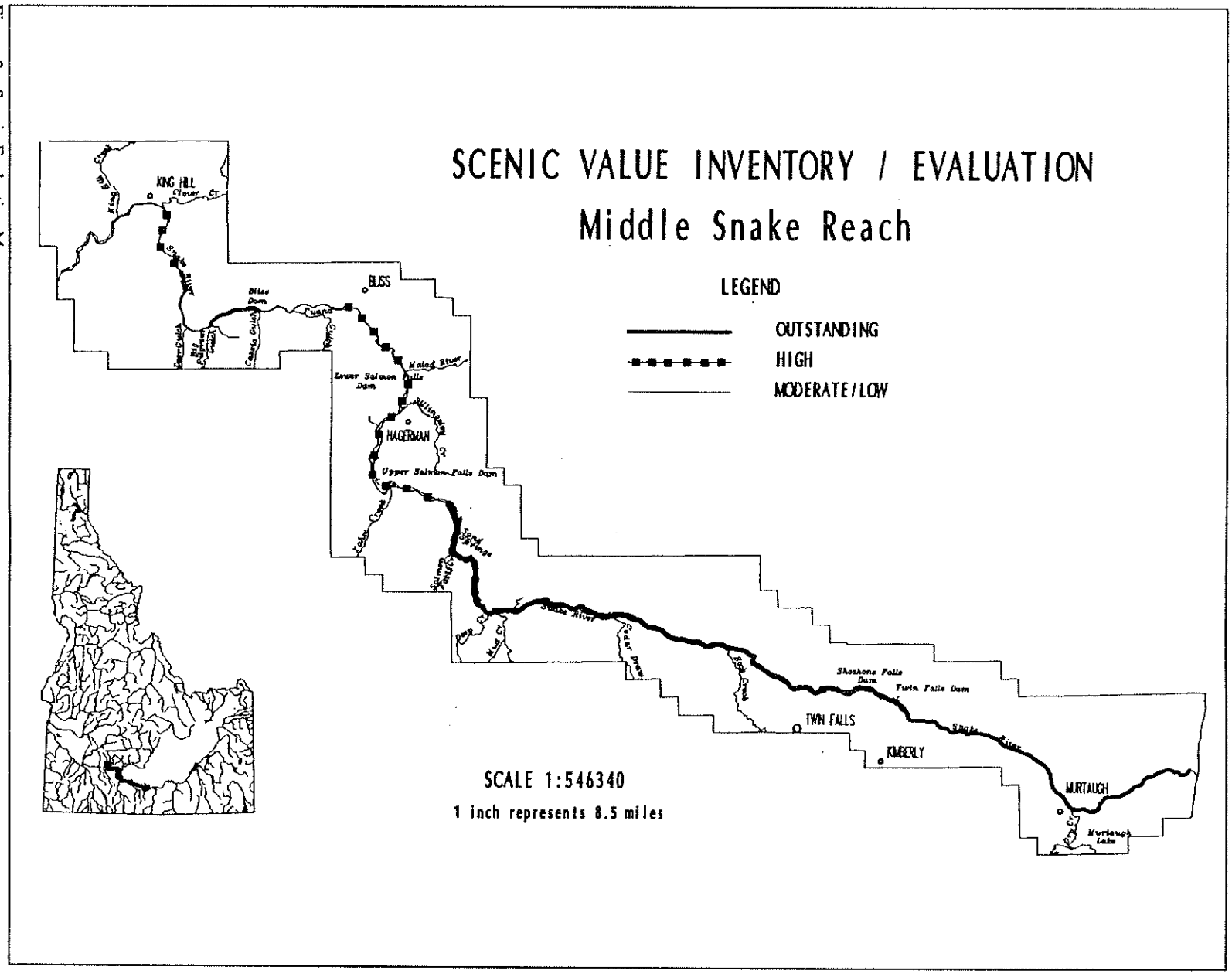

Figure 3. Scenic Evaluation Map.

Geologic Features Evaluation

The geologic features evaluation considered the uniqueness or significance of geologic features from a national or regional perspective, and the degree of protection accorded the resource through statute, regulation, or agency management policy. Geologic data came from the National Park Services National Natural Landmark studies, the Bureau of Land Management, and unpublished and published sources. An inventory of the Middle Snake reach identified landforms, water features (i.e., waterfalls, springs), cultural modifications to the site or along the segment, and distinctive features of the site or segment.

A numeric measure is used to evaluate the degree of geologic distinction of a feature under four factors: scarcity, quality, scientific value, and cultural modifications. The size and degree of disturbance related to historic land-use practices of the specific site were considered in the ranking (Fig. 3).

Scarcity refers to the distribution of the feature both within the state and nationally. Quality refers to the relative physical condition of the geological feature in comparison to other known occurrences of the same feature. A site which is among the best known examples of its kind received a higher evaluation mark than a marginal or low quality occurrence. The scientific value of a feature or a given site refers to its usefulness and importance as an educational resource. The historical, current use, potential use, and accessibility of the given feature or site was considered under the cultural modifications category.

Each factor was rated using a value of 0-5, with the exception of cultural modifications, which is rated from -2 to 2. The ranking system has a maximum of 15 points. Those segments with Outstanding or distinctive geologic features received scores of 11 to 15. Segments considered above average, but not outstanding, received scores of 6 to 10 and were rated High for geologic distinction. Segments with little distinction received a score of 5 or less and were rated Moderate to Low for geologic features (Table 3).

Management	Site designation indicates national significance; National Park, National Monument or National Natural Landmark	State designation or management indicates regional significance	No designation
Scarcity	Few occurrences nationally or within the state 5	Limited in occurrences regionally 3	Fairly common within the region 1
Quality	Site is one of best known examples of geologic feature; size of feature is distinctive 5	Distinctive, though somewhat similar to other comparable geologic features within the state 3	Site does not clearly display feature 0
Scientific Value	Recognized as a high quality study location 5	Accessibility or land ownership may limit study of feature 3	Not recognized in literature or locally as a study location 0
Cultural Modifications	Modifications add to public accessibility or education 2	Modifications have no effect on feature 0	Modifications have eroded distinctiveness or quality of feature -2

Values for each criteria are maximum and minimum only. It is possible to assign scores within the three ranges.

Figure 3. Geologic features evaluation chart.

Table 3. Geologic Features Evaluation for Middle Snake Reach

CATEGORY	CRITERIA	MIDDLE SNAKE REACH
Outstanding	Segments possessing distinctive or unique geologic features defined by scarcity, quality or scientific value (score of 11 to 15); limited in occurrences nationally or within the State; site is one of best known examples of geologic feature; size of features is distinctive; recognized as high quality study location; agency designation indicates national significance (National Monument, National Natural Landmarks)	***Twin Falls Reservoir to Blue Lakes Golf Course*** - distinctive scabland topography remnant of Bonneville Flood has well-defined dry falls and displays flood scouring of canyon floor and sides; largest water falls in the state (height and width); site under consideration as a National Natural Landmark ***Crystal Springs to Thousand Springs*** - discharge volume of Snake River Plain Aquifer from the canyon walls is unique on a national scale; 10 of 65 largest springs in the U.S. (discharge > 100 cfs) are along this segment; Box Canyon is 11th largest spring in the U.S.; Niagara Springs is National Natural Landmark, Box Canyon is under consideration as a National Natural Landmark ***Upper Salmon Falls to Malad River*** - Hagerman Fossil Beds is a National Monument; average discharge of Malad spring complex is > 1,000 cfs; Malad Canyon displays distinctive features of the Bonneville Flood; Malad Canyon is under consideration as a National Natural Landmark
High	Segments with above average geologic features (score of 6-10); limited in occurrences regionally; distinctive, though somewhat similar to other comparable geologic features within the State; accessibility or land ownership may limit study of feature	***Bliss Dam to Clover Creek*** - sand dunes; melon gravels of large diameter deposited by Bonneville Flood in significant quantity ***Milner Dam to Dry Creek*** - scabland topography along the top of the canyon remnant of Bonneville Flood; falls at Caldron Linn are the only undeveloped falls of the Middle Snake reach.
Moderate to Low	Segments with little distinction (score of 0-5); fairly common regionally; site does not clearly display feature; not recognized in literature or locally as a study location	***Dry Creek to Twin Falls Reservoir*** ***Blue Lakes to Crystal Springs*** ***Thousand Springs to Upper Salmon Falls*** ***Malad River to Bliss Dam***

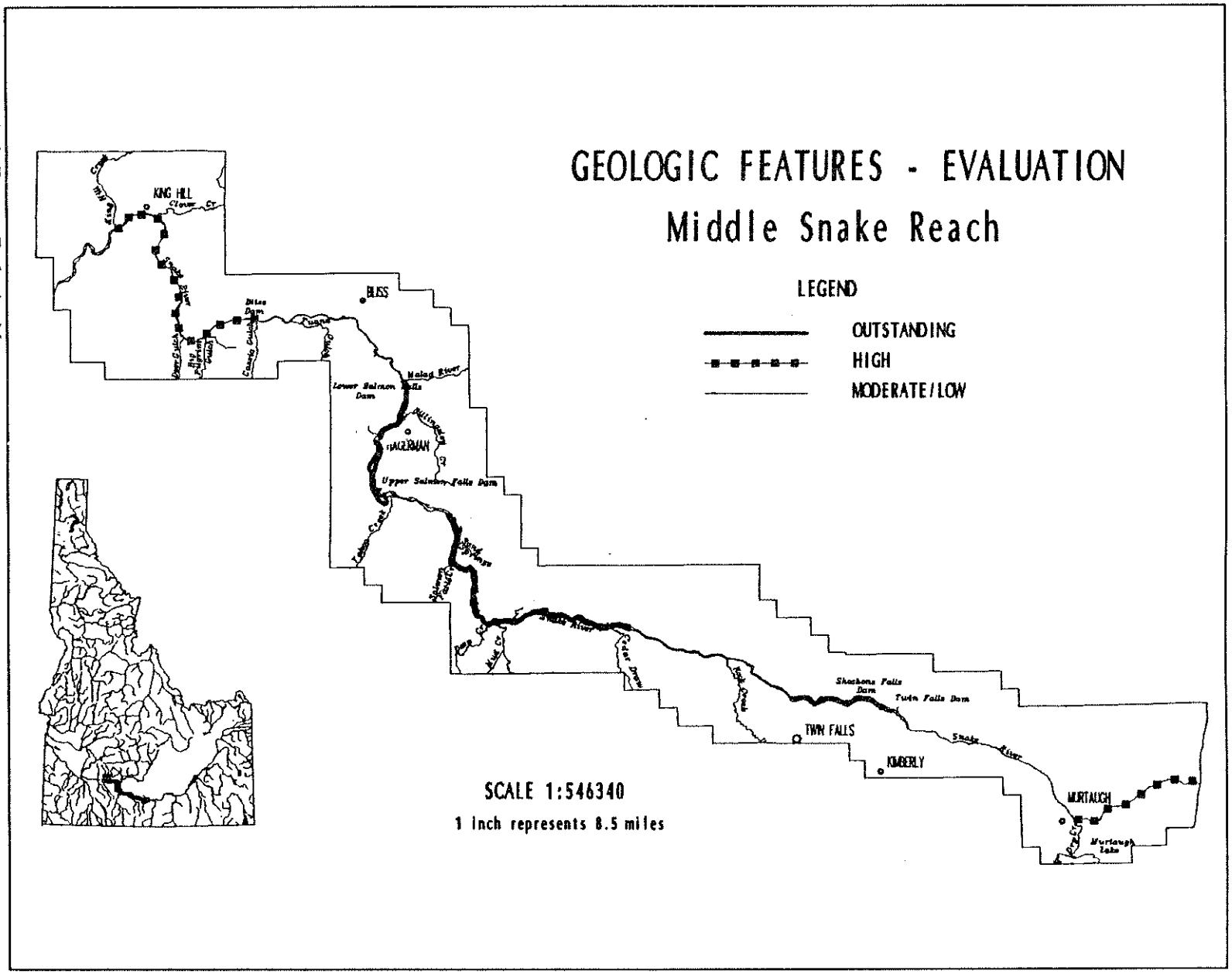

Figure 4. Geologic Features Evaluation Map.

