Comprehensive
STATE WATER PLAN

Henrys Fork Basin

Idaho Water Resource Board
1992

COMPREHENSIVE STATE WATER PLAN:
HENRYS FORK BASIN

December 1992

Buffalo Springs on the Buffalo River, Henrys Fork Basin.

COMPREHENSIVE STATE WATER PLAN: HENRYS FORK BASIN

Executive Summary

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

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

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

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

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

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

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

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

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

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

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

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

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

River Reach Designations

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

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

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

3. Henrys Fork: Island Park Dam to Riverside Campground (16 miles) - Recreational
4. Golden Lake, Silver Lake and Thurman Creek from Golden Lake to mouth (4 miles) - Recreational
5. Henrys Fork: Riverside Campground to Hatchery Ford (4 miles) - Natural
6. Henrys Fork: 100 feet upstream of the Hatchery Ford boat ramp to a point 300 feet downstream of the ramp (approximately 400 feet) - Recreational
7. Henrys Fork: Hatchery Ford boat ramp to National Forest Boundary near Warm River (13 miles) - Natural
8. Henrys Fork: Forest Boundary near Warm River to Ashton Reservoir (8 miles) - Recreational
9. Henrys Fork: Ashton Dam to Falls River (6 miles) - Recreational
10. Buffalo River - (8) miles and Elk Creek (1 mile) - Recreational
11. Warm River: Partridge Creek to the Forest Route 153 bridge (approximately 1/4 mile) - Natural
12. Warm River: Forest Route 153 bridge area (approximately 200 feet) - Recreational
13. Warm River: Forest Route 153 bridge to Forest Route 154 bridge (7 miles) - Natural
14. Warm River: Forest Route 154 bridge area (approximately 200 feet) - Recreational
15. Warm River: Forest Route 154 bridge to Warm River Campground (7 miles) - Natural
16. Robinson Creek: from Yellowstone Park boundary to Forest Route 241 bridge (10 miles) - Natural
17. Robinson Creek: Forest Route 241 bridge to mouth (4 miles) - Recreational
18. Rock Creek: from Yellowstone Park boundary to mouth (9 miles) - Recreational
19. Falls River: Idaho border to a point 100 feet upstream of the Yellowstone Diversion Dam (7 miles) - Natural
20. Falls River: from 100 feet upstream of the Yellowstone Diversion Dam to Kirkham Bridge (11 miles) - Recreational
21. Boone Creek: Idaho border to mouth (4 miles) - Natural
22. Conant Creek: Idaho border to National Forest boundary (6 miles) - Natural
23. Conant Creek: National Forest boundary to Conant Creek diversion structure (3 miles) - Recreational
24. Teton River: Trail Creek to Highway 33 (14 miles) - Recreational

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

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

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

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

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

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

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

Recommendations

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

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

Water Budget - Henrys Fork Basin

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

Annual Flows (Adjusted to 1985 Development Levels)

(1000 acre-feet)

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

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INTRODUCTION

Authority

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

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

Idaho Code 42-1734A
1988 Update of 1965 Legislation

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

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

Idaho Code 42-1734H
1988 Update of 1965 Legislation

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

Acknowledgements

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

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

Basin Description

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

Goals

Broad Basin Goals

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

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

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

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

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

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

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

Figure 1: Location of Henrys Fork Basin

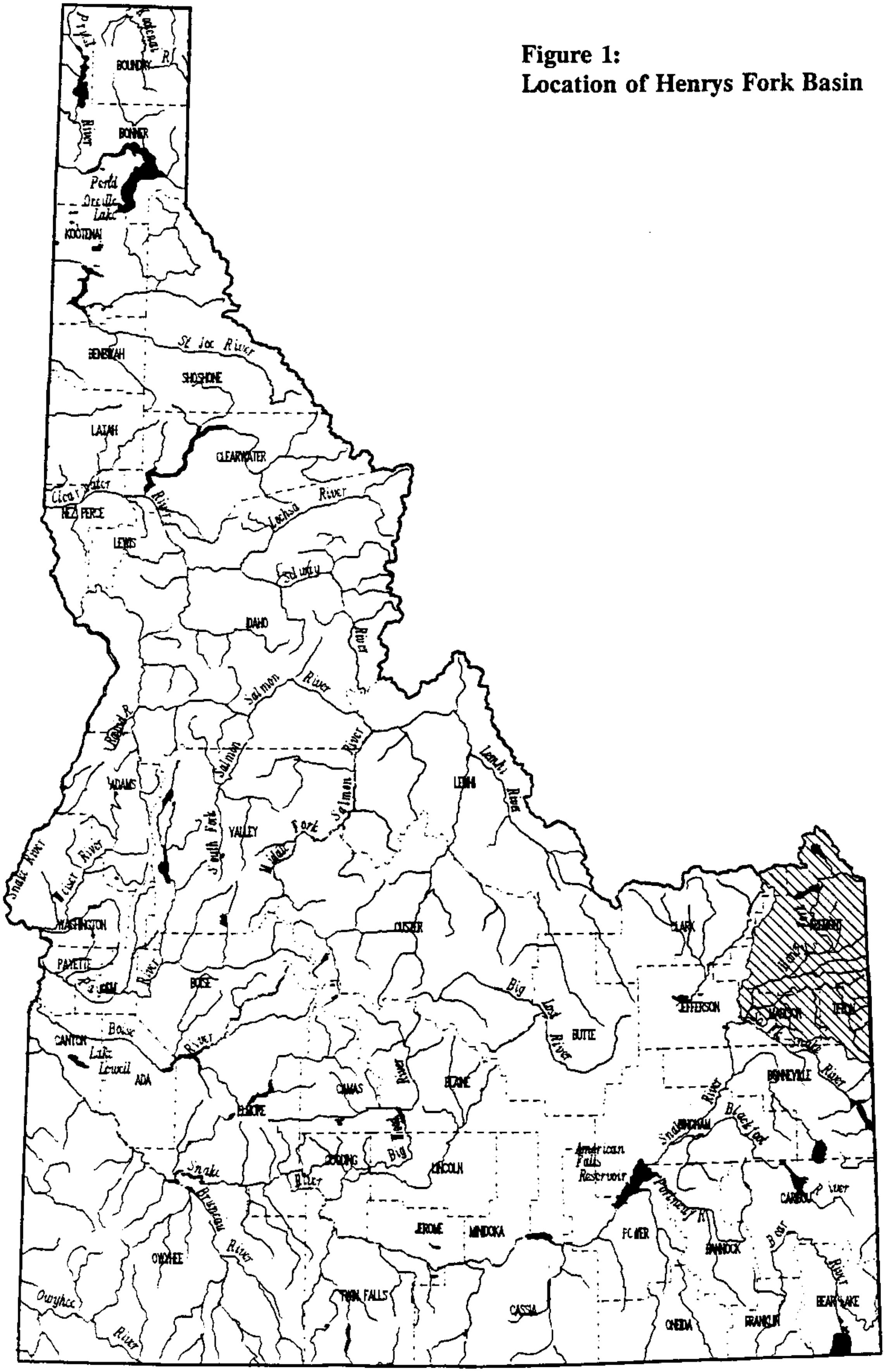
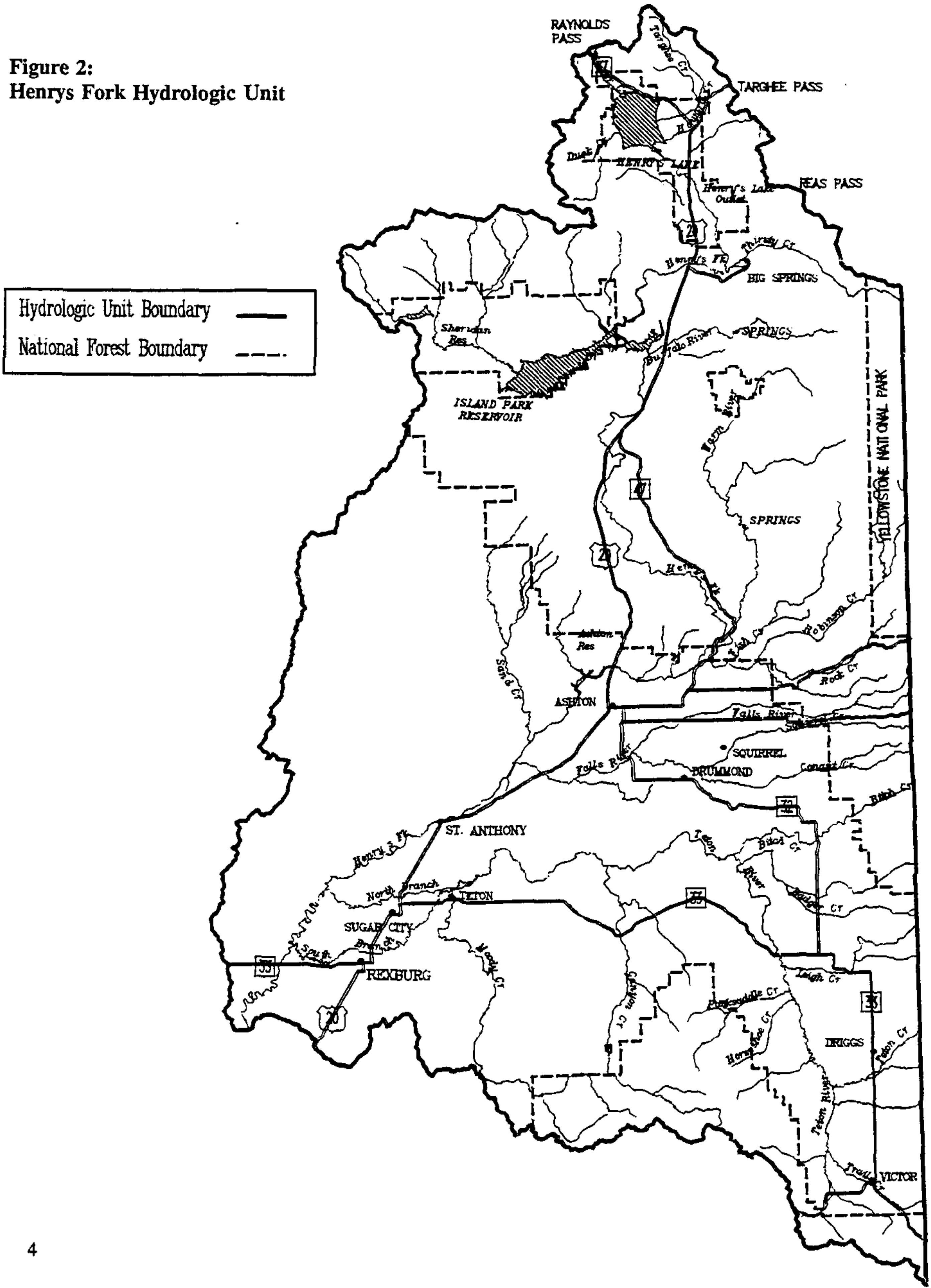


Figure 2:
Henrys Fork Hydrologic Unit



Cultural Features, Human Resources, and Economic Activity Goals

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

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

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

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

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

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

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

Fish and Wildlife Goal

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

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

Wildlife contribute to the food supply, recreation, education, and aesthetic pleasure of human beings. Title 36, Idaho Code declares all wildlife within the state of Idaho to be the property of the State of Idaho, and "It shall be preserved, protected, perpetuated, and managed." Protection of fish and wildlife habitat is noted in both the Idaho Code and the 1986 State Water Plan, and is declared a beneficial use of water.

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

Natural Features and Scenic Values Goal

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

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

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

Aquaculture Goal

1. Ensure proper effluent controls are required for aquaculture.

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

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

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

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

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

Irrigation Goals

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

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

3. Improve safety practices to reduce canal drownings.

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

Livestock Water Goal

1. Meet present and future water needs for livestock.

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

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

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

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

Mining Goal

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

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

There are significant coal deposits in the Big Hole Mountain area of the basin, but the coal beds dip steeply which would make open-pit mining very costly. Underground mining for coal cannot compete with open-pit mines in the West. Oil-shale deposits also are located in the same areas as the coal deposits as are a significant amount of phosphate deposits. Other phosphate deposits are located in the Centennial Mountain area adjacent to Montana. The beds of all these deposits dip steeply making an open-pit mine quite costly in relation to deposits in other areas of the West. Large expenses would need to be made for environmental mitigation measures to mine these sedimentary materials by open-pit methods.

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

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

Navigation

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

Recreation Goal

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

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

Water Safety is a necessary aspect of recreation. As mentioned in the irrigation section, public awareness of water safety issues needs to be continually advocated. Along this line, learn-to-swim campaigns have been mentioned.

There is public interest in paving primary access roads to encourage greater use of recreational resources not located on major highways.

Timber, Grazing and Dry Farming Goals

1. Encourage timber production, grazing, and dry farming at a sustained yield with protective provisions for riparian areas, recreation corridors, fire control, and erosion control.

2. Water yield should be a planning consideration.

3. Encourage the use of best management practices throughout the basin.

Each of these resource industries deals primarily with land-use issues and generally are regulated by other agencies. The water-related issues deal mostly with water quality as influenced by land use and precipitation runoff. Water yield from grazing and forested land is increased significantly when the vegetation shifts more to a grass type.

Energy Conservation Goal

1. Achieve energy conservation through cost-effective retrofits and insulation improvements.

2. Encourage local units of government to adopt stringent construction standards to ensure that new construction will be energy efficient.

Energy conservation can be a cost-effective method of providing new energy resources. Energy conservation is not done in one project by one entity, but by a total of many small projects by many entities. Education therefore becomes an important part of any energy conservation program.

There is an appreciable amount of energy conservation potential in the basin. Energy savings are possible by residential, commercial and irrigation electric users, and by some industrial users. Currently education and regulatory programs are causing some energy conservation activities. More emphasis is needed in both areas.

Geothermal Energy Goal

1. The use of ground-water heat pumps for space heating is encouraged, especially where warm ground water exists.

2. High temperature geothermal uses are encouraged if the resource can be developed without appreciable impact upon other resource uses.

Geothermal water is available in the basin, but, in general, only low-temperature uses are possible. Aquaculture uses are discussed in a separate section. Earlier views of a high-temperature resource in the Island Park area now are questioned. Any drilling for warm water in the agricultural portion of the basin, that is downstream from Warm River, is far enough removed from the Yellowstone National Park area that any connection of systems would be unlikely. Low temperature uses mostly would be for space heating and generally would need to make use of ground-water heat pumps.