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III. CULTURAL FEATURES

The Snake River canyon has played a major role in Idaho's history. The canyon is believed to have been intensively occupied for the last 10,000 years (Butler, 1986; Swanson, 1965; Swanson et al., 1959). Game, fish, firewood, salmon runs, gold, warmer winter temperatures, springs, and bottomlands for farming were draws to the canyon of the Middle Snake reach. Cultural features along the Middle Snake reach may be generalized as prehistoric sites downstream of Shoshone Falls, and mining sites upstream (Green, 1992).

The archeological record of the Upper Snake extends back 14,500 years by radiocarbon dating of artifacts from the Wilson Butte Cave in the Shoshone-Dietrich area. Prehistorians believe this represents the earliest period of human occupation in North America, discerned by cave deposits and Clovis points. Small, highly mobile bands hunted big game, including now extinct megafauna. Native societies shifted from specialized big game hunting to a more generalized hunting and gathering way of life as the climate became more arid (7,500 - 2,000 years before present). In search of food, early inhabitants gradually developed seasonal migratory routes to camas grounds, fishing waters, and other food gathering areas, utilizing natural routes along rivers and through mountain passes. Trails to and from the Snake River traversed the region. Small Shoshone groups from northern Utah may have extended their food-collecting activities into southern Idaho as early as the middle of the fifteenth century. However, the main surge of Shoshone occupation came in the late eighteenth century, after their displacement from the High Plains by the Blackfoot (Butler, 1986).

The Snake and other river canyons are believed to have been favored locations for winter camps. This is particularly true of the Middle Snake reach west of Shoshone Falls which historically marked the upper limit of salmon migrations. In the 1980s, fish hatchery construction along the river below Twin Falls, resulted in an extensive disturbance of deposits containing well-made Clovis points. Housepits at Clover Creek and Kanaka Rapids relinquished ceramic shards, a mano, pestile, several large, thick ovoid bifaces, and a stone ball (Butler, 1986). Prehistoric sites are particularly abundant in the vicinity of Hagerman. Eighty-six sites have been recorded along the Middle Snake reach from the Thousand Springs downstream to Bliss Reservoir. This inventory includes 22 camp sites, ten village sites, nine rock shelters and two burial sites (IPC, 1990). Mild winters, hot springs, and cold spring fisheries made the Hagerman Valley a favorite wintering area. Upper and Lower Salmon Falls and Kanaka Rapids were major fishing sites. Fishing areas focused on falls and rapids which provided easy access to fish.

Historic sites affiliated with the Snake River corridor are associated with gold mining (predominately above Shoshone Falls), the establishment of homesteads, and the development of the

water resources of the Snake River, its tributaries and springs. An abundance of fur bearing animals along the Snake and Malad rivers attracted trappers, the first white men in the region, in the early 1800's. The Wilson Price Hunt expedition of 1810-12 opened Idaho to American fur trapping, and successive European settlement. Beaver hunting expeditions were common in the 1820's, but a decade later the beaver population was devastated. The 1840's saw the migration of homesteaders enroute to Oregon and California by means of the Oregon Trail. The trail paralleled the canyon, approaching the river in more easily accessible places such as Upper Salmon Falls.

In Idaho physical remnants of historic wagon trails have been destroyed in many areas by farming, roads, and urban development. This is especially true on the irrigable lands adjacent to the Snake River. Of the over 1700 miles of emigrant trails that traversed southern Idaho, about 580 miles of trail remnants still exist. Trail remnants are found mostly on public lands, with the longest sections located on large blocks of BLM-administered land in southwestern Idaho.

By the mid-1860's, books describing natural wonders, such as the great Shoshone Falls, began to attract tourists from the east. Tourist traffic to Shoshone Falls and other "wonders" in the area, including Blue Lakes and the Thousand Springs, was heavy by the 1890's. In 1898 a movement began to create a natural preserve, and possibly a national park, for a section of the Middle Snake reach to include Twin and Shoshone Falls and Blue Lakes (Rhodes-Jones, 1979). Simultaneously others saw the potential to utilize the waters of the Snake for irrigation and power. The preserve, or national park proposal died in the courts with a ruling that favored the Twin Falls Water and Land Company's reclamation project. Permanent settlement of the region accompanied irrigation development. In the summer of 1903 the Twin Falls Southside Land and Water Company tract was opened to entry. A townsite was selected near the center of the project, and delineated land was quickly appropriated. Intensive settlement on the north side of the canyon began in 1907 when the Twin Falls North Side Land and Water Company was granted permission to construct canal systems under the provisions of the federal Carey Act.

Evaluation

Evaluation of cultural resources in the Middle Snake area focused on identifying the significance and density of known prehistoric and historic sites through consultation with the Idaho State Historic Preservation Office (SHPO). Additionally, archaeologists from the three Bureau of Land Management (BLM) Districts (Boise, Burley and Shoshone) located within the planning area were consulted. Documentation of archaeological investigations conducted within the area over the past 30 years were also reviewed.

The State Historic Preservation Office conducted the evaluation of cultural resources found along the Middle Snake reach. Site density, historical significance, and National Register of Historic Places (NRHP) status were considered in rating a river segment as Very High, High, or Moderate to Low for cultural resource values. (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 this list was established by the Historic Preservation Act of 1966.)

River segments with "Very High" cultural values have sites or properties with significant historic value, and/or an exceptionally high density of prehistoric and historic sites and properties listed or eligible for listing on the NRHP. A "High" rating indicates a high site density of prehistoric and historic sites listed or eligible for listing on the NRHP. "Moderate to Low" ratings indicate reach segments with low site densities. Segments classified as "Unknown" have not been inventoried (King, 1992).

The SHPO considers the entire Snake River canyon a significant cultural resource (Green, 1991). "Unknown" segments are predicted to possess very high or high values if surveys are conducted (King, 1992). Only one surveyed section was evaluated as moderate to low for cultural resource values (Fig. 5). Table 4 lists the classification criteria and provides an evaluation summary for the Middle Snake reach. Figure 5 illustrates these evaluation classifications for the reach. A narrative describing values for each river segment follows.

RIVER SEGMENTS WITH VERY HIGH CULTURAL RESOURCE VALUES

Milner Dam to Murtaugh Bridge - Caldron Linn, synonymous with this stretch of the Snake River canyon, is considered one of the most significant historical locales in the state (Green, 1992; FERC, 1990; Thorson, 1993). The National Register of Historic Places (NRHP) associates Caldron Linn with an accident befalling the Hunt party in 1811 during an expedition to find "easy" boat access to the Columbia River. The events affiliated with the Hunt expedition have led the National Park Service to recommend investigation of this reach as a National Register District (Corbyn, 1992). The Idaho State Historic Preservation Office supports this proposal (Neitzel, 1992). The Hunt expedition was significant for three key reasons: 1) the expedition verified that the Snake River was not navigable to the Pacific Ocean; 2) the overland route used by the expedition later became the Oregon Trail; and 3) the trip secured claim to the Northwest Territory for the United States (Corbyn, 1992). Several sites associated with this expedition are found within the segment.

Table 4. Cultural Resource Evaluation for Middle Snake Reach

EVALUATION CLASS	CRITERIA	MIDDLE SNAKE REACH
Outstanding/Very High	Reaches with sites possessing significant historic values; and/or exceptionally high site densities eligible or listed on the National Register of Historic Places	***Milner Dam to Murtaugh Bridge*** - Caldron Linn and other sites associated with the John Wilson Hunt expedition; potentially eligible for National Historic District designation; prehistoric sites and historic mining sites ***Twin Falls Reservoir to Shoshone Falls*** - prehistoric rock shelters, caves and other sites; historic mining sites ***River Mile 602 (3 miles east of Cedar Draw) to backwaters of Bliss Reservoir*** - major prehistoric villages, caves, rock shelters, camp sites and other sites, Kanaka, Lower and Upper Salmon falls site of fishing activity and villages; Hagerman Fossil Beds National Monument; historic sites associated with the Oregon Trail and the settlement of the Buhl area ***Bliss Dam to Bancroft Springs*** - significant prehistoric site density including Shoshonean fishing areas and villages; significant Oregon Trail site at Big Pilgrim's Gulch
High	High site densities eligible or listed on the National Register of Historic Places	***Murtaugh Bridge to Twin Falls Reservoir*** - historic placer mining sites including town sites and Chinese mining sites; some prehistoric sites ***Perrine Bridge to Blue Lakes (River Mile 610.5)*** - prehistoric rock shelters and lithic scatter ***Bancroft Springs to King Hill*** - prehistoric sites including a pithouse
Moderate to Low	Low site densities of eligible or listed National Register of Historic Places Properties	***Auger Falls Area*** - low site density and determined not to provide significant prehistory information
Unknown	River reaches with unknown site densities	***Shoshone Falls to Perrine Bridge*** ***Blue Lakes (River Mile 610.5) to Auger Falls*** ***Rock Creek to River Mile 602 (3 miles east of Cedar Draw)*** ***Bliss Reservoir***

Sources: SHPO, 1992; Henrikson, 1992.

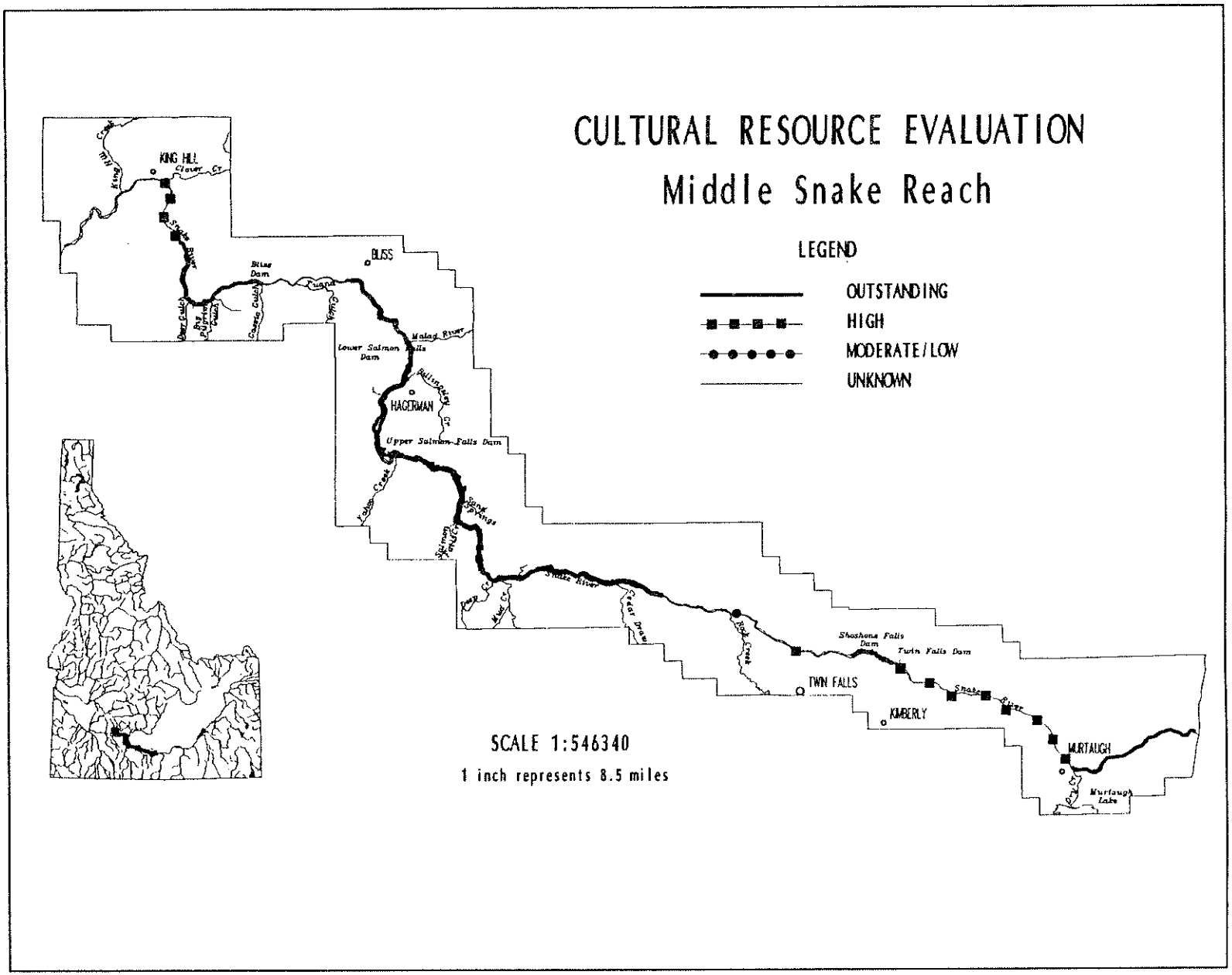

Figure 5. Cultural Features Evaluation Map.

Other historic resources located in this stretch are related to early mining operations. Additionally, Milner Dam and Twin Falls Main Canal are listed in the NRHP (IPC, 1991). The historic townsite of Milner was located in this reach, although little physical evidence remains today. Several Chinese mining structures are also located in the section (Henrikson, 1992).

Prehistoric sites include a stone hunting blind and lithic scatter (Twin Falls Canal Company and North Side Canal Company, 1984). The Star Falls area also is characterized by several prehistoric sites eligible for listing on the NRHP. These include a rock shelter which may have functioned as a base camp for hunting and gathering activities as well as possibly being a winter occupation site. The site could provide significant prehistoric information dating from 7000 to 150 years ago. Another occupation site possesses a lithic workshop, and animal and plant processing areas. Three other rock shelters are in the vicinity, one eligible for NRHP listing, one undetermined, and one ineligible (FERC, 1990).

Murtaugh Bridge to Twin Falls Reservoir - Several sites associated with historic placer mining in the Snake River canyon are located along this segment, many of them related to Chinese mining activity. Specific sites include the townsites of Drytown and Springtown, placer mine tailings, and a rock shelter. Drytown was the first placer mining community inhabited along the Snake River in the study reach (FERC, 1990). These sites are eligible for NRHP listing.

Other important sites include the Twin Falls Dam, powerhouse and associated facilities eligible for listing on the NRHP (FERC, 1990).

Twin Falls Reservoir to Shoshone Falls - Prehistoric sites are located in the vicinity of the Shoshone Falls Reservoir and include a number of rock shelters and a burial site (IPC, 1991). One of the sites is the Pence-Duerig cave which contained artifacts originally interpreted as Shoshonean (Gruhn, 1961). Butler (1979), argues that the cave artifacts have strong associations with the earlier Fremont cultural tradition centered in Utah.

Historic sites are primarily associated with mining, and include the mining town of Shoshone located near the present Twin Falls Dam, a number of rock walls, mining camps and cabins, and Chinese mining sites (IPC, 1991). Among the sites is the Mon-Tung Chinese site providing historic artifacts from the 1870s and 1880s. The Shoshone Falls Hydroelectric Project at Shoshone Falls may be eligible for listing on the NRHP. A former caretaker's house at the hydro project site is listed on the NRHP representing an unusual form of lava architecture (IPC, 1991).

Although located five miles from the Oregon Trail, some emigrants made the trip to see Shoshone Falls whose roar could be heard for miles. The Northside Alternate Trail is only a few hundred feet

from the falls. A trail there gave access to water for travelers on this route. Shoshone Falls became a popular tourist attraction in the late 1800's. Tours out of the town of Shoshone transported people to the falls where a hotel was located. In 1898 the Snake River canyon from Shoshone Falls to Blue Lakes was proposed as a national preserve (Rhodes-Jones, 1979).

Perrine Bridge to Blue Lakes Country Club (River Mile 610.5) - Surveys conducted on private lands in the area have discovered approximately ten prehistoric sites. These consist of small lithic scatters and rock shelters. The eligibility for NRHP listing has not been determined (Henrikson, 1992).

Auger Falls Area - The section of the river containing Auger Falls was surveyed in conjunction with the proposed Auger Falls Hydro Power Project. A ranking of moderate to low was given because of the minor significance of cultural sites in the area. The four sites identified were determined to have little potential to contribute significant information about local prehistory (FERC, 1990).

River Mile 602 (Gooding-Jerome County Line) to Backwaters of Bliss Reservoir - Numerous prehistoric sites have been identified in this stretch of the river including camp sites, villages, rock shelters and burial sites (IPC, 1990; Carley and Sappington, 1982). Major villages were occupied at least 5000 years ago.

Thirteen historic sites are documented between River Mile 602 (Gooding-Jerome County line) and the Clear Lakes Bridge. These sites consist of six homesteads, a stage stop, four roads or bridges, and two mining locations. Many of these sites are associated with the early settlement of the Buhl area in the late nineteenth and early twentieth centuries (Carley and Sappington, 1982). Clark's Ferry began operation near Niagara Springs in 1869. The ferry served wagon and stage travel on the Kelton Road and Oregon Trail (Jones, 1992).

Twelve prehistoric sites were recorded in a survey from Clear Lakes Bridge to Cedar Draw (Carley and Sappington, 1982). Many of these sites were associated with rapids. These sites consisted of lithic scatters, pottery shards, tool fragments and flakes, an overhang shelter, and possible occupation sites. The area has received considerable disturbance from agricultural, road and home building activities. Many of these sites suggest possible prehistoric occupation and additional information may be retrievable with further investigation (Carley and Sappington, 1982).

Kanaka Rapids is a significant prehistoric site. Winter villages were located at the falls and it was the fishing falls mentioned by many who travelled the Oregon Trail (Myers Engineering, 1992). A house pit was excavated at the foot of the rapids (Butler, 1986).

The Snake River reach in the Hagerman Valley possesses abundant prehistoric material (IPC, 1990). Upper and Lower Salmon Falls were major Indian camps. Upper Salmon Falls served as an Indian village with as many as 100 lodges. Use was seasonally related to the presence of salmon (IPC, 1990). Surveys currently being conducted below Upper Salmon Falls Dam indicate a high density of prehistoric sites (Green, 1992).

In the proposed Wiley project reach, six prehistoric sites are documented. The sites include a campsite, lithic scatters, and a rock arrangement dating from the Archaic cultural tradition (4000 B.C. to 1700 A.D.) (FERC, 1982). Two of the identified sites are eligible for NRHP listing.

Historic sites documented from Thousand Springs to downstream of Bliss Dam include homesteads, mining sites, canal/siphons, power plants, bridges, and the Oregon Trail (IPC, 1990). Significant sites associated with the Oregon Trail along this section include:

- Kanaka Rapids marks where the trail returns to the Snake River canyon. Emigrants traded with Indians at this point which was an important salmon fishery.

- Thousand Springs was a landmark mentioned in the diaries of many travelers on the Oregon Trail. The springs, which were clearly visible from the Oregon Trail, gush from beneath the rimrock on the north side of the Snake River. Today, nearly 100 cascades are clearly visible. Here, in 1869 or 1879, the North Alternate Oregon Trail and the early route of the Kelton Road crossed to the north side of the Snake River on M. E. Payne's Ferry. In August 1865, Lt. J.W. Cullen established an Army Camp near the mouth of Salmon Falls Creek to protect the emigrants. A stage station was later established near Cullen's camp.

- Upper Salmon Falls was a favorite Indian fishing spot and trading place for the Indians and emigrants. It was also a popular camping and rest area for the travelers (Planmakers, 1991).

Other significant historic resources include the Teater Studio and Frank Lloyd Wright house, both listed in the NRHP. The Upper and Lower Salmon Falls, Malad, and Bliss hydroelectric projects may be eligible for NRHP listing (IPC, 1990).

In the Wiley project reach, thirteen historic sites are documented, three of them possibly eligible for NRHP listing. Historic sites include homesteads, trash dumps, rock shelters, irrigation facilities, and placer tailings (FERC, 1982).

Bliss Dam to Bancroft Springs - Very high densities of prehistoric sites have been identified in this section. Unpublished State Historic Preservation Office (SHPO) records document 90 sites. These sites include late prehistoric Shoshonean fishing activity areas and villages.

A significant site associated with the Oregon Trail is located at Pilgrim's Gulch. Pilgrim's Gulch constituted a major campground and point of access to the Snake River to obtain water. Nearby, Pilgrim Stage Station served freight and stage traffic along the Kelton Road (Planmakers, 1991). The area has changed little over the years, and the remains of the stage station can still be found.

Bliss Hydroelectric Project may be eligible for listing on the NRHP.

Bancroft Springs to King Hill - Numerous prehistoric sites have been found in this area, although site density is lower than other river stretches. A total of seven sites are recorded in unpublished SHPO's records. Among prehistoric resources are a stratified pithouse with deposits dating from A.D. 500 to 1350 and a circular semi-subterranean house (Butler, 1986).

RIVER SEGMENTS WITH HIGH CULTURAL RESOURCE VALUES

Murtaugh Bridge to Twin Falls Reservoir - Lower density and smaller sites resulted in a high versus a very high ranking (Green, 1992). Several sites associated with historic placer mining in the Snake River canyon are located along this segment, many of them related to Chinese mining activity. Specific sites include the townsites of Drytown and Springtown, placer mine tailings, and a rock shelter. Drytown was the first placer mining community inhabited along the Snake River in the study reach (FERC, 1990). These sites are eligible for NRHP listing.

Other important sites include the Twin Falls dam, powerhouse and associated facilities operating since 1935 and eligible for listing on the NRHP (FERC, 1990). Prehistoric rock shelters may also be located in the area (Henrikson, 1992).

Perrine Bridge to Blue Lakes Country Club (River Mile 610.5) - Surveys conducted on private lands in the area have discovered approximately ten prehistoric sites. These consist of small lithic scatters and rock shelters. The eligibility for NRHP listing has not been determined (Henrikson, 1992).

Bancroft Springs to King Hill - Numerous prehistoric sites have been found in this area, although site density is lower than other river stretches. A total of seven sites are recorded in unpublished SHPO's records. Among prehistoric resources are a stratified pithouse with deposits dating from A.D. 500 to 1350 and a circular semi-subterranean house (Butler, 1986).

RIVER SEGMENTS WITH MODERATE TO LOW CULTURAL RESOURCE VALUES

Auger Falls Area - The section of the river containing Auger Falls was surveyed in conjunction with the proposed Auger Falls Hydro Power Project. A ranking of moderate to low was given because of the minor significance of cultural sites in the area. The four sites identified were determined to have little potential to contribute significant information about local prehistory (FERC, 1990).

RIVER SEGMENTS WITH UNKNOWN VALUES

Archaeological investigations have not occurred for several river segments in the Middle Snake Reach, and therefore, were categorized as unknown for cultural resource sensitivity. These areas tend to occur at impounded sections or private lands. Although rated as unknown, the SHPO predicts the area upstream of Bliss Dam would receive a high and the remaining areas would be rated as very high if cultural surveys were conducted (King, 1992).

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IV. RECREATION

The recreation evaluation for the Middle Snake plan identified the recreational opportunities within the planning area; agency recreational management direction and designations; and the use, and future growth or capacity of recreational activities. The study was conducted from November 1991 to September 1992. Data were acquired from literature review, contacts with various agencies, businesses and private organizations, and review of resource management plans, including the National Park Service (NPS); Boise, Burley, and Shoshone districts of the Bureau of Land Management (BLM); Idaho Department of Parks & Recreation (IDPR); Idaho Department of Fish and Game (IDFG); and Twin Falls County. FERC applications for current and past proposals over the last fifteen years were examined for relevant recreational information.

Summary

Several federal, state and local entities provide recreation services and facilities in the planning area. Recreation use in the planning corridor by agency and regional participation patterns for various recreation activities are summarized in Table 5. Regionally, the most popular recreational pursuits are sightseeing, nature study, camping, picnicking, fishing, and organized sports. Recreation patterns within the planning area reflect some, but not all, of these regional trends. For example, picnicking, nature study, and fishing are also common activities along the Middle Snake, but boating and off-road vehicle (ORV) recreation are popular as well.

Table 5 does not provide complete quantification of recreation use in the planning area, because dispersed use and use of private facilities has not been enumerated or estimated. However, a general description of recreational activities and a comparison of use estimates is presented. The Snake River canyon in the planning area provides a diversity of recreation backdrops ranging from natural, undeveloped settings to areas with facilities. Recreational opportunities vary along the reach.