Power Development Goals

1. The Board's position is that the acquisition of cost-effective energy conservation and efficiency improvements are the most desirable actions at this time. Within these bounds, it is the goal of the Idaho Water Resource Board to encourage energy conservation and the development of new hydropower at existing dams and diversion structures whenever feasible.

2. In keeping with the State Energy Plan, it is the goal of the Idaho Water Resource Board to allow development of hydropower sites that are economically feasible, compatible with existing water rights, and environmentally acceptable on streams not designated for protection, on rivers that are designated as "Recreational Rivers" where hydropower is not prohibited, and in off-stream areas.

3. Proposals to develop new hydropower sites on protected rivers will be evaluated on a case-by-case basis. Where the need for and benefit to the state outweigh negative consequences associated with the proposed development, the Board will support such development.

There are several potential small hydroelectric sites in the basin. Their location along the basin's main water courses, however, in most cases, conflicts with the instream use of the water during the summer recreation season. Many of these conflicts are in such high value recreational use areas that the conflicts are difficult to mitigate. Even for the sites where mitigation is possible, the amount of power able to be produced is small.

In addition to state water right approval, any new project on the Henrys Fork down to Ashton Reservoir would require not only Federal Energy Regulatory Commission approval along with the agencies they consult but also congressional approval (1986 - Public Law 99-495; 100 Stat. 1243). The Idaho Water Resource Board has a 1,000 cfs summer minimum flow right for the Mesa Falls area which would prevent water being used for hydroelectric production except for the use of Island Park Reservoir or Henrys Lake storage releases for much of the summer period. The 300 cfs winter minimum flow in the Mesa Falls area will not greatly constrain power development, nor will the year-round 300 cfs flow from the mouth of the Buffalo River to the Mesa Falls area.

There are several small sites in the basin that appear economically feasible. The likely method of development would be with a partial stream diversion to a canal paralleling the stream. Then after a few miles, there would be a penstock for the drop to a stream-bank powerhouse. Dams also could develop these hydropower sites, although, the environmental changes would be much greater than with the stream diversion-canal method. In the Basin Resources portion of this plan nearly 30 potential hydropower sites are identified.

Flood Control Goal

1. Lessen annual property value losses and other economic impacts resulting from repeated flooding through economically feasible and environmentally acceptable actions.

Flooding from the lower Teton River between the mouth of the Canyon and the junction with the Henrys Fork is a common occurrence. General area inundation occurs more frequently than every 10 years. The general area flooding is increased by low bridge design of about nine structures over the Teton River of which at least three have beams under water during a 10 year flood. These low bridges in turn accentuate the local flooding and could make the bridge owners liable for the increased water inundation damages.

The Teton River bank full capacity appears to be 2,000 cfs while the 100 year flood is 13,000 cfs. Currently, about 11,000 acres would be flooded in the 100 year flood with a present value and project limit in lieu of purchasing a flood easement of $16,000,000. The Federal Energy Management Agency stipulates that the 100 year flood is the standard to be used in zoning for new development. The Corps of Engineers chooses the size of a flood control project based on the greatest net economic benefits (damages prevented in excess of project costs) consistent with protecting the environment.

A recent federal reanalysis of the feasibility of rebuilding Teton Dam allocated $49,000,000 of the construction cost to flood control while the least cost flooded area purchase option is only near $16,000,000. This is one of several factors which makes Teton infeasible at this time.

There also is a flooding problem on the lower Henrys Fork, below Ashton Reservoir, with special problems from four miles below St. Anthony to the junction with the Snake River. Limited control could come from more dual flood control-irrigation space being provided in the upstream reservoirs and exchanged for straight irrigation storage in main-stem Snake River reservoirs. Study is needed of this area to more fully identify the problem and solutions.

A reconnaissance flood control study would help in identifying alternatives for managing the Teton River and Henrys Fork flooding. There appear to be some flood control actions that could be cost-effective. Any federal project would require at least 25 percent nonfederal cost sharing.

Water Quality Goals

1. The surface water quality in the area shall be kept at a high level consistent with good nutrient levels for high aquatic life production.

2. In areas where aquatic life production can be increased through water-quality improvement, remedial actions are recommended.

3. Ground water shall be maintained at a high level to allow for its use as a drinking water supply.

The water quality in the basin generally appears good. Moderate nutrient loads promote plant growth which in turn supports a highly productive fishery in the upper Henrys Fork, Island Park Reservoir, and Henrys Lake. However, there have been summer periods with excessive algae growth and subsequent oxygen depletion in the Henrys Fork. Treatment of wastes from summer homes in the upper Henrys Fork basin is one solution to the problem of excess algae production. Further study of the need to limit nutrient addition to the upper river, Henrys Lake, and Island Park Reservoir appears to be needed. In certain areas and at certain times, additional nutrients could be beneficial for more instream fish production.

The Bureau of Reclamation is providing assistance to the Idaho Department of Health and Welfare in the development of a water quality management plan for Henrys Lake. The purpose of the lake management plan is to provide alternatives for controlling the input and recycling of nutrients. Completion of the management plan is expected in April, 1993.

In the lower Henrys Fork basin shallow perched water levels create an environment easily contaminated by household waste water. Area-wide sampling has shown some well contamination. Further study appears to be warranted in the lower basin. A potentially similar condition occurs in the upper Teton Valley. A study may show the need to upgrade the wastewater treatment for many rural homes. Ground-water contamination may occur due to the downward migration of agricultural chemicals.

In areas of rhyolitic rock radium-226 levels in the drinking water and soil gas radon-222 levels in buildings may be elevated. These areas are located in portions of the Island Park plateau and in the higher plateau lands east of the Henrys Fork.

The impact of runoff from erodible, cropped agricultural land should continue to be controlled. These lands generally are located on sloping plateau benches. Best management practices for farming of the land has been the recommended control strategy. Education has been the tool to encourage the use of the best management practices. New practices are being established as improved chemicals and improved equipment are being developed. As new best management practices are established, the control of sheet (general broad-area) erosion will be under control in the few areas where added control now would be beneficial.

Water Supply and Water Conservation Goals

1. Encourage a greater efficiency of use of the basin's water supply, including possible ground-water recharge during average flow and high flow years.

During an average year 4,100,000 acre-feet of precipitation occurs in the basin, of which 1,300,000 acre-feet evaporates from the ground and water surface or transpires through vegetation at the place of precipitation (evapotranspiration). An additional 1,400,000 acre-feet moves out of the basin through surface outflow. The remaining water is accounted for as follows:

Surface Water Irrigation Consumption	=	500,000 AF
Ground Water Irrigation Consumption	=	200,000 AF
Ground Water Outflow	=	700,000 AF

The above averages are highly variable. For example, the yearly average of 1,410,000 acre-feet of surface outflow under present conditions has varied from 440,000 acre-feet to 2,370,000 acre-feet. This highly variable outflow generally is stored at American Falls Reservoir for downstream users unless exchanged for use by upstream users.

Low water years provide considerably less water for surface water irrigation. The maximum allowable shortage in the worst year of record under current Bureau of Reclamation planning criteria is a 50 percent shortage. Additionally, no more than an average shortage of 10 percent per year over 10 years should be allowed. For the basin the worst average shortage has been less than the maximum allowable (50 percent). There are, however, a few canals that have greater than the maximum shortage. Several remedial measures could help lessen the low-flow year impact.

In general, there are five sources which might provide water for additional use: (1) the water bank, (2) water conservation, (3) pumping ground water, (4) weather modification, and (5) off-stream surface water storage.

First, in many areas of the basin, especially in the lower Henrys Fork basin, more water could be made available through increased use of the rental pool. In the upper basin stream flows may not be sufficient to provide exchangeable water. (Exchanges now require the approval of the water right holder.)

Water conservation on presently irrigated lands and in related distribution systems is a second source of water. Sandy soils located over much of the lower Henrys Fork basin, coupled with gravity irrigation methods command high water use. Similarly, distribution systems through these areas lose considerable amounts of water. The most cost-effective method of conserving water would be to change field application systems from gravity to sprinkler. This conversion is currently happening in the Henrys Fork basin. If large areas are changed to sprinkler irrigation, large amounts of water can be conserved. Perhaps the most economical method to conserve water in distribution systems in the lower valley area where ground water is available at depths of under 100 feet, is to change the entire system to ground water pumps.

During average and good water years there are advantages to inefficient water use in the Henrys Fork basin. Water applied in the Henrys Fork basin recharges the Snake Plain aquifer and is used primarily outside the basin. An ideal system would promote surface water use and gravity irrigation methods in high and average flow years, and ground water use and sprinkler irrigation methods in low flow years. Water conservation which results in reduced irrigation diversions could have third party impacts and these must be investigated as part of water conservation activities.

A third source of water would be ground water. In many areas where new lands for irrigation are located, ground water may be available only in limited quantities. Complete ground water studies are needed in the area east of St. Anthony and north of the Teton River and north of Bitch Creek as well as in the Canyon Creek area. In the lower Henrys Fork valley large amounts of ground water are available at low lifts for supplemental water use in that area and for exchange purposes if water right requirements can be met.

A fourth source of water is weather modification based on cloud seeding. The success is generally an increase of 10 to 15 percent in precipitation, yet the increase in runoff may be a little greater. This may be a very low cost method of providing additional water. For less than a region-wide water using group, new legislation may be needed to allow the implementing group to acquire use of the increased water. Special conditions will be needed to provide that the other water users are protected.

The fifth source of additional water is new surface water storage. Several off-stream sites have been identified in the plan. The sites generally would allow the water to be used on higher ground than the proposed on-stream storage at the Teton site. Any surface water site will have a late storage priority, thus development might need to include the purchase or rental of water in a main-stem Snake River reservoir. These are off-stream sites in the sense that most of the water would be moved from the Falls River or the Teton River. Conflicting development would best be encouraged to move to other areas. (As noted earlier, a recent reanalysis of the feasibility of rebuilding Teton Dam has shown a federal project there not to be feasible. Future water needs may show a different result, even through the yield of water from the reservoir must be augmented during low flow years.)

A limited review of a privately developed Teton project may be helpful not only at this time but also in the future. Over time the need for electric energy increases. Thus, significant hydroelectric benefits from a Teton project when coupled with water storage and flood control benefits may make the project feasible in the future.

Planning Methodology

In 1988 the Idaho Legislature amended state water planning requirements and provided for the development of a comprehensive State Water Plan (Chapter 17, Title 42, Idaho Code). The State Water Plan may be generated in stages by developing comprehensive plans for each river basin, drainage area, river reach, ground-water aquifer, or other geographic area. The resources to be described in each plan are:

- Water Supply
- Timber
- Flood Control
- Mining
- Irrigation
- Livestock Watering
- Power Development
- Scenic Values
- Energy Conservation
- Natural or Cultural Features
- Fish and Wildlife
- Domestic, Commercial, Municipal, and Industrial Uses
- Recreational Opportunities
- Navigation
- Other Aspects of Environmental Quality and Economic Development

Each item is addressed in the following pages as they relate to the Henrys Fork basin.

The 1988 legislation directed the Idaho Water Resource Board to designate seven river reaches in the state as Interim Protected Rivers. One of these reaches was the Henrys Fork from its point of origin at Henry's Lake to the point of its confluence with the backwaters of Ashton Reservoir. This designation served to prohibit many types of activity within the river for a period of two years. The Water Board was charged with using the two years to develop a detailed plan for the area. Since interim protection for the Henrys Fork lasted only until July 1, 1990, the Department of Water Resources petitioned the legislature for an extension of the planning process. The Idaho Legislature extended the interim protection period through December, 1991.

On January 3, 1992 the Idaho Water Resource Board adopted a plan for the Henrys Fork Basin. A bill approving the Board's plan passed the Idaho Senate, but was defeated in the House of Representatives. In order to provide some state protection to waterways in the basin, the Idaho Legislature directed the Water Resource Board to place most of the Henrys Fork and portions of the Warm, Teton, and Falls Rivers as well as the Idaho portion of Bitch Creek in interim protection. This interim period could not extend for more than 10 days after the conclusion of the 1994 legislative session. On April 17, 1992 the Board placed the designated streams in interim protection until 10 days after the 1993 legislative session or until a new comprehensive state water plan for the Henrys Fork Basin was adopted by the Water Resource Board.

The Water Resource Board proposed changes to the plan they had adopted in January and circulated this new version for public review. Information meetings to inform the public about the proposed changes were held in Driggs, Ashton, and Rexburg on September 14, 15, and 16, 1992 respectively. Formal hearings were held in Idaho Falls on October 21 and St. Anthony on October 22, 1992. After reviewing the public comment, the Water Resource Board made further revisions to the plan and adopted this version on December 3, 1992.

The planning statute provides for the designation of protected rivers in the Comprehensive State Water Plan, based on a determination by the Idaho Water Resource Board (IWRB) that the value of preserving a waterway for particular uses outweighs that of developing the waterway for other beneficial uses. The protected designations are either as a Natural or Recreational River. A Natural River is defined as a waterway which possesses outstanding fish and wildlife, recreation, geologic or aesthetic values, which is free of substantial existing man-made impoundments, dams or other structures, and of which the riparian areas are largely undeveloped, although accessible in places by trails and roads. A Recreational River must also possess outstanding fish and wildlife, recreation, geologic or aesthetic values, but the segment might include some man-made developments within the waterway or within the riparian area of the waterway. In Idaho's protected river designations the riparian area is defined by the legislation as the area within 100 feet of the mean highwater mark of a waterway. Man-made developments or the lack thereof in the riparian area is a factor to be considered in determining the eligibility of a stream for protected status. However, when streams are designated for protection, the associated prohibitions apply only to the streambed.

Eligibility for state protected river designation in the Henrys Fork basin was based solely on the relative significance of the reach as a public resource, for example, to be eligible for protection a reach must contain at least one "outstanding" fish and wildlife, recreational, aesthetic or geologic value. An initial attempt to assess these values in the Henrys Fork basin has been documented by the Pacific Northwest Rivers Study (1985). That study was a cooperative effort of the three northwest states, Montana, the Indian tribes, the federal natural resource agencies and northwest power agencies. A matrix of stream segment assets was assembled based on that study, and updated as noted on the matrix (see Resource Evaluation section of report).

The matrix was used to help identify stream segments with "outstanding" natural and recreational resource values. In order to highlight outstanding stream segments in the Henrys Fork basin, screening criteria were applied to the matrix values. Stream segments in the Henrys Fork basin that met criteria for outstanding fish and wildlife, recreational, aesthetic, and geologic resource values are described in the Resource Evaluation Section. After eligibility was determined, an assessment of the effects of designation on other identified resource uses was undertaken.