Milner Dam to Backwaters of Twin Falls Reservoir - Milner and Murtaugh canyons provide an undeveloped recreation setting. This segment is free-flowing, but subject to extreme flow modifications due to the manipulation of releases at Milner Dam for irrigation and flood control. The canyon walls are steep making vehicular access difficult. The setting is relatively natural with rural development on the rim. The Main Milner Powerhouse is currently being constructed near the beginning of Milner Canyon; although a major alteration, the project is designed to minimize visual intrusion. Some powerline crossings, two bridge crossings, and trash dumped over the rim in places are the only other major alterations in this section. The canyon possesses outstanding scenery with numerous springs, rapids, waterfalls, basalt outcroppings, and lush vegetation concentrated at springs

Table 5. Estimated Recreation Activity Participation for Region 4 and the Middle Snake Reach.

	1987 REGION 4 PARTICIPATION[1]		BLM	NPS	IDFG	IDPR	Idaho Power Co.
Activity	**Resident Travelers**	**Non-resident Travelers**	**1991 RVs[2] (% of total)**	**1991 RVs**	**1991 RVs[3] (% of total)**	**1991 RVs[4] (% of total)**	**1990 RVs**
Fishing			6520 (16.9%)		15,750 (39.3%)	12,274 (8.9%)	
Reservoirs	10.6%	2.9%					
Rivers	12.8%	12.2%					
Boating			8945 (23.2%)			818 (0.59%)	
Motor	3.1%	0.4%					
Non-motorized	2.0%	1.4%					
Tour	0.9%	0.2%					
Other Water-based			222 (0.05%)				
Swimming					1800 (4.5%)		
Lakes	1.2%	0.5%					
Rivers	3.0%	0.6%					
Pools	9.4%	1.8%					
Beach	6.4%	1.3%					
Camping	15.6%	12.7%	328 (0.09%)			4,910 (3.5%)	
Hunting			2986 (7.8%)		2880 (7.2%)		
Big Game	2.1%	0.3%					
Upland game	0	0.9%					
Waterfowl	0.7%	3.3%					
ORV Travel	3.8%	1.7%	11,264 (29.2%)				
Other Motorized	44.6%	27.5%	2240 (5.8%)				
Non-motorized			1409 (3.7%)				
Hiking	24.1%	14.5%			720 (1.8%)	1,132 (2.0%)	
Biking	0	3.7%					
Horseback	0.7%	5.8%			528 (1.3%)		
Other Land-based			3216 (8.4%)		2135 (5.3%)		
Picnicking	13.7%	23.7%			1000 (2.5%)	58,292 (42.0%)	
Nature study	36.7%	49.3%			1400 (3.5%)	2,768 (2.0%)	
Sightseeing	55.5%	56.5%			13,880 (34.6%)	54,748 (39.5%)	
Historic sites	2.8%	12.2%				567 (0.4%)	
Tours	8.1%	1.5%				2,204 (1.6%)	
Sports	19.8%	22.1%					
Winter Sports	11.4%	13.9%	1327 (3.5%)				
TOTAL			**38,457**	**approx. 700**	**40,093**	**138,531**	**71,029[5]**

[1] Region 4 includes Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, and Twin Falls counties.
[2] RV - Recreation visit equals one person for one visit regardless of length of visit.
[3] Average estimated yearly use 1986-1991.
[4] Includes recreation use at Pugmire Memorial, Crystal Springs, and Malad Gorge State Park.
[5] Does not include recreational visitation at Niagara Springs Hatchery which is included in the recreation figures for IDPR Niagara Springs Complex.

Sources: US BLM, 1992; Boggs, 1992; Ross, 1992; Sharp, 1992; IDPR, 1989; Lynott, 1992; Wood, 1992; IPC, 1991d, Wilhite, 1992; Perlett, 1992; Musil, 1992.

and falls throughout its length. The Star Falls/Caldron Linn area affords a view of one of the few remaining undeveloped waterfalls on the Snake River and access is relatively easy. This area also possesses significant historical values through association with the tragedy befalling the Hunt party during their journey to Astoria.

This segment may be best known for unique whitewater boating opportunities. River flow above 10,000 cfs creates 1.6 miles of Class V whitewater from Milner Bridge to the Main Milner Powerhouse, and Class IV whitewater through the Murtaugh section, Star Falls to the backwaters of Twin Falls Reservoir (based on the international scale of difficulty with Class I being the easiest and Class VI being extremely difficult). The Murtaugh section is considered a premiere day trip providing river experiences likened to the Grand Canyon. In contrast, the section from the Main Milner Powerhouse to Star Falls is amenable to beginning boaters' skills (Class II rapids). Boating is typically confined to spring and the fall when releases occur at Milner Dam. Hunting, hiking, fishing, picnicking, camping, and sightseeing in a natural setting are other recreational pursuits in the reach.

Twin Falls Reservoir to Rock Creek - The Twin Falls to Rock Creek section provides more developed recreation areas and receives high use. Within this reach are two reservoirs and a free-flowing section downstream of Shoshone Falls. Access to this segment is generally site-specific since landownership and terrain constraints limit continuous access. Twin Falls and Shoshone Falls reservoirs are intensely used for flat water recreation. Popular activities include motorized boating, water skiing, and swimming. Day use parks located at the hydro project sites provide picnicking, boat ramps, and sightseeing opportunities. Views of Twin and Shoshone falls are possible from these parks, which at high river flows still provide an outstanding display of water, rock, and space.

Dierkes Lake Park, adjacent to Shoshone Falls Park, provides picnicking, a swimming beach, boating, and fishing. Hiking opportunities among small "hidden" lakes and unusual geologic formations created 30,000 years ago by the Bonneville Flood are possible. The city has plans to further develop the park by improving hiking trails; developing an interpretive program for the geology, hydrology, and ecology of the area; creating an arboretum of native and non-native trees and shrubs; and renovating a series of rock-lined walkways among cascading brooks.

Devil's Corral and Vineyard Creek, two tributaries in side canyons on the north of the river, supply a natural setting for recreation endeavors. These tributaries support green oases in contrast to the surrounding sagebrush/grassland communities. The areas are attractive for swimming, fishing, picnicking, camping, hiking, and hunting. These lands are part of the Snake River Rim Special Recreation Management Area (SRMA), a BLM management designation emphasizing recreation use. The Snake River Rim SRMA encompasses all public lands adjacent to the Snake River on the north

side of the river, continuing to King Hill Creek. The portion of the SRMA downstream of Shoshone Falls and north of Twin Falls receives significant dispersed use including ORV use, mountain biking, hiking, jogging, equestrian, shooting, photography, bird watching, and driving for pleasure (U.S. BLM, 1989).

Downstream from the reservoirs, Pillar Falls, marked by distinctive basalt outcrops in the river channel, is a popular swimming and picnicking site. Access is possible by foot along a road down to the falls. Motorized and non-motorized boating is popular below Pillar Falls. There is a put-in at Centennial Park located below Perrine Bridge. Fishing is also prevalent below the falls. Non-motorized boating occurs upstream of Pillar Falls.

Downstream of the Perrine Bridge the canyon broadens permitting development in the canyon. The segment is a more urban setting with two golf courses, aquaculture facilities, homes, a sewage treatment plant, Centennial Park, the proposed Auger Falls hydro project, and a proposed trail system. Use in this section includes fishing, motorized and non-motorized boating, and some hunting. Public land on the north and south accommodates dispersed recreation and provides additional access points.

Rock Creek to Crystal Springs - The stretch from Rock Creek to Crystal Springs is isolated and difficult to access. Construction does not disturb the setting except for a pumping station on the south side, and a few dirt roads on the north side of the river. No developed recreation facilities are provided in this segment and recreation use is minor. Access is possible on the north from an IDFG sportsman's access area. Recreation use consists predominately of hunting and fishing.

Crystal Springs to Thousand Springs - This segment offers the greatest diversity in recreational opportunities and settings along the Middle Snake reach. Developed facilities and natural settings are interspersed. Numerous natural features attract sightseers and provide nature study opportunities. The most pronounced feature in the area is the springs cascading from the canyon walls. Some of the more significant springs are: Crystal Springs located adjacent to a state park; Niagara Springs, a National Natural Landmark; Blueheart Springs, the destination of boat tours and scuba divers; and Minnie Miller Spring, one of the last unaltered springs in the Thousand Springs complex. Additionally, several major rapids -- Boulder, Empire, and Kanaka rapids -- provide visual interest.

Wildlife observation opportunities are abundant due to the occurrence of important waterfowl wintering areas, heron rookeries, and nesting raptors. The Box Canyon Area of Critical Environmental Concern (ACEC), managed by the BLM, contains a relatively undisturbed alcove ecosystem which provides scenic and nature study opportunities. The Nature Conservancy's

Thousand Springs Preserve provides wildlife habitat in springs, riparian bottomlands, marshes and sloughs. Wildlife observation and nature study are possible year round.

Numerous points of access are available along the segment. Between Cedar Draw and Banbury Springs there are two state parks (Crystal Lake and Pugmire Memorial Park), Niagara Springs Wildlife Management Area (WMA), Bordewick and Cedar Draw sportsman's access areas, and Catfish Outlet. Fishing, picnicking, camping and hunting occur at these recreation areas. Idaho Power Company has a day use park at Clear Lakes. Clear Lakes Country Club, open to the public, also allows river access in addition to camping, fishing, and golfing.

From Cedar Draw to below Kanaka Rapids fishing is the most popular recreation activity observed with most use concentrated at Crystal Springs (Don Chapman Consultants, Inc., 1992; Wood, 1992; Partridge, 1992). Recreational surveys in this section in 1991 and 1984 indicate fishing, picnicking and sightseeing as recreational activities participated in most (Don Chapman Consultants, Inc., 1992; Wood, 1992).

Several commercial recreation facilities, located on the south side of the river, (Banbury Hot Springs Natatorium, Sligar's Thousand Springs Resort, and Sportsman's River Resort), provide swimming and boating access to the river. Two of them offer pools supplied from geothermal wells. Other activities include camping, picnicking, fishing and duck hunting. A 1991 recreation survey of this section suggests that the most popular activities are motorized boating, water skiing, swimming/sunbathing, and fishing (Reingold, 1992). Many of these activities originate at the commercial facilities.

On the north side of the river is Idaho Power's Thousand Springs day-use park. Sightseeing opportunities are afforded by two fish hatcheries which are open to the public (Clear Lakes and Niagara Springs), and boat tours of the Thousand Springs area.

Upper and Lower Salmon Falls Reservoirs - The impoundments created by Upper and Lower Salmon Falls dams create approximately 12.4 miles of "flat" water. Both reservoirs saw about a 30 percent increase in recreational use from 1990 to 1991 (Reingold, 1992). Steep basalt cliffs are found on the north and east sides of the reservoirs. The Hagerman Valley is the dominate foreground view. The south and west sides of the canyon are defined by the large, light-colored, dissected hills of the Hagerman Fossil Beds National Monument.

At the upper end of Upper Salmon Falls Reservoir, springs cascade from the basalt cliffs on the north side. Views of the springs are possible from State Highway 30, but views also include powerlines, flumes, a powerhouse, commercial businesses, houses, and agricultural development.

The most observed recreation activities on the reservoir are picnicking, water skiing, swimming/sunbathing, and motorized boating (Reingold, 1992).

The Hagerman Wildlife Management Area (WMA), located on the north side of the river adjacent to the Upper Salmon Falls Reservoir, also receives significant fishing use. Several ponds provide bass and trout fishing. An estimated 80 percent of harvested waterfowl in the region use the Hagerman WMA.

Lower Salmon Falls Reservoir is bordered by the Hagerman Fossil Beds National Monument on the west and the Hagerman Valley on the east. The most popular recreational endeavor is fishing, particularly in the Bell Rapids pool. Other popular recreational activities include picnicking, water skiing, motorized boating, and swimming (Reingold, 1992). The Monument saw a significant increase in visitation, from 700 to 1630 visitors between 1991 and 1992 (Wilhite, 1992). Continued increase in site visitation is expected. Future plans for the Monument include a research and visitor's center for interpretation and display of fossils, and establishment of an ongoing paleontological research service.

Lower Salmon Falls Reservoir to Bliss Reservoir - Lower Salmon Falls Dam to Bliss Reservoir is an 7.3 mile free-flowing stretch. The canyon walls narrow and provide more enclosure, while the setting varies from developed to natural. Land ownership is primarily private, and there are few developed recreation facilities. River access is available at Lower Salmon Falls Dam, the Malad River confluence, a day-use park at the Malad project, and Bliss Bridge. Some public lands on the south provide additional access opportunities. Recreational use on this segment increased 32.5 percent between 1990 and 1991 (Reingold, 1992).

River floating is the most popular recreational activity, increasing 143 percent over the last ten years (Wood, 1992). The Idaho Outfitters and Guides Licensing Board has licensed five outfitters for this segment of the Middle Snake reach. Inflows from the Snake Plain Aquifer provide sufficient flows for boating year round. Fishing for trout and sturgeon, and pleasure driving are also popular endeavors in this segment.

Bliss Dam Reservoir to Clover Creek - The reservoir formed by Bliss Dam is approximately four miles long and receives limited recreation use. In fact, while use in upstream sections of the planning area were increasing, recreation use on Bliss Reservoir decreased by 3.4 percent from 1990 to 1991 (Reingold, 1992). The most popular recreation activities were picnicking, fishing, and water skiing.

Bliss Dam to the community of King Hill is a 13.5 mile free-flowing reach. The river is enclosed by sloping, dissected hills on the south and west side of the river, and basalt cliffs on the

north and east. Sand dunes are located on a north-side bench below Bliss Dam. The canyon is undeveloped, except for some disturbance immediately below Bliss Dam, a pumping station near Big Pilgrim Gulch, the Interstate 84 bridge crossing, and skyline views of powerlines. Agriculture is the principal land use on the benches above the river and on the canyon rim.

Recreation use is dispersed. Access to the river is possible from public lands on the north and east managed as the Snake River Rim SRMA. Additional public lands are located on the south and west. Fishing for trout and white sturgeon are probably the most popular recreation activities in the reach. White sturgeon fishing is considered a unique fishing experience, and this segment of the Middle Snake supports the most abundant and important white sturgeon fishery above Hells Canyon.

Whitewater boating from Bliss Dam to King Hill provides an experience suitable for novices (Moore and McClaran, 1989). Currently, there are no developed access points for whitewater boating, which may account for the low boating use. However, a commercial outfitter was recently licensed for this section. Other recreational endeavors include waterfowl and upland game hunting. Minor camping, ORV use, and equestrian use also occurs.

Developed Recreation Facilities

Developed recreational facilities provide access to the Snake River for fishing, hunting, swimming, and boating. The majority of recreational facilities are privately operated, and also provide camping, picnicking, and hiking (Table 6). Many are associated with hydropower development and consist of reservoir-related recreation activities. Of the developed recreational facilities with visitation tallies, the Crystal Springs/Pugmire Memorial Recreation Area complex, operated by the IDPR receives the largest number of visits. Perrine viewpoint, the golf courses, and the City of Twin Falls' Shoshone Falls and Dierkes Lake parks also receive substantial use.

CAMPING

The 1990 State Comprehensive Outdoor Recreation Plan cited camping facilities as a high priority for the Region (IDPR, 1989b). Several privately operated facilities are located adjacent to the river south of Hagerman including Sligar's Thousand Springs Resort, Sportsman's River Resort, and Banbury Hot Springs (Table 7). These establishments provide boating and fishing access to the river as well. Other private campgrounds in the canyon, but away from the river, include Miracle Hot Springs near Banbury on the west side of State Highway 30, and Rock Lodge and Creekside RV Park north of Hagerman on Billingsley Creek. No developed campgrounds are located on public lands.

Dispersed camping opportunities are available on Bureau of Land Management, Department of Fish and Game, and some state park lands in the planning area. Camping on BLM lands occurs at

Table 6. Developed Recreational Facilities Within the Middle Snake Study Area.

State of Idaho		1991 Estimated Attendance
Pugmire Memorial Recreation Area and Crystal Springs Park	picnicking, fishing, dispersed camping, bird watching	81,825[1]
Twin Falls County		
Picnic Access	picnicking	
Centennial Park	boating, fishing (future phases: picnicking, trails)	
City of Twin Falls		
Shoshone Falls Park	picnicking, viewpoint, fishing, water sports, boat dock and ramp	
Dierkes Lake Park	picnicking, swimming, fishing	37,000[2]
Perrine Bridge Viewpoint	scenic vista, tourist information	55,000[3]
Private		
Banbury Hot Springs	swimming, boat docks, picnicking	---
Sligar's Thousand Springs Resort	picnicking, camping, boat ramp and dock, water sports, fishing	---
Sportman's River Resort	picnicking, fishing, boating, camping, water sports	---
Twin Falls Park	picnicking, fishing, boat ramp and dock, water sports, overlook	23,500 recreation days
Upper Salmon Falls Park	picnicking, fishing, water sports, boat ramp and dock	8,920 recreation days
Lower Salmon Falls Park	picnicking, fishing, water sports, boat ramp and dock	14,700 recreation days
Upper Malad Park	picnicking	1,900 recreation days
Lower Malad Park	picnicking, fishing, water sports	5,000 recreation days
Niagara Springs Hatchery	viewpoint, picnicking, hatchery tours	81,825[1]
Clear Lakes Park	picnicking, fishing, water sports	5676 visitors
Thousand Springs Park	picnicking, fishing, boat ramp (small boats), water sports	8133 visitors
Bliss Park	picnicking, fishing, swimming, water skiing, boat ramp and dock	3,200 recreation days
Blue Lakes Country Club	golfing, fishing, swimming	21,000 rounds golf
Jerome Country Club	golfing	38,000 rounds golf
Canyon Springs Golf Course	golfing	41,000 rounds golf
Clear Lakes Country Club	golfing, fishing, picnicking, camping	32,000 rounds golf

[1] Represents attendance for Pugmire and Crystal Springs parks, and Niagara Springs Hatchery.
[2] Attendance for Shoshone Falls and Dierkes Parks combined.
[3] People signing attendance book. Actual attendance is likely greater.

Sources: IPC, 1991; Heider, 1992; Lynott, 1992; Wood, 1992; Zuck, 1992; Twin Falls City Parks and Recreation, 1992; Thorne, 1992; Ericson, 1992; Peterson, 1992.

Table 7. Developed Campgrounds

	Number of Sites
Banbury Hot Springs	30
Miracle Hot Springs	14
Rock Lodge and Creekside RV Park	11
Sligar's Thousand Springs	50
Sportsman's River Resort	9
TOTAL	**114**

Source: Idaho Department of Parks and Recreation, 1991.

Star Falls, Murtaugh Bridge, Devils Corral, and other lands in the Snake River Rim SRMA. Pugmire Memorial Park allows camping although no facilities are provided; to date camping activities at Pugmire have been associated with group reservations of the picnic shelter (Lynott, 1992). Dispersed camping is allowed at IDFG sportsman's access areas.

SWIMMING, WATER SKIING AND SCUBA DIVING

Swimming occurs at the reservoirs and at sites along free flowing segments of the river where access is available. A number of swimming pools are also available in the area, some taking advantage of hot spring sources. Developed hot spring pools are open at Banbury, Sligars and Miracle Hot Springs. Dierkes Lake Park has a swimming beach. Recreational surveys in the lower portion of the planning area indicate swimming is one of the more popular activities observed in the Thousand Springs area and Upper and Lower Salmon Falls reservoirs (Reingold, 1992). Water quality problems in the last few years has resulted in a curtailment of swimming in the river, especially from Crystal Springs downstream to Thousand Springs. Some resort owners have reported increased use of their pool facilities because of the low water and water quality problems in the river (Sligar, 1992).

Water skiing occurs on all five reservoirs and on the river in the Thousand Springs area. In recent years water skiing has been impeded because of algal blooms. On a normal summer weekend from 100 to 200 water skiers may be observed in the Thousand Springs area (Bolduc, 1992; Sligar, 1992).

Scuba diving occurs in the vicinity of Thousand Springs and Blueheart Springs. Classes conducted at Boise State University, the College of Southern Idaho, and Northwest Nazarene College bring students to the area for approximately six months in the winter (Bolduc, 1992).

PICNICKING

Picnicking opportunities are possible at the many developed facilities located in the study area. These include state, county and city parks, as well as facilities provided by private entities most notably Idaho Power Company's many parks at its hydropower facilities.

Draft survey data collected by Idaho Power Company suggest picnicking may be one of the most popular activities within the river canyon (Fuhrman, 1992). A telephone survey conducted in 1983 cited picnicking as the recreation activity engaged in most by recreationists using Twin Falls Hydro Project facilities (53.8 percent of respondents) (IPC, 1985). Picnicking was also the most frequent recreation activity observed at Lower Salmon Falls and Bliss reservoirs (Reingold, 1992).

Boating/Floating

The Middle Snake reach provides opportunities for motorized and non-motorized boating. Five reservoirs provide flat water boating: Twin Falls, Shoshone Falls, Upper and Lower Salmon Falls, and Bliss reservoirs. Boat ramps are provided at all of these facilities. When there is sufficient

water in the river, it is also possible to power and jet boat on several free-flowing sections of the Snake. Centennial Park, located in the canyon to the west of Perrine Bridge, provides boat access to the river below Pillar Falls. Other free-flowing stretches used by power boats include the Thousand Springs area, where developed boat ramps and launches are provided by several private enterprises, and below Lower Salmon Falls and Bliss dams.

Boater registration suggests motorized boating in the planning area has increased at a rate greater than the state-wide trend. In 1991, 3,747 registered boaters indicated Gooding, Jerome or Twin Falls as their primary use area, an increase of 8.5 percent from the previous year. Registered boaters in the State of Idaho as a whole increased by 3 percent in 1991 from 1990 (Brandt, 1992). Discussions with the Idaho Department of Parks and Recreation Boating Safety section and Idaho Power Company recreation planners indicate no capacity problems on existing reservoirs. Conflicts that do occur are generally related to access constraints rather than reservoir capacity (Brandt, 1992; Reingold, 1992).

The planning area provides whitewater runs for all experience levels (Table 8). When referring to whitewater boating within the Middle Snake reach, four sections are usually delineated: Milner, Murtaugh, Wiley, and Bliss (Amaral, 1990; Moore and McClaran, 1989). At flows of 10,000 cfs and above, the Milner and Murtaugh segments are cited for possessing national significance (U.S. BLM, 1989). With the construction of a developed boat access at the Milner Powerhouse, boating opportunities will be available from the powerhouse to Star Falls.

Table 8. Middle Snake Whitewater Sections

Segment	Put-in/Take-out	Ideal cfs	Skill Level*	Craft	Licensed Outfitters
Milner	Milner Bridge/ Main Milner Powerhouse	12,000 - 15,000	Expert - Class V	Kayak	0
Star Falls	Main Milner Powerhouse/Above Star Falls	-	Beginner - II/III (@ 1200 cfs) Beginner II (@ 3500-4000 cfs)	Kayak, rafts, canoes	0
Murtaugh	Below Star Falls or Murtaugh Bridge/ Twin Falls Reservoir	10,000 - 15,000	Advanced Intermediate - Class IV	Kayak, raft	4
Wiley	Below Salmon Falls/Bridge at Bliss	Above 10,000	Beginner - Class II (III)	Kayak, raft, canoe	5
Bliss	Below Bliss Dam/King Hill	Above 10,000	Beginner - Class II (III+)	Kayak, raft, canoe	1

* Based on the international scale of difficulty with Class I being the easiest and Class VI being extremely difficult.

Sources: Amaral, 1990; McClaran and Moore, 1989; Idaho Outfitters and Guides Licensing Board, 1992; Lesser, 1991; Lucachick, 1992; Ridenhour, 1992.

The Idaho Outfitters and Guides Licensing Board licenses outfitter use for most of the Middle Snake reach. Currently, there are four licensed for the Murtaugh, five for the Wiley, and one for the Bliss section. One outfitter was recently licensed for power and float boating from Centennial Park to Pillar Falls (Gardner, 1992). Information on commercial use of these sections of the Snake River are limited by the current drought which has made some sections unboatable. Additionally, the Outfitters and Guides Board only began requesting this information in 1986, which coincides with the current drought cycle.