By statute, in designating a Natural River, the Board shall prohibit the following activities within the streambed:

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

In designating a Recreational River, the Board shall determine which of the activities listed above shall be prohibited or may specify terms and conditions under which the listed activities may go forward.

To supply further direction for the river basin planning effort, the Idaho Water Resource Board established Planning Rules and Regulations. A provision of the Rules and Regulations states, "The Board shall seek the involvement of volunteers from the geographic area to be affected by a portion of the comprehensive water plan. These volunteers shall constitute a local advisory group that shall inform the Board of local concerns throughout the planning process."

On January 31, 1989, a public meeting held in St. Anthony, Idaho, announced the beginning of the river planning effort for the Henrys Fork basin. The need for persons to serve on the citizens advisory group was announced. Selected local citizens for the Henrys Fork Advisory Group were:

Paul Bowen, Rexburg - Member of Upper Snake River Fly Fishers
Ed Clark, Ashton - board member Fremont-Madison Irrigation District
Jan Jensen, Island Park - resort operator
Arnold Kunz, Victor - Teton County Commissioner, 1989-1991
Mike Lawson, St. Anthony - Henrys Fork Foundation
Robert Lee, Rexburg - president, Hydro-Idaho, Inc. and Golden West Irrigation Co.
Del Raybould, Rexburg - irrigation interest member
James Siddoway, Teton - Fremont County Commissioner
Ronald Stoddard, St. Anthony - Stoddard Lumber Company
Bruce Webster, Rexburg - Madison County Commissioner - 1989-1991
Cal Wickham, Ashton - past manager of Fall River Rural Electric Coop
Keith Kunz, Victor - Teton County Commissioner, 1991-present
Reed Sommer - Madison County Commissioner, 1991-present

The Henrys Fork Advisory Group provided guidance and insight into resource values, use, and potential, basin goals, and plan recommendations. Members were selected who represented conflicting user viewpoints. While balance is sought, consensus is not necessary since the group is advisory in nature and attempts to insure that all potential uses and conflicts are considered during the planning process. Advisory Group meetings were held in St. Anthony at the Fremont County Courthouse. Meeting dates were:

#1 - April 5, 1989
#2 - October 25, 1989
#3 - June 14, 1990
#4 - November 20, 1990
#5 - February 13, 1991
#6 - February 26, 1991
#7 - April 17, 1991

Prior to the formal hearing process, the Board held information meetings in Ashton, Rexburg, and Idaho Falls. Hearings were held in Ashton, Rexburg, Idaho Falls, Driggs, and St. Anthony. Board member J.D. Williams acted as hearing officer. Written comments were accepted as part of the hearing record for 92 days after the original notice of proposed action appeared. Oral testimony was provided by 114 persons. The Board received 249 written comments relating to the Henrys Fork Plan. The Board weighed competing uses for the water resources of the basin. The Board endeavors to balance uses so that public interest concerns are met while providing for the overall benefit of the state.

Amendments to the Plan

The Water Resource Board will amend the water plan when it determines that amendments are in the public interest. The Board will consider proposals to amend the plan from private parties as well as state agencies. In the event the Board determines that any such proposal has a substantial possibility of not impairing the values which were the basis of the protected river designation the Board shall follow the public hearing process and procedures required for the adoption of the original plan (Sections 42-1734A and B, Idaho Code). The Board shall determine whether or not to amend the plan after weighing the impact the uses allowed by the proposed amendment would have on the other uses and values which were the basis of the original protected river designation. In addition, the Board shall review and reevaluate the Comprehensive State Water Plan at least every five years (Section 42-1734(B)(7)). All amendments to the state water plan shall be submitted for consideration of the Idaho Legislature as required by law (Section 42-1734B).

BASIN DESCRIPTION

General

The Henrys Fork basin is located in the northeast corner of Idaho. The basin includes the major portions of the counties of Fremont, Madison and Teton with their county seats of St. Anthony, Rexburg and Driggs. The main river systems are the Henrys Fork which originates in small streams which empty into Henrys Lake (the main stem of the Henrys Fork is usually described as originating at Big Springs), Falls River which originates in the southwest corner of Yellowstone National Park and the Teton River which partially originates on the west edge of Grand Teton National Park.

The major part of the upper Henrys Fork basin consists of a high mountain plateau with lodgepole pine and large open meadows. The upper portion of the Teton River basin largely consists of a wide high-mountain valley. The middle portion of the Henrys Fork basin consists largely of undulating plateau lands. The lower basin consists of the relatively flat upper end of the Snake River Plain.

The Henrys Fork of the Snake River drains 1,750,000 acres. From Henrys Lake, set in a pocket of the continental divide at 6,500 feet, the stream drains to the south-southwest and flows for 117 miles before entering the Snake River. Basin elevations vary from about 4,800 feet in the southern part of the Snake River to over 10,000 feet at the mountain peaks to the north.

The basin has one of Idaho's colder climates. Freeze-free periods at the Ashton and Island Park climatological stations are 90 and 45 days. Annual precipitation, much of which falls as snow, averages 16.9 and 28.9 inches at Ashton and Island Park Dam. Annual precipitation varies from 10 inches in the lowlands to 60 inches in the mountains.

The upper Henrys Fork basin is at the eastern end of the Snake River Plain, a downwarped feature arcing across southern Idaho into Wyoming. As the plain was downwarped, volcanism and sedimentation filled it with basalt, rhyolites, and sedimentary deposits. A large shield volcano formed in the south-central part of the Henrys Fork basin and later collapsed to form the Island Park caldera, an elliptical bowl approximately 18 by 23 miles. Basalt flows later impinged on the caldera's rim from the south while rhyolitic flows reached the rim from the Yellowstone plateau and filled the bowl along with other sediment. The upland agricultural soils are almost all silt loams derived from wind-blown sediment. Valley soils are generally alluvial in origin.

Land use is timber production and grazing in the uplands with both irrigated and dryland farming in the lower plains. In 1975 forested land comprised 9 percent of the basin area, rangeland 26 percent, irrigated cropland 15 percent, dryland agriculture 13 percent and other uses 7 percent. Irrigated cropland in the Henrys Fork basin amounts to about 321,000 acres planted primarily to grain, potatoes and hay. The bulk of the irrigated lands lie on both sides of the lower Henrys Fork and lower Teton River between the Snake River and Ashton. Land use is shown on Figure 3.

The basin is sparsely populated with a total of 38,000. The principal cities of Rexburg, St. Anthony, Ashton, Driggs and Sugar City had 1990 populations of 13,000 in Rexburg and 8,000 in the remaining towns. Urbanization onto agricultural lands is not considered a problem in the basin. Summer tourist influxes are heavy and contribute substantially to sewage loading of surface streams. Land ownership is shown below in Table 1 and delineated on Figure 4.

Table 1. Land Ownership		
Ownership	**Acres**	**% Basin**
Private	763,485	46%
Forest Service	643,259	39%
BLM	120,311	7%
National Park Service	36,722	2%
State	86,620	5%
Water	18,738	1%

Henrys Lake is a very shallow natural lake which has been raised by the construction of a low dam at the outlet allowing approximately 12 feet of water storage capacity. With the high elevation, Henrys Lake is a relatively cold lake. Ice cover persists from mid-November to late April in most years. Some stagnation occurs beneath the ice, but dissolved oxygen usually does not fall below 3 to 4 mg/l. Thermal stratification is slight since the shallow lake undergoes nearly continuous mixing throughout the summer. Organic loading and algae production are high, so even with no thermal stratification, oxygen depletion will occur in deeper waters (14-20 feet) during the warm summer-fall period. Algal blooms in Henrys Lake are very heavy. The colonial blue-green algae, *Gleotrichia* and *Aphanizomenon*, bloom every year through the summer. Near-surface concentrations of algae masses are swept downstream into the Henrys Fork River, thereby carrying high oxygen demand into that stream and significantly reducing its transparency above Island Park Reservoir.

Island Park Reservoir is also shallow, less than 50 feet in most places, and similar to Henrys Lake in mixing characteristics. Dissolved oxygen and temperature profiles show little stratification, indicating well mixed waters. Island Park Reservoir has a number of significant impacts on the Henrys Fork River. One study showed that median August temperature increased 7°F over the inflow (from 59° to 66°F); median August dissolved oxygen declined from over 9 to 7.5 mg/l; BOD doubled with passage through the reservoir (from algal production in the pool); August total phosphorus increased from 0.02 to 0.05 mg/l; Kjeldahl nitrogen increased from 0.23 to 0.37 mg/l; and ammonia increased from 0.01 to 0.08 mg/l.

Major tributaries in this reach, Buffalo River and Warm River, obtain most of their flow from groups of springs either at their heads or along their channels. These springs occur along the base of the steep-fronted bluffs of Yellowstone plateau rhyolite. The combined flow of these springs is about 600 cubic feet per second (cfs), or about 42 percent of the average discharge of the Henrys Fork near Ashton. These springs are large, two of them discharging more than 200 cfs.

After leaving Island Park Reservoir, the Henrys Fork cuts across the Island Park caldera before dropping off the plateau at Mesa Falls then flows to the south toward Ashton. Average stream gradient in this reach is a precipitous 26 feet per mile. Below Ashton the river levels out as it flows across the agricultural regions at an average gradient of 8 feet per mile.

The mean annual flow of the Henrys fork near the mouth is 1,407,000 acre-feet or 2,100 cfs with approximately one-third of that contributed by the Falls River and one-third by the Teton River. The flow range is extreme between wet and dry years; it varies from 600,000 acre-feet to 3,000,000 acre-feet. An additional estimated 1,000,000 acre-feet is recharged into the Snake Plain Aquifer and flows to the west.

Figure 3:
Land Use in the Henrys Fork Basin

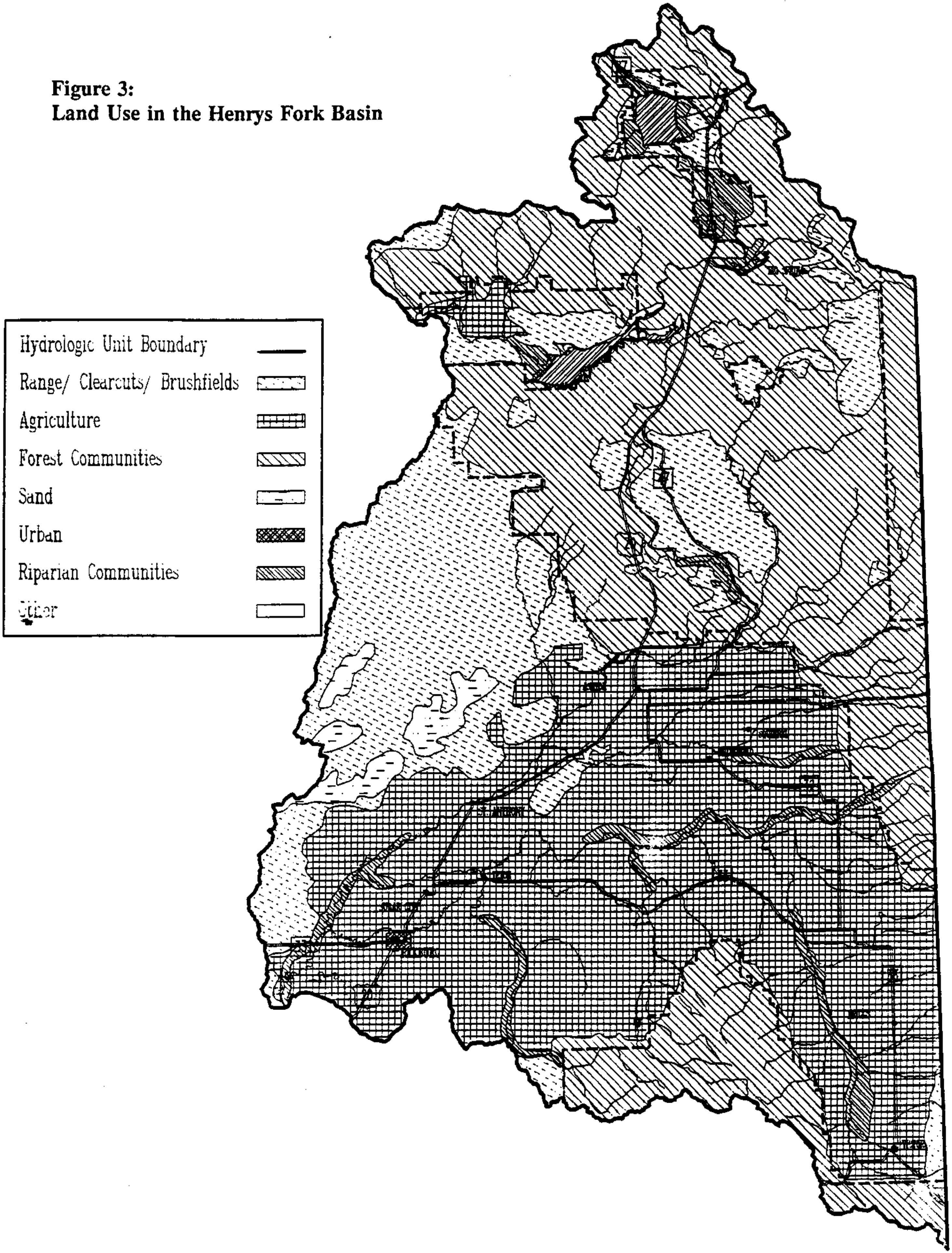
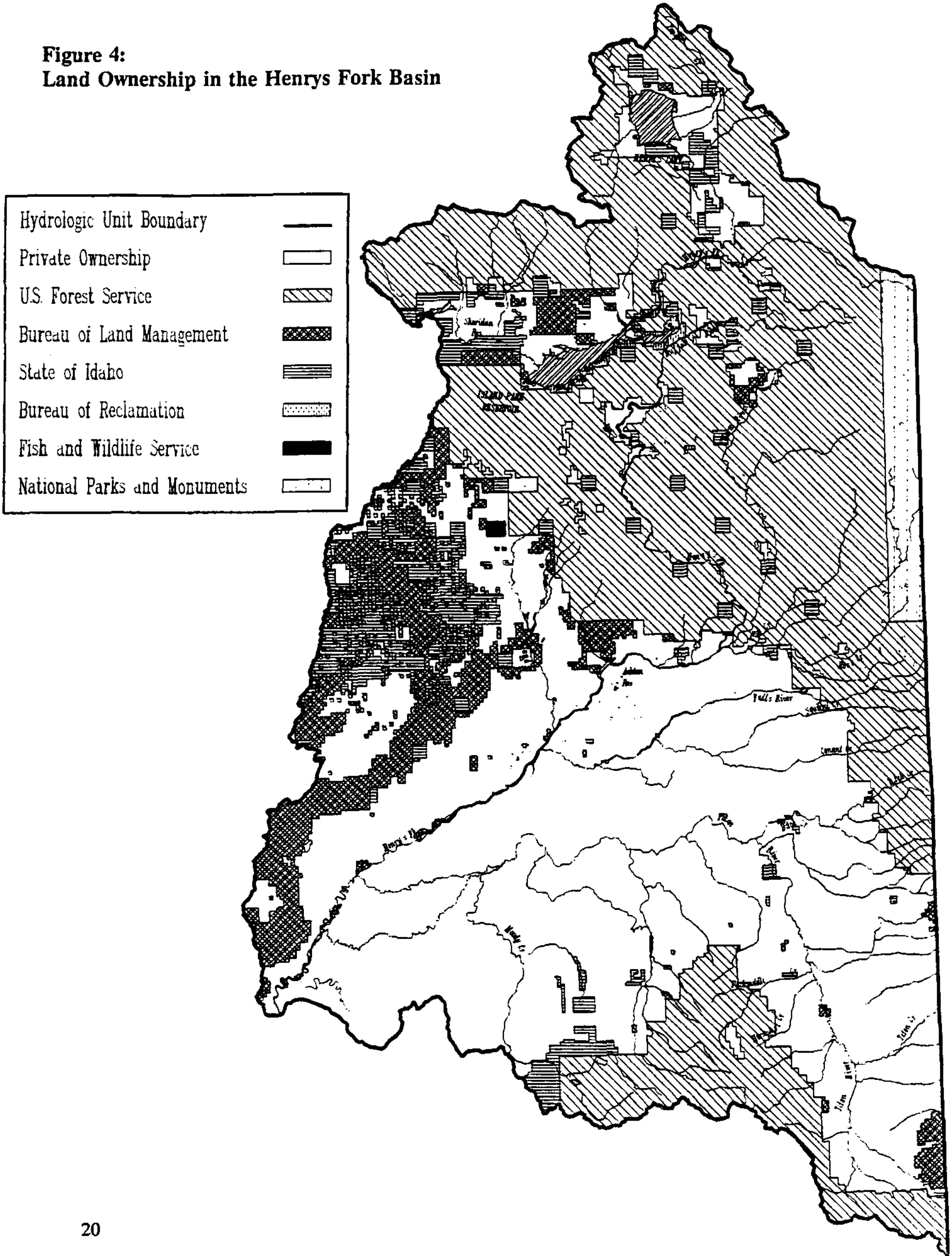


Figure 4:
Land Ownership in the Henrys Fork Basin



Source

Bennett, David, H., C. Michael Falter and Robert G. White. *Columbia Basin Water Withdrawal Environmental Review, Appendix D Fish Part II Snake River,* U.S. Army Corps of Engineers, Portland, District. 1980.

Early History

Evidence of early human presence in the lower Henrys Fork Valley coincides with findings in other parts of southern Idaho. Radiocarbon dating of artifacts from the Wilson Butte Cave in the Shoshone-Dietrich area shows the earliest known activity to be 14,500 before present (B.P. = 1950). The Jaguar Cave in the Blue Dome area of Birch Creek had artifacts dating back to 11,600 B.P.

After the introduction of the horse (about the year 1700), Shoshone and Bannock Indians traveled through the Henrys Fork area on elk hunts into Yellowstone Park via Targhee Pass. They established camps in the basin in the Island Park area and in the Teton Valley. Other tribes visited the area. The Blackfeet of Montana sent raiding parties into the area. The Crow, Flathead, and Nez Perce made summer visits to the area using Targhee, Reas, and Raynold Passes.

In 1808, John Colter, after leaving the 1805-06 Lewis and Clark expedition, was the first white to enter the region. His entrance was via the Teton Basin later referred to as Pierre's Hole. (Pierre Tevanitagon, an Iroquois Indian who traveled through the area about 1819, was an employee of Donald McKenzie of the British North West Company headquartered near present day Lewiston, Idaho.) John Colter was employed by Manual Liza, founder of the Missouri Fur Company, a rival of the British Hudson Bay Company and the North West Company.

In 1810, Andrew Henry, also of the Missouri Fur Company, built Fort Henry (a cabin about 10 x 10 feet) near St. Anthony. The company established the rendezvous system (1825-1840) which gave the Americans advantages over the British, although the British were active in southeast Idaho under Peter Skene Ogden and Donald McKenzie. An area-wide rendezvous site, used both in 1829 and in 1832, was Pierre's Hole or the Upper Teton Valley. Fort Henry was abandoned in 1856 because of Indian hostilities, largely from the Crow of Montana. A notable trapper, Richard "Beaver Dick" Leigh and Jenny, his Shoshone wife, settled and trapped in the area starting in the 1840's until 1876 when Jenny and all their children died of smallpox.

In 1868, Gilman Sawtell set up base near Sawtell Peak. A few other individuals subsequently settled in the area. The Bannock Chief, Targhee, whose name is used throughout the area, was killed by the Crow in the winter of 1871-1872 after signing the Fort Bridger Treaty of 1868. In 1877, the upper Henrys Fork was crossed by Chief Joseph and the Nez Perce as they were eluding the troops of General Howard.

Although Brigham Young visited the valley in 1852 following the 1847 westward migration, the possibilities of early frost delayed Latter-Day Saints (LDS) settlement until 1879. LDS settlers in the lower Teton River area near Rexburg built a diversion for the McCormick-Rowe Canal from the South Branch of the Teton River and another for the Teton Island Feeder Canal from the North Branch of the Teton River. In the upper Snake River area, two irrigation diversions predate these canals. The first was in 1874 from Willow Creek, above Ririe Reservoir but below Tex Creek, and a second diversion in 1876 from lower Willow Creek, south of the settlement of Ririe. In the Teton Valley the first permanent settlement is reported to have been in 1882 by non-LDS. In the Falls River vicinity, the LDS settled at Chester in 1885.

Yellowstone Park was created in 1872, predating the adjacent agricultural settlements. The Targhee National Forest was created in 1903 out of portions of the Forest Reserves set aside in 1891. Grand Teton National Park was created in 1929.

Demographics

A general decrease in rural population, prevalent across the United States since the turn of the century, is reflected in population figures for the three Henrys Fork Basin counties between 1920 and 1960. Beginning in the 1960s, but specifically through the 1970s, the U.S. observed an increase in rural population (Table 2 and 3). The shift is attributed to a strong agricultural economy, industrial development in rural areas, and a desire for rural settings and small towns. Population increase in the three basin counties since 1970 reflects this change and general growth in the western U.S., particularly the Pacific and Mountain states. In the 1980s population growth focused again on urban areas, but rural "amenity rich" counties, defined as providing recreation opportunity, scenic beauty, services, and/or cultural amenities, continued to experience growth.

Most of the population growth in the basin has been in Rexburg and may be associated with growth at Ricks College. Likewise, the secondary home market and the tourism sector in upper Fremont and Teton counties has supported the growth of Rexburg as a trade center. Recent growth in Teton County is primarily from retirees who are moving permanently into their "recreation" homesites. In Teton County most of the new residents are from out-of-state. In Fremont County, where growth slowed significantly in the 1980s, retirees from Eastern Idaho, primarily Idaho Falls and Pocatello, are the predominant newcomers. The INEL workforce is also moving into the basin (Hefferon, 1991; see also Table 4 for town population figures).

Table 2. Population Levels

	1920	1930	1940	1950	1960	1970	1980	1990	2000[a]	2010[a]
United States	106,000,000	123,000,000	132,000,000	151,000,000	179,000,000	203,000,000	227,000,000	248,000,000	268,000,000	282,000,000
Idaho	432,000	445,000	525,000	589,000	667,000	713,000	944,000	1,006,000	1,047,000	1,079,000
									*1,107,000	*1,198,000
Fremont	10,380	8,320	9,190	9,160	8,680	8,710	10,810	10,937	11,400	12,500
Madison	9,170	9,920	10,300	9,350	9,420	13,450	19,580	23,674	27,400	31,100
Teton	3,920	3,570	3,600	3,200	2,640	2,350	2,890	3,439	4,000	4,700
TOTAL BASIN	23,470	21,810	23,090	21,710	20,740	23,510	33,280	38,050	42,800	48,300

[a] Bonneville Power Administration county projections published in January, 1990.

[b] The number of second-home sites in Fremont County (1,500) with 2.75 people per house suggests an additional 4,000 summer residents plus another estimated 4,000 short-term visitors for a total summer increase of 8,000 people, mostly in the Island Park area. The total summer increase for Teton County is estimated to be nearly 1,000.

* Idaho projections by Northwest Power Planning Council in the 1989 Supplemental to 1986 Northwest Conservation and Electric Power Plan, Volume Two, medium-low scenario.

Sources: County figures are from the Idaho Almanac from Idaho Division of Tourism and Industrial Development, 1977, p. 315-316; United States and Idaho projections are from the U.S. Department of Commerce Bureau of Census, Current Population Reports, Population Estimates and Projections of the Population of the States by Age, Sex and Race 1988 to 2010, Table 5; county figures for 1990 are from preliminary 1990 census data; county projections use the 1980 to 1990 rate of change.

Table 3. Population Rate of Change in Percent

	1920-30	1930-40	1940-50	1950-60	1960-70	1970-80	1980-90	1990-2000	2000-2010
United States	16	7	14	19	13	12	9	8	5
Idaho	3	18	12	13	7	32	7	4	3
								10	8
Fremont	-4	4	-9	-7	0	24	1	5	10
Madison	-9	10	0	3	43	46	21	16	14
Teton	-9	1	-11	-18	-11	23	18	21	15
TOTAL BASIN	-7	6	-9	-4	18	36	14	13	13

Table 4. Growth of Henrys Fork Basin Towns

	1960	1970	1980	1990
Fremont	8,680	8,710	10,813	10,937
Ashton	1,242	1,187	1,219	1,114
Drummond	31	13	25	37
Island Park	53	136	154	159
Newdale	272	267	329	377
Parker	284	266	262	288
St. Anthony	2,700	2,877	3,212	3,010
Teton	399	390	559	570
Warm River	20	19	2	9
Madison	9,420	13,450	19,480	23,674
Rexburg	4,767	8,272	11,559	14,302
Sugar City	584	617	1,022	1,275
Teton	2,640	2,350	2,897	3,439
Driggs	824	727	727	846
Tetonia	194	176	191	132
Victor	240	241	323	292

Source: U.S. Department of Commerce, Bureau of Census.

Birth rates shown in Table 5 are one element in the population growth pattern. In-migration or out-migration as a result of economic conditions are the major influences affecting population. Birth rates in the basin have usually been higher than the average for the State of Idaho. Idaho birth rates have historically been higher than the average for the United States. While national birth rates have been constant, Idaho as well as basin birth rates have fallen considerably; so, at least Idaho birth rates now approximate national birth rates. The decline, however, has been slower in Madison County (see Table 5).

The 1988 death rates for the basin counties range from 3.8 to 7.5 per thousand or less than half of the birth rates. The difference between birth rates of 20 and death rates averaging 5 per thousand indicates a natural increase in population. The net increase of 15 per 1,000 per year gives a 10 year net increase of 16 percent. In the Henrys Fork basin the natural increase of 16 percent is more than the population growth of 14 percent, therefore, some out migration is occurring.

The educational level of basin residents generally is above the average in the United States and in Idaho (see Table 6).

Table 5. Birth Rates Per 1,000 Population and 1988 Death Rates Per 1,000 Population

	1983	1984	1985	1986	1987	1988	Deaths 1988
United States	15.5	15.7	15.7	15.5	15.7	15.9	8.8
Idaho	19.0	18.0	17.5	16.4	16.0	15.7	7.6
Fremont	21	22	19	18	15	17	7.5
Madison	25	22	23	22	19	22	3.8
Teton	24	19	24	22	19	15	6.9
Basin Average	24	22	22	21	18	20	5.1

Source: Idaho Department of Health and Welfare, Annual Summary of Vital Statistics.

Table 6. Educational Attainment Residents 25 Years and Older

	Percent High School Graduates	Percent with Four Years or More of College
United States	66.5	16.2
Idaho	73.7	15.8
New Hampshire	72.3	18.2
Colorado (highest in nation)	78.6	23.0
Fremont	71.5	12.0
Madison	81.3	18.7
Teton	78.5	17.0
Ada	81.7	22.1

Sources: U.S. Department of Commerce, Bureau of Census, 1980 Census of Population, Volume 1, Characteristics of the Population, Chapter C, General Social and Economic Characteristics, Part 14, Idaho, tables 66 and 175; also Part 1, U.S. Summary, Table 102.

Employment and Income Trends

Average annual employment in the three basin counties shows an upward trend over the twenty year period 1970-1990. The increase in employment numbers is greatest in Madison County, followed by Fremont and Teton respectively. Despite the upward trend overall, Fremont County experienced a large drop in employment in 1978 and showed little growth in the 1980s. Madison County had a large drop in employment in 1980, but employment numbers grew again through the decade.

The 1990 average annual employment figure for Fremont County is an increase of 30 percent over 1970 (see Table 7). According to the Idaho Department of Employment, there were 3284 people employed in Fremont County in 1970 compared to 4284 in 1990. Farm employment fell 23 percent and non-farm employment grew by 34 percent. Total employment increased 71% in Madison County and 94% in Teton County between 1970 and 1990. In Madison County farm employment fell 31 percent and non-farm employment grew over 150 percent between 1970 and 1989. In Teton County farm employment remained relatively steady and non-farm employment increased 97 percent (Idaho Department of Employment, Labor Statistics, 1970-1990; Bureau of Economic Analysis, U.S. Department of Commerce).

The unemployment rate in Fremont County usually exceeds both the national and state average. Since 1984, the Teton County unemployment rate has often exceeded both the national and state average while the Madison County rate generally has been below the Idaho average rate (see Table 8). Since 1985, the reduction in the unemployment rate throughout Idaho and the nation has not, on average, taken place in Fremont County. An indicator of an economically depressed area is an unemployment rate of 1.5 times the national rate. During the 1980s Fremont County's unemployment rate has generally been 1.5 times the U.S. unemployment rate.