Milner Section - The Milner canyon is a short stretch from Milner Dam to the Milner Powerhouse which provides a Class V experience for expert kayakers at flows above 10,000 cfs. Floating opportunities are controlled by releases over Milner Dam. In normal water years this section was floated in late spring. Sufficient flows for boating have not been available since 1986. With completion of the Milner hydropower complex opportunities to float will be further reduced, by diversion of flows to the main powerhouse. Currently, the FERC license for the project requires halting operation of the powerhouse up to 12 days a year for 8 hour periods between April 1 and May 31 when flows in excess of irrigation needs exceed 4,000 or 10,000 cfs (Milner License Article No. 415). Models based on historic discharges (1928-1989) and operations indicate the possibility of flows of 4000 cfs or above occurring in April is 52 percent, and 45 percent in May; flows of 10,000 cfs or more have a 33 percent chance of occurring in April and a 20 percent chance in May.

The Idaho Outfitters and Guides Licensing Board has made provision to license three outfitters in the section from Milner Dam to Star Falls. No outfitters are currently licensed for this stretch.

Star Falls Section - The Star Falls section (put-in at the Main Milner Powerhouse and take-out above Star Falls) provides an opportunity suitable for beginning boaters in a scenic and relatively natural section of the Snake River. Construction of the Milner Powerhouse has provided access to make floating this section feasible. Limited knowledge is available regarding whitewater characteristics at varying flows. At 1200 cfs, Class II and some Class III rapids develop. The confined nature of the canyon at this flow restricts use to small craft such as kayaks, small rafts, and canoes (Lucachick, 1992). Flows of 4000 cfs result in class II rapids (Reingold, 1992).

Murtaugh Section - The Murtaugh section, with put-ins at Star Falls or Murtaugh Bridge, extends to the backwaters of Twin Falls Reservoir. This stretch provides Class IV whitewater and outstanding scenery for boaters with advanced-intermediate skills. The boating experience is described by many as comparable to the "big water" of the Grand Canyon, but neatly packaged in a one day trip (Lesser, 1991; Gardner, 1991; and Bridges, 1992).

Four outfitters are licensed for this stretch. No commercial use has occurred since 1986, because of inadequate water flows (Idaho Outfitters and Guides Licensing Board, 1992). However, some private use has occurred as this section can be kayaked at flows as low as 600 cfs (Gardner, 1992). A minimum of 6000 cfs is required to float a raft down the river (Ater, 1992; McBride, 1992). Boating use on the Murtaugh section was reported to be increasing prior to the drought (U.S. BLM, 1989). Floating opportunities in the Murtaugh section are dependent on releases at Milner Dam or the main Milner powerhouse. In a normal water year, the boating season is typically from March to June.

A survey conducted of boaters using the section of the Snake from Star Falls to Twin Falls Reservoir (Murtaugh section) from April 23 to July 6, 1984 reported 68 percent of boating use was whitewater boating. The remaining were power and jet boats, canoes, and flatboats used on Twin Falls Reservoir. Most whitewater boaters kayaked (60%), but rafts (38.9%) were also common. Whitewater boating was by far the most popular boating activity in this section of the planning area when sufficient flows were available (Feldman and McLaughlin, 1986).

Wiley Section - The Wiley section with put-in below Lower Salmon Falls Dam and take-out at Bliss Bridge provides whitewater suitable for beginning boaters. An alternative put-in is at the Malad River confluence. The whitewater consists of Class II rapids and one Class III rapid (Amaral, 1990). Unlike the Milner and Murtaugh sections and other rivers in Idaho, this section is unique because boating flows are available year round. This section of the Middle Snake reach is the most heavily used for float boating.

Boating use on the Wiley segment has tripled since 1981 (Table 9; IPC, 1981; Wood, 1992). The majority of boating craft consisted of rafts (97.6%) while canoes, inner tubes, and kayaks made up minor portions in a 1981 study (IPC, 1981). A 1989 survey conducted by IDPR obtained similar results. Rafts comprised 92 percent of craft, the remaining 8 percent were made up of kayaks, inflatable kayaks, and inner tubes (IDPR, 1989a). Current studies indicate that rafts are still the major means of floating the Wiley section, although minor increases in kayak use are occurring (Reingold, 1992).

Recent surveys are showing a larger regional draw for this section. Surveys in 1981 and 1989 indicated the majority of Idaho boaters came from Gooding, Jerome and Twin Falls counties (IPC, 1981; IDPR, 1989a). Surveys conducted in 1990-1992 show an increase in boaters from the Boise area and Wood River Valley (Reingold, 1992). The broader regional draw may be the result of the drought which has reduced the season on other rivers while the Wiley reach has been boatable year round. However, the growing popularity of whitewater boating and growing knowledge of this area will likely result in continued use of this section from a greater regional area in the future.

Table 9. Estimated Boating Activity.

	MURTAUGH SECTION	WILEY SECTION
1981	-	1856[1]
1984	1042[2]	-
1989	-	3258[3]
1992	-	approx. 5500[4]

[1] Estimated use for May 15 to October 2, 1981.

[2] Derived from Feldman and McLaughlin, 1986. Estimated whitewater boating use for a season from March 28 to July 8, 1989.

[3] Derived from IDPR, 1989a. Does not depict total use for 1989, but only use estimated for June 1, to August 31, 1989.

[4] Based on statement made by Wood, 1992 at Wiley Hydro Project consultation meeting.

Sources: IPC, 1981; Feldman and McLaughlin, 1986; IDPR, 1989a; Wood, 1992.

The Idaho Outfitters and Guide Licensing Board has licensed five outfitters to float this section (Idaho Outfitters and Guides Licensing Board, 1992). Commercial use in general is experiencing increases, with a significant increase in 1992 (Table 10). Recent increases can be attributed to more bookings by large groups. Outfitters on the Wiley stretch are floating more business groups, organized bus tours, senior citizens, college classes, and family reunions (Sager, 1992; Hess, 1992; Gardner, 1992) . Another trend is the increase in non-resident clientele. The majority of floaters using outfitters in 1991 were from out-of-state. Although figures for resident and non-resident boaters are not available for 1992, one outfitter estimates 80 percent of their business consists of non-residents with the majority from California (Sager, 1992).

Table 10. Reported Boating Activity by Outfitters and Economic Values.

	MURTAUGH		HAGERMAN		KING HILL	
Year	Total (Non-resident)	Economic Value	Total (Non-resident)	Economic Value	Total (Nonresident)	Economic Value
1986	111 (75)	$4780	227 (77)	$8635	-	-
1987	*	*	155 (55)	$4460	-	-
1988	*	*	141 (43)	$5820	-	-
1989	*	*	369 (136)	$13,340	-	-
1990	*	*	225 (73)	$8090	-	-
1991	*	*	335 (212)	$11,710	-	-
1992	*	*	1310 (Not available)	$59,250	-	-

* Insufficient flows for commercial floating.

Sources: Idaho Outfitters and Guides Licensing Board, 1992; U.S. BLM, Shoshone District, 1986-1991; Hess, 1992; Gardner, 1992; Sager, 1992; Edson, 1992.

Two of the five licensed outfitters are experiencing increases in commercial trips. One outfitter has not conducted trips in the last three years pending sale of the business, and two others focus efforts on other rivers in the state. The potential exists for increased commercial opportunities

if all five outfitters marketed to their potential. However, increased commercial use, along with concurrent expansion in private use, may lead to resource impacts.

Commercial outfitters currently report put-in and take-out facilities are at or exceed capacity on some weekends. Reported problems include crowded parking facilities, trash at the take-out and picnic spot known as Mustard Beach, potential river safety conflicts from overcrowded conditions, and conflicts with motorized craft using the section. Many inexperienced boaters and families float this section of the river. Crowded conditions could result in unsafe experiences. If use continues to increase, more formal management of the river may be necessary.

Bliss Section - The Bliss section, with put-in below Bliss Dam and take-out in the King Hill area, offers additional year round opportunities for beginning float boating. This section of the river provides a more natural setting offering an alternative to the Wiley stretch. Current use is low, because of lack of developed put-in and take-out facilities. However, an outfitter was recently licensed to offer commercial trips on this stretch.

Fishing, Hunting and Wildlife Observation

The Snake River Canyon possesses abundant opportunities for wildlife observation, fishing, and hunting. Several areas within the canyon are designated wildlife management areas (WMA), sportsman's access areas, and isolated wildlife tracts. Isolated wildlife tracts are cooperatively managed by the BLM and IDFG predominately for upland game. The IDFG and BLM also have jurisdiction over many of the river islands.

Wildlife Management Areas and sportsman's access areas are funded from fishing and hunting license fees to secure access for these uses. The areas also provide opportunities for wildlife observation and nature study. Table 11 lists IDFG sportsman's access areas and WMAs located in the Snake River canyon.

Table 11. IDFG Sportman's Access and Wildlife Management Areas

Hagerman WMA	fishing, hunting (upland birds)
Bell Rapids Access	fishing, hunting (waterfowl), boat ramp and dock
Bordewick Access	fishing, hunting (waterfowl)
Niagara Springs WMA	fishing, hunting (waterfowl, upland birds)
Niagara Springs Access	fishing, hunting (waterfowl)
Cedar Draw Access	fishing, hunting (waterfowl)
Banbury's Access	
Scott Access	fishing, hunting (waterfowl and upland birds), boat ramp

Source: IDFG, 1990.

FISHING

Warm and cold water fishing opportunities are available along the Middle Snake reach. Access to the river is provided at Idaho Power Company's hydro project facilities, IDFG sportsman's access and WMAs, and a number of county, city, and private operations. Public lands located along portions of Milner and Murtaugh canyons, below the Perrine Bridge, in the vicinity of Bliss Bridge, and below Bliss Dam also provide fishing access.

Statewide fishing license sales have been relatively stable over the years increasing by four percent from 1977 to 1987. For this same period a 14 percent increase in angler use occurred (Reid, 1989). In 1990, five percent of statewide fishing license sales were purchased in Gooding, Jerome and Twin Falls counties (IDFG, 1991a). Although all purchasers may not reside or fish in the vicinity of license purchase, there likely is some relationship.

Fishing is frequently one of the most observed recreational activities in surveys conducted on the Middle Snake. Within the planning area the Lower Salmon Falls to Bliss Dam section probably has the most angler effort expended because of the easy access (Partridge, 1992). A 1976 survey conducted from Loveridge Bridge to Lower Salmon Falls Dam by the IDFG observed the majority of angler effort occurred from Lower Salmon Falls Dam to Bliss Bridge (Gibson and Mate, 1976). In a 1981 recreation survey conducted from Lower Salmon Falls Dam to Bliss Bridge, fishing was the most observed activity comprising 40 percent of all recreational activity. Most fishing occurred below Lower Salmon Falls Dam and at the Malad Power Plant (IPC, 1981). Whitewater boating has currently surpassed fishing in popularity in this stretch (Wood, 1992). Another area with significant angler effort is the Clear Lakes area, particularly at Crystal Springs (Partridge, 1992). From Mud Creek to Cedar Draw, fishing was the most observed recreation activity in 1984 and 1991 surveys (Don Chapman Consultants, Inc., 1992; Wood, 1992). The surveys found fishing activity concentrated at Crystal Springs. Lower and Upper Salmon Falls reservoirs receive the most angler effort of the five reservoirs in the planning area (Partridge, 1992).

The IDFG *Fisheries Management Plan* classifies trout habitat, with the exception of spawning habitat, as good in free-flowing sections between King Hill and Milner (IDFG, 1991b). Trout species present include rainbow, brown, cutthroat, and a rainbow-cutthroat hybrid. The hybrid is found predominately between Milner and Twin Falls dams. The reservoirs are also suitable for trout. Trophy size trout have been caught in Lower Salmon Falls Reservoir. Recent public meetings conducted by IDFG have resulted in harvest restrictions for Lower Salmon Falls Reservoir in order to build a trophy fishery (Turnipseed, 1992). Warmwater species include largemouth and smallmouth bass, bluegill, brown, bullhead, channel catfish and yellow perch (IDFG, 1991b).