Table 7. Average Annual Employment

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Fremont	3284	3242	3545	3923	3925	4065	3748	3962	3171	4523	4561	4574	4418	4520	4533	4563	4389	4489	4419	4443	4284
Madison	4693	5529	5493	4729	6244	7080	7055	7788	8261	8331	6733	6648	6965	7199	7409	7383	7501	7596	7897	8171	8034
Teton	80	822	880	897	973	970	1059	1107	1166	1120	1220	1271	1501	1482	1454	1488	1532	1444	1474	1550	1542

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

Table 8. Average Annual Unemployment - In Percent

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	March 1990
United States	7.0	7.5	9.5	9.5	7.4	7.1	6.9	6.1	5.5	5.3	5.2
Idaho	6.4	6.5	8.8	7.5	6.3	6.5	6.5	5.7	4.7	5.1	5.5
Fremont	7.8	6.5	9.1	10.6	9.0	9.7	10.4	9.3	7.3	7.6	9.3
Madison	5.4	4.5	4.8	5.6	4.6	5.6	6.0	5.0	5.0	4.3	4.9
Teton	6.2	5.1	6.5	7.7	6.9	7.2	7.3	7.7	6.2	5.2	5.6
Ada*	6.6	6.1	7.5	7.9	5.3	5.9	5.9	5.7	3.9	3.4	3.5

* for comparison

Sources: Idaho Department of Employment, *The Labor Force in Idaho*; U.S. data from U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, Table A-1.

Average annual unemployment and poverty rate levels are related. As shown in Table 9, the average basic poverty rate in Idaho in 1980 was only slightly greater than the average in the United States. The poverty rate in Fremont, Madison, and Teton counties was about twice the average State of Idaho rate. The high rate in these counties is close to the rate in Mississippi, the state with the highest poverty rate in the nation.

Although the actual poverty rate of 20 to 25 percent is important, many more people are affected when underemployment levels in these counties are considered. Table 9 shows that half of the people had incomes under 200 percent of the poverty rate. The number of underemployed in the Fremont, Madison and Teton counties area was twice the rate of urban areas such as Boise, Pocatello or Idaho Falls. The relatively rural state of New Hampshire had statewide rates equal to Idaho urban areas, thus, a rural character does not necessarily determine a condition of high poverty or underemployment. A major cause of high underemployment is the seasonal nature of two major industries, agriculture and tourism. There is a great need for companion employment in these industries during their nonpeak periods.

Table 9. Percent Below Poverty Levels - 1980

	Below Actual Rate	Below 150% of Poverty Level	Below 200% of Poverty Level
United States	12	22	32
Idaho	13	24	38
Connecticut (lowest state rate)	6	14	22
New Hampshire	9	17	28
Mississippi (highest state rate)	24	38	51
Fremont County*	17	33	50
Madison County*	28	45	60
Teton County	18	40	62
Ada County (at Boise-comparison)	9	17	27
Bannock County (at Pocatello)	9	18	29
Poverty Level Family Income with Four People	$12,800	$19,100	$25,500

* Persons in college dormitories or in institutions are not included in these calculations.

Source: U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population; Volume 1, Characteristics of the Population; Chapter C, General Social and Economic Characteristics; Part 1, United States Summary, Tables 108 and 245; and Part 14, Idaho, Table 181.

Related to underemployment is the distribution of the income within an area, that is, the income levels of the most affluent when compared to the poorest section of the population. The calculated equity ratio of the income levels in the Fremont-Madison-Teton county area appear to be similar to urban Idaho counties and to the United States equity ratio. The actual dollar amounts, however, are considerably lower in these counties for both the richest and the poorest fifth of the population than the levels in more urban areas within the state.

Related to income levels, the household assessed valuation gives an indication of the available assets in the county. The three counties of Fremont, Madison and Teton are compared in Table 10 to the Idaho average and to the high and low counties in the state. By using values per household instead of per capita, the influence of families with large numbers of children is somewhat negated. Statewide, two counties with a destination recreation economy (Blaine and Valley) rank near the top in valuation per household. Teton County, which has a spillover recreation economy from Jackson, Wyoming, also has a high valuation. The other two basin counties, Fremont and Madison, are near the state average in valuation per household. There are fairly good asset values per household in the basin counties, yet the income levels are low, causing higher than normal near poverty levels. Thus the assets in many cases are not income producing or are low income or wage producing assets.

Table 10. Household Valuation

Rank	County	Valuation in $1,000 - 1986	Households 1985	Valuation Per Household
1	Power	$ 544,000	2,300	$236,000
2	Valley	553,000	2,600	213,000
3	Blaine	1,165,000	5,500	212,000
9	Teton	144,000	1,000	144,000
15	Fremont	306,000	3,200	96,000
	Idaho-State	29,551,000	354,000	83,000
29	Madison	444,000	5,600	79,000
43	Bannock	1,470,000	24,300	61,000
44	Payette	350,000	5,800	60,000

Despite a decline in the number of people employed on farms, farm income continued to rise in all three counties between 1981 and 1989. Farm income is a significant percentage of all personal income in the basin. Retirement and Investment income is also significant and increasing in importance in the three basin counties (see Table 11; U.S. Department of Commerce, Bureau of Economic Analysis).

In Madison County the broad "Service" sector generates the greatest personal income. The service sector is here defined to include health, business, professional, customer services as well as finance, insurance, wholesale and retail trade. Rexburg is the trade center for the basin. Manufacturing has also grown considerably in Madison County. Some of this growth is in the potato processing industry. Total personal income in Madison County amounted to $231,449,000 in 1989, a 28 percent increase from 1981 (adjusted to 1989 dollars).

In Fremont County, the government sector is a primary income source due to federal land holdings. Total personal income in Fremont County amounted to over $130 million in 1989, a 9 percent increase from 1981 (adjusted to 1989 dollars). The bulk of that increase came from improved returns in farming and retirement income. Fremont County experienced a decline in service sector income and employment during the 1980s. This is counter to the national and regional trend and suggests an opportunity for improvement. Employment and income figures for the retail sector indicate that potential sales are not being realized.

Teton County has had growth in manufacturing, transportation, and the service sectors as well as in retirement and investment income. Total personal income in Teton County amounted to over $40 million dollars in 1989, a 23 percent increase over 1981 (adjusted to 1989 dollars). Income from farming in Teton County increased by almost 40 percent over the past 20 years, from $7.6 million in 1969 to $12.5 million in 1989.

Table 11. Percentage of Total Personal Income by Source

	Fremont	Madison	Teton
Agriculture	19%	12%	31%
Manufacturing	6%	8%	<1%
Construction	2%	3%	4%
Services	17%	44%	15%
Government	13%	8%	10%
Retirement	12%	7%	11%
Investment	16%	15%	18%
Other Transfer Payments and Calculated Residence Adjustment	15%	3%	10%

Source: U.S. Department of Commerce, Bureau of Economic Analysis

The percentage of retail trade that is tourism related is estimated at 0.12, 20, and 23 percent respectively for Madison, Fremont, and Teton counties. The recreation economy in the basin appears, in many respects, to be an immature industry. There are many small operators attempting to provide services, but recreation needs are not being met, particularly for the large out-of-state market. As the basin's recreation industry grows, managers will develop new services, greater experience, and financing to capitalize on recreational opportunities in the basin.

Related to the poverty level and underemployment data is the median family income level. Table 12 shows that the median family income in the basin counties is considerably below the Idaho average median family income, and also is below the non-urban Idaho average. Similarly, the Idaho median family income is below the average United States median family income and more importantly, below the average United States non-metropolitan median family income. The Teton County average is actually below the lowest state in the nation, Mississippi, and is below the average non-metropolitan median family income for Mississippi. These figures are not per capita income so the affect of larger families is not reflected. See Table 12 for persons per household and per capita income.

There has been a noticeable drop in the median family income for the State of Idaho when compared to the nation over the last 20 years. The basin counties have followed the state trend of lagging behind the nation. A median family income of 59 to 71 percent of the national average seems low even when cost of living factors are considered.

Table 12. Median Family and Per Capita Income

	Family Income	Family Income Comments	Persons per Household - 1987	Per Capita Income - 1987
United States - 1990	$35,700		2.6	$15,500
- 1990 Metro	$38,200			
- 1990 Nonmetro	$28,000			
- 1969	$9,600			
Idaho - 1990	$27,200	44th State 76% of U.S.	2.7	$11,900
- 1990 Metro	$32,700			
- 1990 Nonmetro	$26,000			
- 1969	$8,400	37th State 88% of U.S.		
Mississippi - 1990	$24,600	50th State	2.8	
- 1990 Metro	$30,000			

- 1990 Nonmetro	$22,500			
- 1969	$6,100			
Alaska - 1990	$46,200	1st State	2.9	
- 1969	$12,400			
Fremont - 1990	$25,300	71% of U.S.	3.2	$11,000
- 1969	$7,800	81% of U.S.		
Madison - 1990	$26,000	73% of U.S.	3.8	$8,700
- 1969	$8,100	84% of U.S.		
Teton - 1990	$20,900	59% of U.S.	3.1	$11,000
- 1969	$5,900	61% of U.S.		
Bonneville - 1990	$33,900	1st Idaho County	2.9	$12,700
- 1969	$9,700			

Median Family Income - The amount which divides the distribution into two equal groups, one having incomes above the median and the other having incomes below the median. A family is limited by those related individuals who reside together.

Source: U.S. Department of Housing and Urban Development Office of Economic Affairs: Economic and Market Analysis Division: HUD Users office telephone 1-800-245-2691 for yearly data.
Metro = Metropolitan Statistical Areas (Ada County only in Idaho)

Amenities

The basin generally has a very good highway system including many paved arterial routes within the national forest. On the Upper Henrys Fork plateau during the winter, however, only U.S. 20, Idaho 87 past Henrys Lake, and a few short access roads are kept open. Railroad service is available up river to Ashton. Airstrips are available at Rexburg, St. Anthony, Driggs, and Henrys Lake.

Electric power is available to all the basin communities and to most of the isolated rural areas. High schools have been consolidated into the larger towns throughout the basin. Rexburg has a large well-established two-year college which provides associated cultural benefits.

Recommended Action

1. Encourage protection of paleontological sites, aboriginal village or camp sites, historic trails, early pioneer structures, fur-trade related sites, and Chief Joseph war related sites.
2. Encourage development of archeological and/or historical site interpretation facilities for public appreciation and education.
3. Encourage water resource-related economic development funding for private, city, county, state, and federal projects that strive for increased long-term, sustainable returns to the local economy.
4. Develop companion employment for non-peak periods in the agricultural and tourism industries.

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Fish and Wildlife

Management plans for fish and wildlife are developed every five years by the Idaho Department of Fish and Game. Their documents contain valuable descriptions of the status of fish and wildlife values in the basin and establish management goals for species and areas. An excellent discussion of wildlife values is contained in the environmental impact statement for the leasing and development of the Island Park Geothermal Area (1980) which covers a substantial portion of the northern part of the basin.

Wildlife

For wildlife much information is available on some animal species, yet little is available on other species. When possible, information has been quantified. To the extent possible, animals are discussed as individual species or groups of similar species.

For the Island Park area a total of 5 amphibians, 8 reptiles, 179 birds and 61 mammals were identified according to habitat and seasonal use. Migrant and accidentally occurring species are included in the Appendix. Species are oriented to a habitat if they use that type for reproduction and feeding. Table 13 is a partial listing of the number of habitats used by common species and those of special interest (Appendix A contains a summary of all species).

The number of habitats each species uses for feeding and reproduction is a measure of the adaptability of the species. The greater the number of habitats used the more adaptable the species and the less vulnerable it is to habitat manipulation or loss. The more species using the habitat for feeding and reproduction the more important it is to wildlife. Table 14 gives a summary of the wildlife-habitat associations.

Analysis of wildlife in the preceding manner does not allow consideration of certain key components of wildlife management such as winter range, migration routes, reproduction areas or legal considerations. The following discussion considers key points for species or groups of special interest. Wildlife population projects and goals are presented and, when relevant, past trends are discussed.

1. Big Game

The following map shows big game winter range. Deer and moose also winter throughout the middle of the elk winter range. Much of the elk and deer winter range is within the Sand Creek Wildlife Management Area (Figure 5).

Elk (Wapiti) have long been an important game animal in the area. Their occurrence in the area depends mainly upon the presence of their food supply. Their numbers have varied, but the present population is increasing after a 10 to 15 year low, as shown in Table 15.

Most elk migrate by late November and congregate on a major staging area in the lower elevations (Figure 5). Much of this staging area is on lands administered by the Bureau of Land Management and the State of Idaho. The specific function of this staging area is unknown; however, animals spend most of the staging area time feeding, apparently preparing for winter. During mild winters they use the staging area for winter range. In summer, elk are distributed throughout the forested area. Habitat use patterns vary with climate and various activities in the area (grazing, logging and recreation). Elk wander back and forth across the Yellowstone National Park boundary throughout the summer.

By mid-December of most winters, elk have moved to the Juniper Mountains/Sand Dunes winter range approximately 30 miles southeast of the forest boundary. This winter range is administered by the Bureau of Land Management and the Idaho Department of Fish and Game (IDFG) in cooperation with the Department of Lands and private landowners. Most of the elk that summer in the forest spend the winter on this range.

Since 1974 hunting in Idaho has been "bulls only" during general seasons, with fewer special permits, fewer general hunts and shorter seasons. Some either sex permits issued during special hunts will continue to be used in the future.

There are no discrete elk calving grounds. Calving occurs on the winter, spring and summer range and is totally dependent upon climate. In years with heavy snowfall and a "late" spring, calving takes place on the winter range. In years with light snowfall, elk may calve anywhere in the forest in suitable habitat. However, key calving areas (those used every year of "normal" snowfall) are along Big Bend Ridge and Thurmon Ridge.