For the last 20 years the Snake River could not be considered a "quality" fishery (Table 12; Partridge, 1992). Fishing opportunities are greatly reduced because of current water quality problems, low flows, and spawning habitat losses. Additional potential threats to the trout and sturgeon fisheries include hydropower development on the mainstem and tributaries, and dewatering in the summer which impairs spawning habitat access. However, the IDFG believes the Snake River has the "greatest potential for increasing angler opportunity" in Southern Idaho (IDFG, 1991b).

Unique fishing opportunities are afforded by the white sturgeon fishery occurring in free flowing sections from Auger Falls to King Hill. Angler interest is described as high for this species (IDFG, 1991a). The IDFG manages this population for catch and release only. Studies conducted in the early 1980's concluded the best sturgeon habitat and populations occur in the free-flowing sections below Bliss Dam to C.J. Strike Reservoir. Based on catch rates, this section was also determined to have the most abundant populations between Shoshone Falls to Givens Hot Springs (Lukens, 1982). The IDFG plans to augment sturgeon populations in the free-flowing sections between Auger Falls and Bliss Dam with hatchery stock (IDFG, 1991b).

Table 12. Angler Hours and Catch Rates for Areas Within the Middle Snake Planning Area.

Segment	1971	1975	1981	1984	1987	1991
Shoshone Falls to Upper Salmon Falls	2988 hrs.[1] 0.55 fish/hr.					
Lower Salmon Falls to Bliss Dam		5137 hrs.[2] 0.29 fish/hr	4581.8 hrs.[3] 0.58 fish/hr.			
Bliss Dam to King Hill		1665 hrs.[2] 0.08 fish/hr				
Upper Salmon Falls Reservoir	6023 hrs.[1] 0.6 fish/hr.					
Lower Salmon Falls Reservoir					22,000 hrs.[5] 0.48 fish/hr.	40,078 hrs.[6] 0.30 fish/hr.
Hagerman Wildlife Management Area				23,958 hrs.[4] 0.99 fish/hr.		

[1] March 29 to December 19, 1971 [2] April 7, 1975 to January 11, 1976 [3] May 15 to October 2, 1981
[4] June 30 to November 2, 1984 [5] June 1 to December, 1978 [6] December 1, 1990 to November 30, 1992

Sources: Reid, 1972; Gibson and Mate, 1976; Grunder, 1986; Grunder, Elam and Bell, 1989; IPC, 1981; Partridge, 1992.

HUNTING

Hunting activities in the Middle Snake reach focus on waterfowl, upland birds and game, and deer. Restrictions apply in many sections. Deer harvest is restricted to archery from Milner Dam to Perrine Bridge, shotguns from Rock Creek to the Malad River and on the islands downstream of the Highway 30 Bridge near Hagerman. The Hagerman Wildlife Management Area is closed to waterfowl hunting, and geese are protected from Clear Lakes Bridge to the Malad River (Musil, 1992).

Hunting for upland bird and game occurs throughout the planning area. In the Hagerman area quail and pheasant are the main species harvested. Table 13 summarizes hunter days expended over the last five years for waterfowl, and upland birds and game in Gooding, Jerome, and Twin Falls counties. A hunter day is equivalent to one hunter hunting any portion of a day.

Table 13. Estimated Hunter Days for Gooding, Jerome and Twin Falls Counties.

Year	Waterfowl	Upland Birds	Upland Game
1987	29,198	38,305	3076
1988	20,504	26,126	1434
1989	35,670	29,867	2854
1990	19,199	40,552	5091

* Waterfowl includes Canada geese, snow geese, coots and ducks; Upland birds include chukars, huns, quail and pheasant; Upland game includes doves, cottontail rabbits, snipe and snowshoe hare.

Source: IDFG, 1987-91.

Waterfowl are by far the most popular species hunted in the planning area. The reach from Cedar Draw to Bliss Bridge receives the most use (Kvale, 1992). The IDFG estimates that 80 percent of the ducks harvested in Region 4 inhabit the Hagerman Wildlife Management Area (Turnipseed, 1992). A decrease in waterfowl hunter days in 1990 is attributed to increased costs for ammunition, and state and federal waterfowl stamps (Kvale, 1992).

Private hunting clubs in the Hagerman area capitalize on the waterfowl populations in the vicinity. Water development and farming operations are managed on these lands to promote waterfowl habitat. For a fee members may hunt. One such hunting club is Buckeye Ranch located across the river from the Hagerman Fossil Beds National Monument. Another is located downstream from Buckeye Ranch.

Deer harvest within the planning area is mainly managed to control depredation of orchards in the Niagara Springs area (Turnipseed, 1992). Deer hunting occurs in Milner and Murtaugh canyons and the vicinities of Devil's Corral, Vineyard Creek, and Crystal Springs. Success rates are low compared to the rest of the state. Table 14 summarizes the estimated deer hunter days for the past five years by IDFG hunting unit. The Middle Snake Reach is located within three IDFG hunting units; the reach is primarily encompassed by Unit 53, with very small portions within Units 45 (located on the north side of the Snake River west of Bliss) and 46 (located on the south side of the Snake River west of State Highway 30).

Table 14. Estimated Deer Hunter User Days.

Year	Unit 45	Unit 46	Unit 53*
1987	-	3512	-
1988	-	2523	3175
1989	-	1953	110
1990	-	5953	2244
1991	-	2806	1249

* The study area is located predominately in Unit 53.

Source: Nelson, 1986-91.

WILDLIFE OBSERVATION

The Snake River canyon in the Middle Snake reach possess abundant opportunities for wildlife observation including waterfowl, raptors, heron rookeries, and pelicans. Refer to Section I, Fish and Wildlife, for more detailed information regarding species located within the canyon.

Two areas specifically noted for wildlife viewing opportunities in the *Idaho Wildlife Viewing Guide* include Hagerman and Niagara Springs Wildlife Management Areas (Carpenter, 1990). Management of these land areas emphasize protection of wildlife habitat and provide ample opportunities for wildlife observation. These areas are noted for year round opportunities to view waterfowl, wading birds, and raptors. In addition, the Hagerman WMA is noted for upland birds and fish; the Niagara Springs area for songbirds and as a major wintering waterfowl area.

The Thousand's Springs Nature Preserve was acquired by The Nature Conservancy in 1986. Important wildlife habitat include a remaining unaltered spring system in the Thousand Springs complex, riparian bottomland, steep basalt cliffs, several spring creeks, marshes and sloughs. Opportunities exist to view Shoshone sculpin, several snails listed as endangered, waterfowl, wading birds, and nesting raptors. The Preserve has probably the best population of Shoshone sculpin in its spring creeks. Tours are conducted every weekend from June through September in cooperation with Malad Gorge State Park.

Sightseeing and Trail Use

SIGHTSEEING

The planning area provides the opportunity to visit many interpretive centers and museums. In the Hagerman area, there is Rose Creek Winery, Snake River Pottery, Hagerman Historical Society Museum, and a Frank Lloyd Wright House, the only house designed by the architect in

Idaho. Other attractions include the Evil Knievel jump site near the city of Twin Falls; the many hydroelectric projects; and numerous federal, state, and privately owned aquaculture facilities.

Thousand Springs Tours is a two year old business operating out of Hagerman which provides boat tours on the Snake River from April through October. The tours begin at Sligar's Thousand Springs Resort and go upstream to Blueheart Springs, past the Thousand Springs complex. An estimated 1000 people took the tour this year (Bolduc, 1992).

Numerous natural features offer sightseeing opportunities in the planning area, most notably the canyon spring complex and major waterfalls and rapids. Springs issue from the canyon walls in many places. Most notable are Niagara Springs, a National Natural Landmark, and Minnie Miller Springs, one of the last undeveloped springs along the reach. Waterfalls and major rapids also attract people. Most notable are Star Falls/Caldron Linn, Shoshone Falls, Twin Falls, Pillar Falls, Auger Falls, and Kanaka, Boulder, and Empire rapids.

Numerous viewpoints on the canyon rim provide extensive views of the Snake River Canyon. Hansen Bridge viewpoint, Perrine Bridge viewpoint north of Twin Falls, and a viewpoint located on Highway 30 providing a panoramic view of the Hagerman Valley are developed. There are also many areas where public lands along the rim provide opportunities to observe the canyon. The Thousand Springs Scenic Byway, U.S. Highway 30, traverses the Snake River canyon from Bliss, south through the Thousand Springs area. Perrine Bridge and Hansen Bridge are also a part of the scenic byway. Shoestring Road follows sections of the Oregon Trail in the western portion of the study area. Views of the Snake Canyon upstream of King Hill to Bliss Bridge are possible from this road.

TRAIL USE

Developed trails within the canyon are limited although public input indicates the demand is great. Limitations to extensive trails along the canyon is due to the diversity in land ownership. Although public and state parcels are located along the canyon, extensive sections of private land limits the opportunity to provide extensive trail systems. Additionally, several points of interest (rapids, waterfalls, and springs) are difficult to access because of private ownership of lands surrounding the feature.

Some trail systems are proposed and attempts are currently being made to coordinate with various entities to achieve more trail opportunities. Hiking, equestrian and mountain biking activities are possible on public lands located throughout the planning area. Extensive areas of public land occur on the north side of the river from Bliss to Clover Creek, and in the Twin Falls area. Other trail opportunities provided by the BLM include a proposed trail located near Twin Falls on the south

side of the canyon. Some trail activity occurs on BLM land at the Hansen Bridge Scenic Overlook on both the north and south sides of the rim. The Owsley Bridge ORV SRMA provides motorized and non-motorized opportunities adjacent to the Hagerman Fossil Beds National Monument.

The Oregon Trail traverses the planning area. The trail, extending over 2000 miles from Independence, Missouri to Oregon City, Oregon, defines one of the major emigrant trails used in the settlement of the west. Ruts and other historic sites associated with the emigrants' journey across the Snake River Plain on the trail are found throughout the planning area. Known ruts located on public lands are marked by carsonite markers at 1/4 mile intervals. Approximately 580 miles of the original 1700 miles crossing Idaho remain (Planmakers, 1991). In 1989, an estimated 1500 people visited the marked trail in Idaho (Ross, 1992).

The Oregon Trail is defined by many routes. Segments of the primary route and associated historic sites were designated a National Historic Trail in 1978 (Dolonich, 1992). Many of the historic sites and trail segments located on public lands will be interpreted and promoted for recreational use as part of the 1993 sesquicentennial celebration of the trail. Historic sites associated with the trail and located in the Middle Snake reach are described in the cultural resources section. A backcountry byway is proposed as part of the interpretation of the Oregon Trail. The purpose is to promote the recreational opportunities of the trail and give individuals an opportunity to traverse sections of the original trail and view significant sites (Jenks, 1992).

Additional trail opportunities exist with proposed development in the canyon in the vicinity of Twin Falls. For example, the licensed Auger Falls hydro project proposes a trail system for hiking, equestrian, and biking uses as part of the recreation mitigation for the project. The trail system would consist of a loop located around the perimeter of the project site with side trails, including a trail paralleling the river providing view access to Auger Falls. Future phases of the Twin Falls County Centennial Park also include plans for a trail system. One proposal would link the park with the restaurant located at Canyon Springs Country Club, to the Auger Falls trail system, and eventually to Rock Creek Park. Additionally, a trail system from the park to Pillar Falls is desired (Heider, 1992). Currently, a private road allows access to Pillar Falls.

The Idaho Department of Parks and Recreation also would like to implement a trail system in its Niagara Springs Complex. This trail would connect Niagara Springs, Pugmire Park and Crystal Springs (Lynott, 1992). The Banbury Springs dispersed recreation area owned by Idaho Power Company has some trails which have been established by boy scouts who use the area (Wood, 1992).

Other Recreation Opportunities

RECREATIONAL DREDGE MINING

Although the planning area is closed to one stop permits, recreational dredge mining has occurred in the past through procurement of a Stream Channel Alteration Permit from the Department. Permits have been issued for such activity in the vicinity of Auger Falls and above Star Falls, but have expired. Occasionally interest is expressed to dredge mine in the canyon; however, serious activity has not been pursued (Blau, 1992)

HAGERMAN FOSSIL BEDS NATIONAL MONUMENT

The Hagerman Fossil Beds National Monument encompasses 4500 acres situated on the east side of the Snake River across from Hagerman. The Monument was only recently designated as such by Congress in 1988. This designation is to protect and preserve the paleontological sites, to provide a research center, and display and interpret the specimens discovered at the Monument (Public Law 100-696).