Table 13. Some Common and Special Interest Wildlife Species and Number of Habitats Each Uses (See Table 14 for Different Habitats)

Chorus frog	6	Great horned owl	24	House finch	19
Leopard frog	19	*Burrowing owl	4	Pine siskin	22
*Rubber boa	21	*Short-eared owl	14	Green-tailed towhee	11
Racer	20	Common nighthawk	22	*Vesper sparrow	4
Common garter snake	23	Calliope hummingbird	18	Dark-eyed junco	18
*Western grebe	13	Belted kingfisher	17	Brewer's sparrow	5
Great blue heron	19	Common flicker	21	White-crowned sparrow	24
*Black-crowned night heron	5	*Lewis woodpecker	21	Vagrant shrew	24
*American bittern	4	Yellow-bellied sapsucker	15	Little brown myotis	23
*Trumpeter swan	19	*Hairy woodpecker	19	Silver-haired bat	19
Canada goose	12	Eastern kingbird	19	Big brown bat	25
Mallard	23	Western tanager	21	Pika	5
Gadwall	15	Hammond flycatcher	19	Snowshoe hare	18
Pintail	16	Western wood pee-wee	18	Least chipmunk	19
Blue-winged teal	12	Olive-sided flycatcher	22	Yellow pine chipmunk	25
Baldplate	15	Horned lark	7	Yellow-bellied marmot	12
Northern shoveler	15	Tree swallow	24	Richardson's ground squirrel	2
Redhead	16	Bank swallow	17	Red squirrel	18
*Canvasback	11	Gray jay	19	Northern pocket gopher	24
Turkey vulture	25	Black-billed magpie	21	Beaver	24
*Sharp-shinned hawk	23	Common raven	23	Deer mouse	31
*Cooper's hawk	24	Clark's nutcracker	16	Boreal red-back vole	12
Red-tailed hawk	27	Black-capped chickadee	25	Mountain vole	20
*Swainson's hawk	21	Red-breasted nuthatch	18	Muskrat	10
*Ferruginous hawk	5	Brown creeper	14	Western jumping mouse	17
*Golden eagle	29	Dipper	20	Porcupine	25
*Bald eagle	23	Canyon wren	15	Coyote	30
*Marsh hawk	10	American robin	26	*Gray wolf (Northern Rky.Mtn.Wolf)	27
*Osprey	17	Mountain bluebird	26	Black bear	31
*Prairie falcon	7	Golden-crowned kinglet	14	*Grizzly bear	27
*Merlin	23	*Loggerhead shrike	10	Marten	14
*American kestrel	25	Starling	10	*Fisher	21
Blue grouse	25	*Warbling vireo	11	Long-tailed weasel	30
Ruffed grouse	20	*Yellow warbler	5	Mink	26
*Sharp-tailed grouse	8	Yellow-rumped warbler	23	*Wolverine	17
*Sage grouse	6	*Yellow-breasted chat	16	Badger	16
Sandhill crane	14	House sparrow	7	Striped skunk	18
Common snipe	14	Western meadowlark	7	*Canada lynx	19
Spotted sandpiper	11	Yellow-headed blackbird	6	*Bobcat	26
American avocet	12	Red-winged blackbird	7	Elk (Wapiti)	24
California gull	11	Northern oriole	14	Mule deer	23
Mourning dove	17	Brewer's blackbird	15	Proghorn	25
*Barn owl	17	Evening grosbeak	19	Moose	25

Table 14. Wildlife Habitat Associations Based on Reproduction and Feeding
AF = Subalpine Fir; DF = Douglas Fir; LPP = Lodgepole Pine

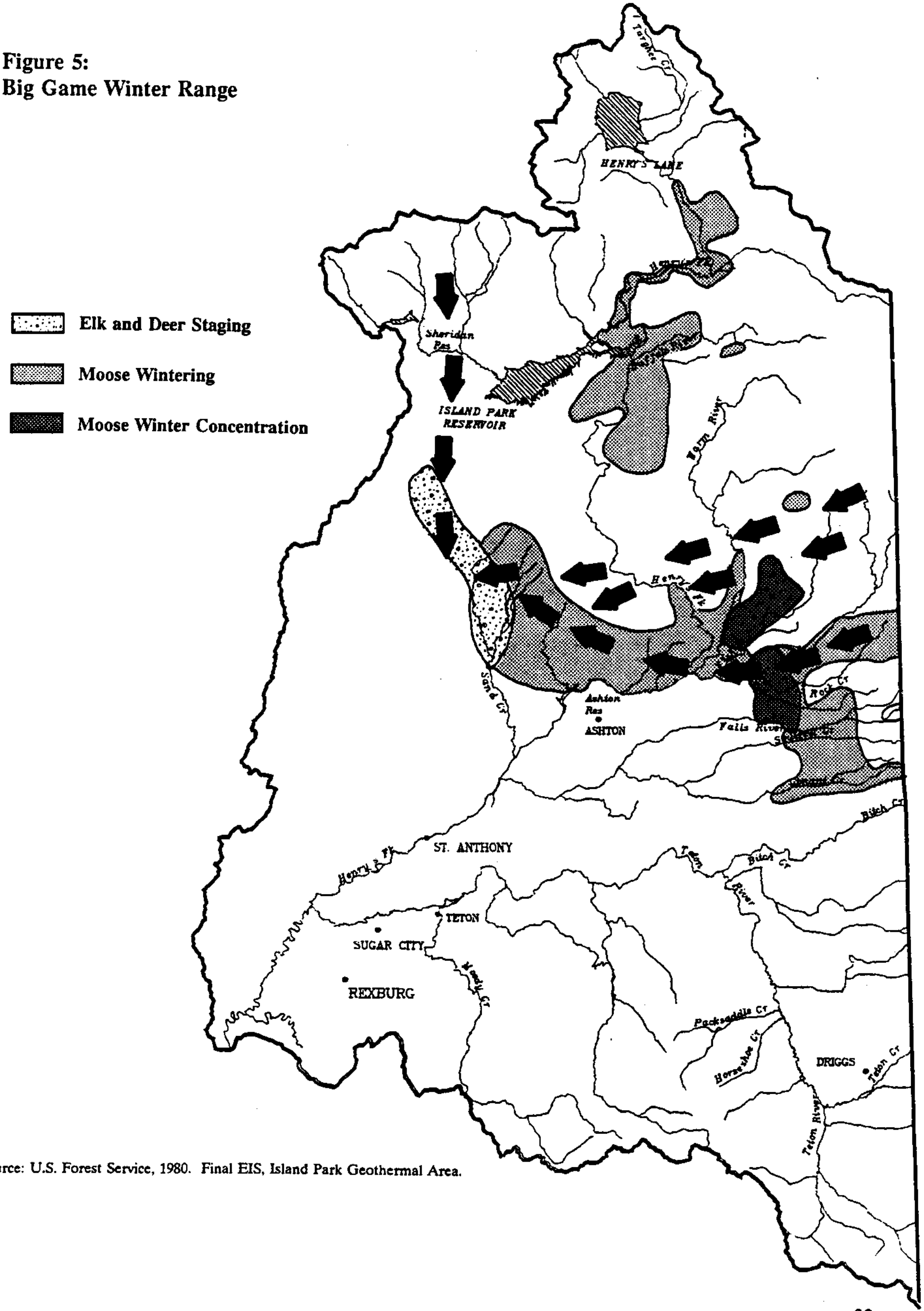
Habitat	Number of Wildlife Species Using Habitat for: Reproduction	Feeding	Total Number of Species Using Habitat
AF/Snowberry	122	141	142
DF/Snowberry	130	160	162
AF/Spirea	121	142	143
AF/Huckleberry	99	106	108
AF/Whortleberry	90	95	96
AF/Pinegrass	94	105	106
DF/Huckleberry	137	162	163
DF/Pinegrass	133	168	168
DF/Spirea	90	116	143
DF/Mountain Maple	127	148	149
LPP/Bitterbrush	72	73	74
Forest Successional stage			
Grass Forb	57	164	165
Shrub - Seedling	85	175	175
Seral pole	83	150	151
Full-size seral	128	142	152
Full-size climax	125	133	143
Old growth	113	127	136
Aspen Groves	77	123	126
Sagebrush	68	103	103
Mountain brush	71	103	104
Dry Meadows	41	122	122
Wet Meadows	48	128	128
Rivers & Streams	132	192	193
Lakes & Reservoirs	82	144	144
Riparian Deciduous	123	170	176
Marshes	109	148	152
Cliffs & Rims	39	48	62
Talus	23	59	61
Caves	21	10	25
Snags	44	43	58
Down Material	45	73	84

Table 15. Status of Big Game in the Island Park Area

	Year	Population	Harvest	Demand (Hunter Days)	Success (Days/Animal)
Elk (Wapiti)	1975	1,700	275	12,712	40.6
	1980	1,920	375	15,750	38.1
Mule Deer	1975	2,700	525	6,220	13.3
	1980	2,300	295	6,000	12.5
Moose	1975	320	22	84	4.7
	1980	200	4	20	5.0
Black Bear	1975	430	25	845	30.8
	1980	465	35	1,630	48.0

Source: Idaho Department of Fish and Game

Figure 5:
Big Game Winter Range



Source: U.S. Forest Service, 1980. Final EIS, Island Park Geothermal Area.

The mule deer is the most important big game species in Idaho in terms of total animals harvested and hunter participation. The entire forest is summer range in fair to good condition with good summer range in short supply. Deer numbers are low (Table 15) due to several factors: mule deer populations have fluctuated over the past 100 years with variations in habitat, climatic conditions, reproductive success and fawn/yearling survival. Low deer numbers are not limited to Idaho, as adjacent states have indicated that deer herds are below desired levels and have declined for the past several years.

The main deer winter range is the Juniper Mountains/Sand Dunes range described above for elk. Approximately 1,200 deer used this range in the winter of 1977-78. Numbers have ranged from 700 to 1,100 in the past 5 to 10 years. Deer use the same migration routes described for elk (Figure 5); fawning occurs along these routes.

Moose are distributed throughout the forest with variable patterns of habitat use. During the summer small groups (2-5) and single individuals are scattered through forest, mountain brush and riparian habitat. Willow areas receive considerable use.

Previous high density moose populations in the forest declined severely in the 1970's. Wintering numbers decreased due to winter mortality, uncontrolled Indian harvest and illegal kills. Within the last ten years the moose numbers have significantly increased with over 100 hunting permits issued for use in the basin for 1990.

The forested area provides extensive winter range for moose. Range condition varies throughout the area, but in most portions is good. The main winter areas are: (1) Fall River-Warm River Butte, which receives heavy use during extreme winters and is rated fair to poor winter range. Moose in portions of this area reach densities of 10-20 animals per square mile. Most move into Yellowstone National Park and Wyoming during the summer. (2) Big Bend Ridge--this range is in good condition, but the population has been declining, possibly due to illegal harvest. The main concentration areas are Snake River Butte and drainages. (3) Island Park-Henrys Lake--the main areas of use are along Henrys Fork with scattered use in the Henrys Flat region. This range is also considered good. Approximately 30 to 40 moose winter along the south shoreline of Island Park Reservoir utilizing willow-covered peninsulas.

Snow depth in extreme winters can be a problem to moose. They are able to get along in deep snow, but depths of six and seven feet can increase mortality of old and young animals. Food availability determines winter range selection and overall well-being of the herds. Important forage species include willow, bitterbrush, chokecherry, serviceberry, subalpine fir, sedges and grasses.

Black bear reach highest numbers in the eastern half of the forest, however, they are present throughout the area. Despite a continual open season and indiscriminate killing, densities remain high in certain portions, especially in the southeastern section.

The mountain lion is present in the area, but its status and numbers are unknown. Total numbers are undoubtedly low since the area has less than optimum mountain lion habitat. Mountain lions are currently protected in Idaho.

Antelope use Henrys Lake Flat. This flat is predominantly private grassland used for livestock grazing, with small pockets of sagebrush throughout. The IDFG estimates that 180 pronghorn use the summer range in and around Henrys Lake Flat. The herd migrates through Raynolds Pass into Montana for the winter. A few permits (muzzleloader or shotgun only), are issued to hunt this herd.

2. *Upland Game*

Sage grouse use sagebrush-grass and mountain brush habitats for summer feeding and brood rearing (Figure 6). Preferred habitats are associated with stream areas where water and meadows with succulent vegetation are available for brood rearing. The strutting grounds are in the northwest portion of the basin. Preferred nesting habitat is usually within a two-mile radius of the strutting grounds. Despite annual fluctuations, sage grouse populations generally have increased since 1960. A peak was reached around 1970, and a decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (Table 16).

Sharp-tailed grouse are rare in the basin with most sightings in mountain brush along the southwestern edge of Big Bend Ridge. Sharp-tailed grouse are associated largely with grasslands interspersed with brush. The sharp-tailed grouse is a species of special concern to the IDFG, which recommends that all possible measures be taken to protect, enhance, and expand existing habitat. A peak in numbers was reached around 1970, and decline was evident by 1975. It is projected that populations will gradually rebuild through 1990, with greater hunter demand and essentially the same hunter success rate (Table 16).

Two species of forest grouse, blue and ruffed grouse, are common in forested areas of the basin. Blue grouse use most habitats and move to higher elevations for wintering. They nest on grassy open slopes and sagebrush covered ridges, usually at the base of a small tree or shrub. Nesting habitat is usually found at elevations below the mature coniferous forest used for wintering. They depend on conifer needles for winter food. Ruffed grouse are also found in the forest. Although these birds eat a variety of food during much of the year, they feed largely on the buds of aspen and other deciduous species during the winter.