The National Park Service is currently preparing a management plan which is expected to be available for public review in early 1993. This plan will evaluate and recommend development and uses on the Monument. Erosion and slumping problems because of fragile soils will likely limit the degree of developed facilities within the Monument itself. A number of sites across the river from the Monument are currently being evaluated for possible location of a research/visitor center. Potential development on the Monument might include visitor contact stations, trails for guided and self-guided tours, and picnic areas (King, 1992). Plans will also include interpretation of the Oregon Trail which passes through the southern portion of the Monument and is currently marked (Wilhite, 1992). Hunting is and will continue to be allowed within the first fifty (50) feet in elevation from the river. Fishing access will also be provided.

The Monument received approximately 700 visitors in 1991 at its visitor center located in downtown Hagerman and on tours of the quarry site. These numbers reflect limited visitor hours at the temporary visitor center (Wilhite, 1992). A significant increase in visitation occurred in 1992 for a total of 1630 as of the end of September (Wilhite, 1992). Increased visitation may be attributed to tours of the monument which were conducted at least once a month from April through September (King, 1992). Future visitation is expected to continue to increase substantially. Similar sites have received between 20,000 to 30,000 visits annually (Wilhite, 1992).

BUREAU OF LAND MANAGEMENT LANDS

Lands under the jurisdiction of the BLM provide opportunities for dispersed recreation use in the study area. Lands managed by the Boise District - Jarbidge Resource Area, Burley District - Snake River Resource Area, and Shoshone District - Bennett Hills Resource Area are found in the Middle Snake planning area supporting camping, hunting, fishing, ORV travel, boating, and hiking opportunities. The most popular activities reported are ORV travel, fishing and boating.

BLM lands provide one of the few opportunities for camping on public lands, although no developed facilities are available. Additionally, these lands provide important access in areas where no other access is available, for example in Milner and Murtaugh canyons, and the reach from Bliss Bridge downstream.

The BLM has few developed recreation facilities in the study area, although considerable dispersed recreational use occurs. Two special recreation management areas (SRMAs) are located in the planning area. The Snake River Rim SRMA is located on public lands adjacent to the river on the north side for the entire length of the planning area. Recreational activities occurring on the site include off-road vehicle use, mountain biking, hiking, jogging, equestrian, shooting, photography, bird watching, fishing, swimming, and sightseeing (Perletti, 1992; Sharp, 1992; U.S. BLM, 1989). Another is the Owsley Bridge SRMA located adjacent to the south of the Hagerman Fossil Beds National Monument and managed primarily for ORV use.

Another management designation with recreation implications is the Box Canyon and Blueheart Springs area of critical environmental concern (ACEC). This designation was established to protect biologic, visual, geological, and hydrologic values (U.S. BLM, 1985). These values attract recreational use to the area. Sightseeing, wildlife observation, and scuba diving are some of the activities which occur.

Semi-developed facilities are available at whitewater boat put-ins and take-outs at Murtaugh Bridge and Bliss Bridge, and the canyon viewpoint at Hansen Bridge. Potential developed facilities may include a trail on the south rim down to Twin Falls, a picnic/ interpretative area at Hansen Bridge, and expanded facilities at Bliss Bridge take-out (U.S. BLM, 1989; Boggs, 1992; Ridenhour, 1992). Future recreational facilities on the Shoshone District, located on north side of the river, are currently being evaluated as part of the Bennett Hills Resource Management Plan.

Recreation Evaluation

The recreation evaluation focused on recreational opportunities occurring within specific river reaches. The evaluation entailed identification of recreation units; analysis of the recreational

diversity and importance of each unit; and categorization of a final evaluation value (Outstanding, High, or Moderate to Low) based on diversity and uniqueness of the recreational experiences available on the river segment.

The Middle Snake reach was grouped into segments or discrete recreation units delineated on the basis of landform, hydrology, land use patterns, visual character, and recreational use patterns (Table 15). 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 assessment forms filed with the Department of Water Resources.

Table 15. Recreation Units for the Middle Snake Reach

Recreation Unit No.	Segment
1	Milner Dam to Milner Bridge
2	Milner Bridge to Main Milner Powerhouse
3	Main Milner Powerhouse to above Star Falls
4	Above Star Falls to Twin Falls Reservoir backwaters
5	Twin Falls Reservoir backwaters to Shoshone Falls Dam
6	Shoshone Falls Dam to Centennial Park
7	Centennial Park to Rock Creek
8	Rock Creek to Crystal Springs
9	Crystal Springs to north end of Ritter Island
10	North end of Ritter Island to Lower Salmon Falls Dam
11	Lower Salmon Falls Dam to Bliss Bridge
12	Bliss Bridge to Bliss Dam
13	Bliss Dam to Clover Creek

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: (1) identification of land-based and (2) water-based recreation opportunities, (3) natural features and (4) level of access. Land-based activities include camping, hiking, or hunting. Water-based recreation includes fishing, swimming, and boating.

Four criteria were assessed to determine recreational importance: (1) unique or rare features which enhance the recreation experience, (i.e., unusual landforms, hot springs, water falls or rapids), or highly-valued fisheries; (2) public concern for the recreational values of the unit (determined from public and advisory committee input, and agency consultation); (3) use based on recreational survey data; and (4) special designations and/or management objectives.

Land-based and water-based recreation activities occurring within the river corridor were identified through review of agency documents and maps describing recreation facilities; communications with various agencies and user groups; and review of several recreational surveys conducted by the IDPR, IDFG, Idaho Power Company and Myers Engineering Company, for various segments within the reach over the last fifteen years.

Natural features were identified which enhance recreation opportunities or experiences. Evaluation included a description of water characteristics influencing boating activity; a summary of the aesthetic values of the unit; identification of 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 volume, and opportunities for primitive or isolated recreation experiences versus a 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.

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; or b) provides a unique or rare experience within the region or planning area; or c) receives the highest use; 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; or b) potentially providing an important recreation experience which is not rare but lacking in the region. Moderate to Low designations define those river segments with recreational opportunities typical in the region and receiving moderate to low use, and/or having low recreation diversity. Table 16 summarizes the results of the recreation evaluation for the Middle Snake reach. Information for specific recreation units is available from the Department of Water Resources.

Table 16. Recreation Evaluation Criteria and Results for the Middle Snake Reach

EVALUATION CLASS	CRITERIA	RECREATION UNITS
Outstanding	Significant recreational opportunities available as indicated by a great diversity of activities; a unique or rare experience; highest use areas; or agency designation indicating the national or regional significance of recreational opportunities	***Milner Bridge to Main Milner Powerhouse*** - unique expert whitewater boating run (Class V) at high flows ***Star Falls to Twin Falls Reservoir*** - Star Falls one of the last undeveloped waterfalls in the reach, unique expert whitewater boating run comparable to the Grand Canyon (Class IV-IV+) ***Twin Falls Reservoir to Shoshone Falls Dam*** - recreational use of reservoirs and parks is very high ***Crystal Springs to Thousand Springs (north end of Ritter Island)*** - significant diversity combined with unique recreational opportunities ***Thousand Springs to Lower Salmon Falls Dam*** - Hagerman National Monument and high diversity of recreational opportunities ***Lower Salmon Falls Dam to Bliss Bridge*** - unique year round whitewater boating opportunity receiving significant use ***Bliss Dam to Clover Creek*** - unique and highly-valued sturgeon fishing opportunities
High	River segments with a high use volume; and/or a recreation opportunity which is not rare but not typical in the region	***Main Milner Powerhouse to Star Falls*** - potential intermediate whitewater boating run offering easy access in an isolated setting ***Pillar Falls to Centennial Park*** - high use volume
Moderate and Low	River segments with moderate to low use volume; low diversity of opportunities; and/or providing recreational opportunities typical and abundant within the region	***Milner Dam to Milner Bridge*** - low use and diversity ***Shoshone Falls Dam to Pillar Falls*** - low use and recreation diversity ***Centennial Park to Rock Creek*** - moderate recreation diversity ***Rock Creek to Crystal Springs*** - low use and recreational diversity ***Bliss Bridge to Bliss Dam*** - low use and recreational diversity

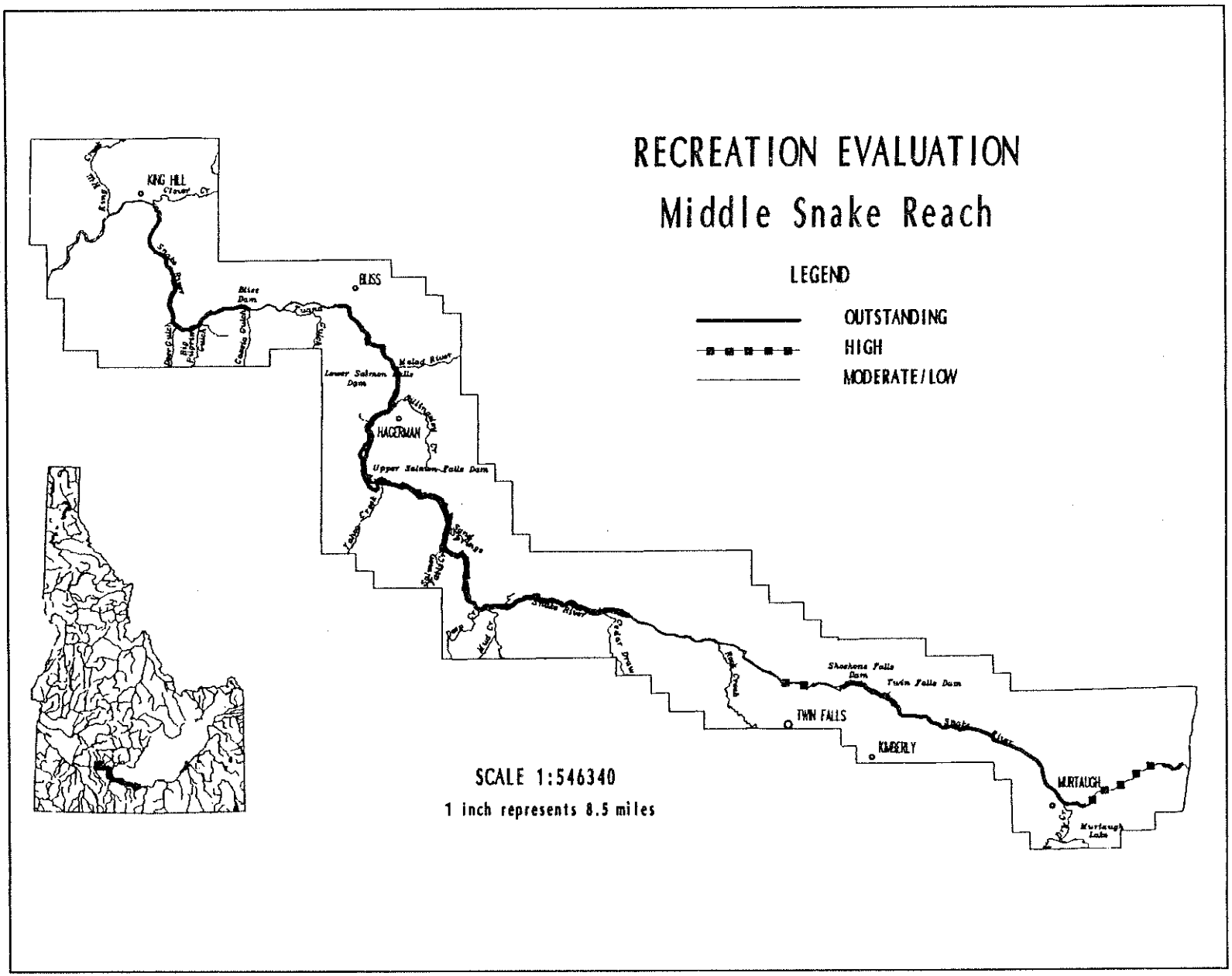

Figure 6. Recreation Evaluation Map.

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