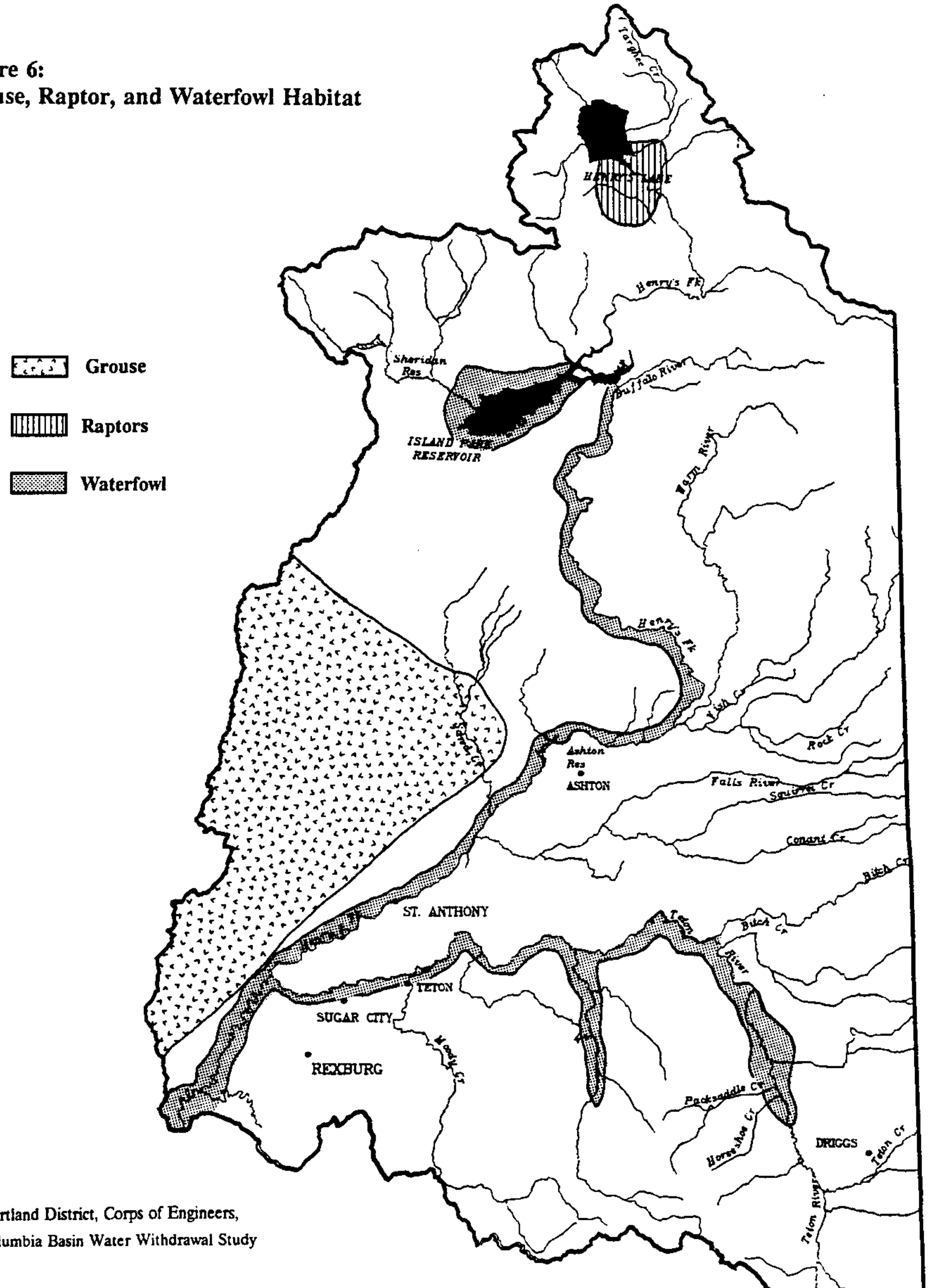
Populations of forest grouse typically fluctuate and may be cyclic. Allowing for these fluctuations, past populations have been relatively stable, and this trend is expected to continue through 1990 (Table 16). Most forest grouse are harvested incidentally during big game hunting, although grouse hunting is increasing in popularity. Harvest levels have steadily increased. Demand and harvest are both projected to continue increasing through 1990, with a fairly consistent hunter success rate.

The mourning dove is common throughout the Henrys Fork Basin; migratory and nesting populations are present. It is associated mainly with sagebrush-grass, mountain brush and riparian habitats, but also occurs in some forested habitat types. Mourning dove populations gradually increased from 1960 through 1975. Under current management levels and habitat trends, populations should remain at present levels through 1990 (Table 16).

Mourning doves fall under the jurisdiction of the Migratory Bird Treaty Act. Under this Act, harvest regulations and management are primarily the responsibility of the U.S. Fish and Wildlife Service. The earliest opening date allowed under this Act is September 1, which coincides with the peak of migration out-of-state and effectively limits hunting.

Mountain cottontails (rabbits) are associated primarily with nonforested habitat, aspen groves and riparian habitats. Essentially stable populations of the last 10-15 years are projected to remain so through 1990. Less than 20 cottontails are harvested annually on the forest. Cottontails are a main constituent in the diet of many raptorial birds.

Figure 6:
Grouse, Raptor, and Waterfowl Habitat



Source: Portland District, Corps of Engineers,
Columbia Basin Water Withdrawal Study

Table 16. Upland Game Bird Statistics for the Island Park Area

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
		SAGE GROUSE AND SHARP-TAILED GROUSE			
1975	5,500	600	330	790	0.8
1980	5,600	680	340	800	0.8
1985	5,760	860	360	800	1.0
1990	6,000	1,000	400	1,000	1.0
		FOREST GROUSE			
1975	40,000	2,100	700	2,800	0.8
1980	45,000	2,600	1,000	4,000	0.7
1985	45,000	3,000	1,200	4,800	0.6
1990	45,000	3,800	1,500	6,000	0.6
		MOURNING DOVE			
1975	2,000	345	35	117	2.9
1980	2,000	360	40	130	2.8
1985	2,000	380	48	160	2.4
1990	2,000	400	50	170	2.4

Source: Idaho Fish and Game Department

3. *Waterfowl*

The basin is located along a portion of the Pacific waterfowl flyway. Over a million waterfowl migrate over the area in spring and fall. Fall movements begin in mid-to-late-August and continue through December. Large numbers of ducks and geese concentrate on and around Island Park Reservoir, Henrys Lake, Hebgen Lake and Harriman State Park before moving south. These areas are immediately adjacent to the Red Rock Lakes Migratory Water Waterfowl Refuge in Montana, only 15 miles to the northwest. Migrating waterfowl make extensive use of watercourses, lakes, marshes and potholes in the area. The northward migration begins in late March and continues through May.

Resting and feeding habitat in the area for migrating waterfowl is currently adequate to support the numbers passing through or overwintering. These conditions are not expected to change through 1990. Numbers of migratory birds are dependent upon production in out-of-state areas, primarily Canada. Despite annual fluctuations, numbers have been generally stable. Populations of migratory ducks are expected to decrease due to losses of suitable habitat. With growing hunting demands, harvests and success, rates will decrease.

Some waterfowl breed and produce young in the area. The best production areas are small bodies of water, such as beaver ponds, large and small streams, and marshes. Allowing for normal fluctuations, the number of ducks produced in the basin has remained relatively constant since 1960. Harvests vary with duck populations and hunter numbers; success rates are projected to persist through 1990 (Table 17).

Canada geese breed in the nonforested, riparian habitats in the basin. Nesting occurs primarily along rivers and streams, small lakes and potholes. Many migrating geese use the area for nesting and feeding. Numbers have generally increased since 1960. Migratory goose populations and harvests are expected to increase through 1990 (Table 17). The IDFG has a major effort underway to create new and improved nesting and rearing habitat. As part of this effort nesting platforms have been installed on Island Park Reservoir.

Table 17. Waterfowl Statistics for the Island Park Area

Year	Pre-season Population	Total Harvest	Total Hunters	Total Hunting Days	Success (Birds/Day)
		DUCKS			
1975	13,500	1,000	165	660	1.5
1980	13,500	1,100	175	720	1.5
1985	14,500	1,200	180	800	1.5
1990	15,000	1,400	200	900	1.6
		CANADA GEESE			
1975	1,500	450	360	1,080	0.4
1980	1,500	480	390	1,365	0.4
1985	1,500	525	420	1,640	0.3
1990	1,500	540	435	1,780	0.3

Source: Idaho Department of Fish and Game

4. Raptors

A survey of birds of prey in the Targhee National Forest was done by the U.S. Fish and Wildlife Service in 1977. Their report detailing nest locations, breeding territories, reproductive effort and diversity of raptors is on file with the Targhee National Forest. It indicates that 31 species of raptors use the area during some portion of the calendar year. Appendix A has a list of these birds and their habitats.

Birds of prey subsist mainly on small rodents, fish, reptiles, amphibians, carrion and an occasional hoofed animal (ungulate). Shrubs, trees and cliffs provide cover and nesting sites for most of the species. In open country around Henrys Lake Flat utility poles, fence posts, snags and other isolated structures provide important perches for nesting and hunting. Many of these structures are also found around sagebrush flats, meadows and riparian habitats in the area. Raptors are important elements in predator-prey relationships in most ecosystems. They can help control small prey species such as rabbits, hares and rodents.

The U.S. Fish and Wildlife Service raptor report emphasized the importance of Henrys Lake Flat. This high elevation grassland is used by hundreds of fledged falcons and hawks as a staging area during migration in August and September. Nearby ridges funnel birds in from the north, south and west to the Flats, where they use the surrounding forest for hunting. Raptors are completely protected by the Federal Migratory Bird Treaty Act and State regulations.

5. Species of Special Concern

Of special concern are species whose restricted range, specific habitat requirements and/or low numbers make them vulnerable if adverse impacts on populations or habitat occur. The following are found in the area: grizzly bear, Northern Rocky Mountain wolf, Canada lynx, fisher, wolverine, trumpeter swan, sharp-tailed grouse, ferruginous hawk, prairie falcon, American peregrine falcon and northern bald eagle. The grizzly, wolf, peregrine falcon, and bald eagle are federal Threatened and Endangered Species.

The bobcat, Canada lynx, fisher and wolverine are common to rare mammalian predators whose numbers have declined in the past 10 to 15 years. Rising prices for bobcat and lynx pelts and uncontrolled harvest have reduced their numbers drastically. They have been removed from predator lists and placed under Idaho Department of Fish and Game's control. The fisher, requiring forested, wilderness habitat, is also under State control. The wolverine, which also requires wilderness habitat, is extremely rare in the area.

The trumpeter swan is a common resident of the area. While the species is no longer endangered or threatened, in recent years trumpeter breeding populations have experienced extremely high mortality among the young (60-90 percent). Breeding habitat requirements of these birds are:

1. Waters with a relatively static level, not marked by seasonal fluctuations.
2. Quiet waters of lakes, marshes or slough, not subject to current or constant wave action.
3. Shallow waters of lakes or open marshes, not so deep as to preclude digging and foraging for lower aquatic plant parts, roots and tubers.
4. Minimum human disturbance and relatively remote areas.

The open waters of the Henrys Fork drainage are the primary wintering areas for all of Canada's trumpeter swans. In addition to the migrants, approximately 50 percent of the year-round resident trumpeters winter within the area. The relative isolation, abundant submerged vegetation and open waters of the Henrys Fork are critical to the welfare of the remaining trumpeter population of Canada and the United States (Hebgen Lake, approximately four miles north of the basin, also supports wintering trumpeter swans). To prevent downstream freezing, minimum flows of about 500 cfs (300 cfs from Island Park Reservoir and 200 cfs from the Buffalo River) may be needed.

The sandhill crane, considered unique, is common in the basin. It is a summer resident which breeds and nests where there are abundant marsh and riparian habitat. Sandhill cranes congregate on a major staging area in the forest where they feed and prepare for the fall migration.

6. Threatened and Endangered Species

The Endangered Species Act of 1973 (P.L. 93-205) officially recognizes two categories of animals, endangered species and threatened species. Section 7 of the Act requires all federal agencies to take necessary actions to insure critical habitat for endangered or threatened species is not adversely modified or destroyed.

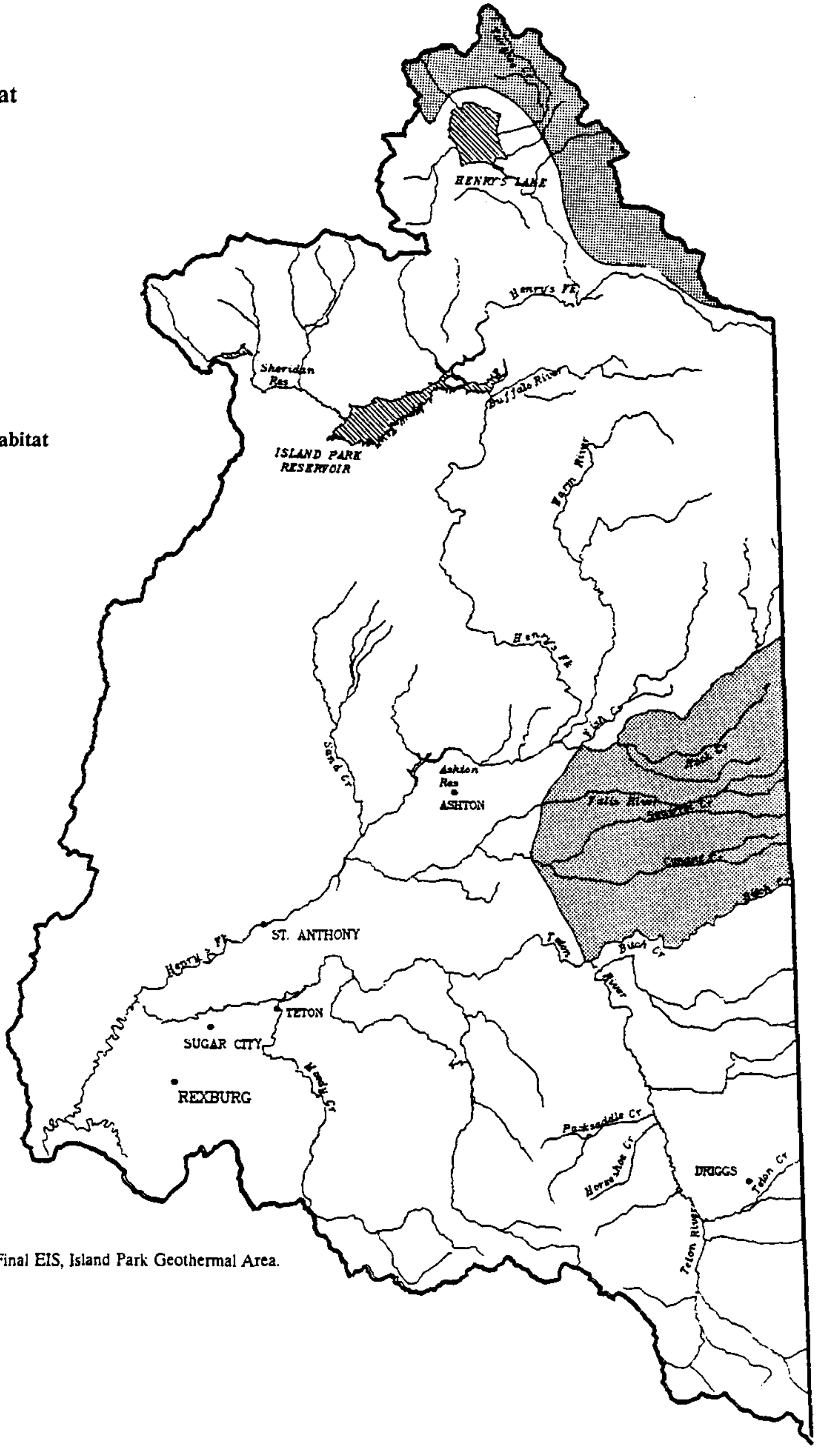
Three endangered and one threatened species inhabit the basin. Although most wildlife lists and maps show the range of the endangered spotted bat (*Euderma maculata*) extending into the basin, no authenticated records of spotted bats have been collected.

The grizzly bear (*Ursus arctos horribilis*), a threatened species, occurs throughout the eastern portion of the forested area. Bears in this area are part of the Yellowstone population, which has been studied since 1973 by an Interagency Grizzly Bear Study Team of research biologists from the National Park Service, Fish and Wildlife Service, Forest Service and the states of Wyoming, Montana and Idaho.

Approximately 94,000 acres of the forested area have been designated as land where the grizzly bear will receive management priority (Figure 7). Pending formal determination of critical habitat, this area will be treated as critical habitat and protected from adverse modification or destruction. Delineation of grizzly bear habitat in the area relied heavily upon past sightings.

In the area, some habitat appears more valuable to grizzlies than other habitat, particularly those lands in the Reas Pass area northeast of Macks Inn and the Winegar Hole area south of Falls River.

Figure 7:
Grizzly Bear Habitat



Grizzly Bear Habitat

Source: U.S. Forest Service, 1980. Final EIS, Island Park Geothermal Area.

The Reas Pass and Winegar Hole areas have highly productive forest understories, open wet meadows, bogs, swamps and potholes. Both contain extensive downed timber which supports heavily used food sources (fungi, rodents and insects). Tall huckleberry habitat in Winegar Hole supports some of the most productive rodent populations in the Targhee National Forest. Rodents, particularly pocket gophers (*Thomomys talpoides*), are an important grizzly food. Large numbers of rodents are present in both the Reas Pass and Winegar Hole areas with highest densities in wetter areas.

The Northern Rocky Mountain wolf (*Canis lupus irremotus*), one of 32 subspecies or geographic races of the gray wolf, was listed as endangered and became legally protected in 1974. The historical and current distribution of the wolf includes the Henrys Fork Basin. Unverified sightings have occurred in the area for several years, and verified sightings have been made. The basin is at the edge of the wolf's present range, and thus is used occasionally (Dennis Flath, Team Leader, Northern Rocky Mountain Wolf Recovery Team, 1978).

The American peregrine falcon (*Falco peregrinus anatum*), an endangered species, is known to use the area. Only one active natural nest has been observed in recent years. Hack towers have been installed at two locations in the basin.

The endangered bald eagle (*Haliaeetus leucocephalus*) feeds extensively along lakes and reservoirs in the summer, and some birds winter in the area. There are 15 known active bald eagle nests in the basin.

Fisheries

The Henrys Fork basin provides one of the most important rainbow trout fisheries in the state. In addition to the Henrys Fork itself, important fisheries occur on the tributary Teton, Warm, and Buffalo rivers. Henrys Lake and Island Park Reservoir are important components of the Henrys Fork fishery. Basin streams contain rainbow trout, westslope cutthroat, brook trout, coho, kokanee, mountain whitefish, and grayling. Although cutthroat trout are the native salmonid in the drainage, rainbow trout are the most important game species present. Mountain whitefish are the most numerous game species in the basin.

The Henrys Fork below St. Anthony suffers from impacts associated with irrigation water returns and low flows due to upstream diversions. The ability of the river to support salmonid populations is limited by these impacts. Management goals for this reach of the Henrys Fork project catch rates of 0.3 fish per hour.

The Henrys Fork between St. Anthony and Big Springs attracts fishermen from throughout the nation. Fish and Game surveys have documented annual angler use and harvest along this reach of river at 175,000 hours of effort with catch rates of 1.25 fish per hour (see Table 18). Wild rainbow trout make up the bulk of the fish in the creel with lesser numbers of brook trout, hatchery rainbow trout, mountain whitefish and cutthroat. Native cutthroat make up less than 1 percent of the catch. Management plans will emphasize wild, natural populations without hatchery supplementation. Ashton Reservoir will be managed as a yield fishery with hatchery rainbow trout, under general regulations.

Fishing on the Henrys Fork near Harriman State Park.

Table 18. Angler Effort - Henrys Fork Basin of the Snake River

Reach of Stream	Miles of Stream Surveyed	Fishing Season 1991	Fisherman-Hours 1973/74	Fisherman-Hours 1976	Fisherman-Hours 198-		Hours/Mile	Trout Per Hour 1976
Railroad Trestle to Macks Inn Bridge	4.2	5/25-11/30	38,600	32,500	25,700	(1988)	6,100	1.12
Macks Inn Bridge to McCrea Bridge	6.1	5/25-11/30	25,100	22,100	—		3,600	1.68
Island Park Dam to Buffalo River	0.5	5/25-11/30	6,300	3,200	3,900	(1982)	7,800	1.28
Buffalo River to No. Boundary Harriman State Park	5	5/25-11/30	20,500	17,500	22,500	(1982)	4,500	1.73
No. Boundary Harriman State Park to Osborne Bridge (main Harriman State Park)	5	6/15-10/15	16,500	25,600	31,000	(1982)	6,200	0.72
Osborne Bridge to South Boundary Harriman State Park	2.5	6/15-10/15	4,800	7,100	4,200	(1982)	1,700	0.77
South Boundary Harriman State Park to Riverside Campground	3.5	5/25-11/30	7,000	6,600	2,500	(1982)	700	.91
Riverside Campground to Lower Mesa Falls	12	5/25-11/30	2,000	4,400	12,000	(1986)	1,000	0.50
Lower Mesa Falls to Warm River	6.5	5/25-11/30	1,700	2,900	—		400	1.12
Warm River to Wendell Bridge	7	5/25-11/30	5,200	8,500	5,100	(1980)	700	.51
Wendell Bridge to Ashton Dam	4	year-round	7,100	5,300	4,700	(1980)	1,200	0.95
Ashton Dam to Chester Dam	6	5/25-11/30	17,500	21,900	19,200	(1980)	3,200	1.27
Chester Dam to St. Anthony	7	year-round	11,500	12,500	9,834	(1980)	1,400	0.67
St. Anthony to North Fork Teton River - (limited data available)								
North Fork Teton River to Mouth - (limited data available)								
Buffalo River	3	5/25-11/30			7,400	(1988)	2,500	
Warm River	9	5/25-11/30			8,000	(1985)	900	
Falls River - No level of use studies known; use estimated to approach Teton Canyon Use.								
Teton River Upper Teton Valley	21.0	5/25-11/30	17,500		21,700 18,100	(1981) (1988)	900	
Teton River Canyon	16.0	5/25-11/30	1,400		6,100 4,800	(1988)	300	
Teton River below the Dam Site	25	5/25-11/30	5,100		29,700 9,000	(1980) (1988)	400	
Henrys Lake	–	5/25-10/31		68,100	63,300 340,000		(1982) (1989)	
Island Park Reservoir (above Lakeside Lodge	–	1/1-3/13 & 5/25-12/31 5/25-11/30)		100,000	124,400 49,000		(1982) (1989)	
Ashton Reservoir	–	5/25-11/30			4,700 12,600		(1980) (1985)	

Source: IDFG, 1990; Angradi and Contor, 1989; Maiolle, 1987; Rohrer, 1984; 1981; Moore et al., 1983; Jeppson, 1982; 1981; Coon, 1977, 1978.

Island Park Reservoir is a widely fluctuating irrigation reservoir on the Henrys Fork. It contains important fisheries for rainbow trout, coho, and kokanee with catch rates of up to 0.6 fish per hour. Drought conditions have had severe impacts on the reservoir fishery, flushing large numbers of fish downstream. Island Park will be stocked with rainbow trout, coho, and kokanee.

From Island Park Reservoir upstream to Henrys Lake the Henrys Fork provides a yield fishery supported by natural reproduction and further supplemented with hatchery rainbow trout. At the Henrys Lake outlet, harvest is supported by emigration of trout from Henrys Lake.

Henrys Lake is a shallow, highly productive lake covering 6,300 acres at the headwaters of the Henrys Fork. It has a long history of supporting an extensive sport fishery for large, native cutthroat trout. The Department of Fish and Game has managed Henrys Lake as a trophy fishery since 1976. The goal for Henrys Lake is to provide catch rates of 0.15 fish per hour for cutthroat-rainbow hybrids, 0.10 fish per hour for brook trout and 0.45 fish per hour for cutthroat trout. Fish and Game hopes to achieve size goals of 20 percent of the hybrids over 20 inches in length, 10 percent of the cutthroat over 20 inches, and 5 percent of the brook trout over 18 inches. Recent increases in angler use and estimated harvest suggest the resource may soon approach full-capacity use (Table 19).

Table 19. Angler Effort - Henrys Lake

Year	Angler Hours	Estimated Harvest	Catch & Release	Total Catch	Catch Per Hour
1978	85,000	26,000	15,000	41,000	0.48
1979	94,000	19,000	11,000	30,000	0.32
1980	68,000	9,000	5,000	14,000	0.21
1981	66,000	8,000	7,000	15,000	0.23
1982	63,000	7,000	22,000	29,000	0.46
1983	96,000	25,000	97,000	122,000	1.27
1984	163,000	47,000	224,000	271,000	1.66
1985	126,000	38,000	121,000	159,000	1.26
1986	173,000	67,000	88,000	155,000	0.90
1987	150,000	36,000	45,000	82,000	0.54
1988	100,000	20,000	62,000	81,000	0.82
1989	340,000	104,000	156,000	259,000	0.77

The Idaho Department of Fish and Game and the Henrys Lake Foundation are working with local landowners cooperative effort to improve instream habitat and fish passage on tributaries to the lake. This involves fencing and the screening of irrigation diversions.

Warm River is a major tributary to the Henrys Fork. A large spring six miles upstream from its mouth provides the base flow. Warm River has large sections of good spawning gravels and fairly constant temperatures which make for ideal trout spawning conditions. Due to the lack of good spawning habitat in the Henrys Fork between Ashton Dam and Mesa Falls, Warm River is critical to maintenance of wild rainbow and brown trout populations in this section of the Henrys Fork.

Falls River is the largest tributary to the Henrys Fork. It supports an excellent wild rainbow trout fishery. Cutthroat trout also contribute to the angler catch from Falls River.

The Teton River fishery was severely impacted by the construction and failure of Teton Dam. Overall catch rates of 1.42 fish per hour declined to about 0.75 fish per hour. Despite intensive fish stocking efforts, in 1988 the catch rate below the dam site was 0.48 fish per hour. Efforts are now underway to improve both habitat lost through the collapse of the dam and habitat affected by changes in land use practices. Goals are to improve conditions so that the cutthroat population becomes self-sustaining and to maintain a catch rate of at least 1.0 fish per hour.

Most of the smaller tributaries in the Henrys Fork drainage are managed with restrictive regulations to preserve the native cutthroat trout.

Factors Limiting the Fishery in the Henrys Fork

1. Late winter under-ice low oxygen levels in Henrys Lake.
2. Excessive summer-fall blue-green algae blooms in Henrys Lake and Island Park Reservoir reducing zooplankton and littoral zone production that is usable by salmonids.
3. Extreme drawdown of Island Park Reservoir eliminates most summer benthic invertebrate production in that pool.
4. Low fall-winter flows in the Henrys Fork River below Island Park Reservoir and below Henrys Lake.

5. Late summer low flows below St. Anthony and in the lower Falls River as irrigation waters are diverted.
6. Irrigation return flows in the lower Teton and Henrys Fork rivers.

Recommended Action

1. Examine the need for minimum streamflows in basin streams. Where the need for a state protected flow is identified, seek to provide such flow.
2. Support protection of fish passage on existing and future projects. Because of grandfather rights, several streams need corrective action. Prime examples are passage problems at the mouth of the Buffalo River associated with the Ponds Lodge hydroelectric project and highway culverts on Targhee and Howard creeks which are tributary to Henrys Lake.
3. Construct self-cleaning screens on irrigation diversion structures in selected streams to reduce fish mortality.
4. Encourage protection of riparian vegetation which is important to fish and wildlife.
5. Encourage protection of key seasonal habitats such as wildlife calving areas and winter ranges.
6. Give consideration for land use and water use management to aid in recovery of populations of threatened and endangered species.
7. Increase the research program to evaluate and improve the fisheries on important Henrys Fork tributaries such as the Falls, Teton, Warm and Buffalo rivers, and Bitch and Robinson creeks.

Sources

Final Environmental Impact Statement of the Island Park Geothermal Area. U.S. Department of Agriculture - Forest Service and U.S. Department of the Interior - Bureau of Land Management, 1980, Targhee National Forest.

Fishery Research Reports including Regional Fishery Management Investigations, Idaho Department of Fish and Game, 1979-89.

Fisheries Management Plan 1991-1995, Idaho Department of Fish and Game.

Idaho Bald Eagle Research Project, Greater Yellowstone Ecosystem, Annual Production Summary 1991, USBLM, USFS, IDFG, Northern Rockies Conservation Cooperative.

Natural Features and Scenic Values

The Island Park plateau, located above the town of Ashton and the Teton Valley, a high mountain valley, are scenic focal points in the Henrys Fork basin. High snowfall combined with pleasant cool-dry summers support coniferous forests with large open meadows. Porous rock allows for the infiltration of much of the snowmelt providing good summer recreation-season streamflows.

Prominent scenic attractions are the Tetons, a series of mountain peaks in Wyoming, Henrys Lake, Sawtell Peak, Island Park Reservoir, and Mesa Falls. The 6,300-acre Henrys Lake, the 8,400-acre Island Park Reservoir, and the Henrys Fork meandering through the canyons and open meadows of the Island Park plateau attract national notice. The 4,060-acre Harriman State Park complex and the scenic Big Springs-Macks Inn reach are focal points for visitors.

The Teton Range is a prominent scenic feature of the basin.

Mesa Falls, on the Henrys Fork, is one of the most impressive falls in the State. The Upper Falls has a drop of 114 feet, but the Lower Falls, dropping 65 feet one mile downstream, is perhaps more impressive because the river is constricted. Sheep Falls, four miles upstream of Upper Mesa Falls on the Henrys Fork, also is noteworthy with a drop of 35 feet. Sheep Falls on Falls River, about two miles downstream from the Idaho border, has about a 30-foot drop. These falls can be viewed at the end of a two-mile trail.

Northwest of St. Anthony, are many lava caves of which Crystal Falls Cave is one of the most remarkable. The name comes from the ice formations found within the cave.

Mountain Ranges

Centennial Mountains - This part of the Continental Divide between Idaho and Montana reaches from the western boundary of the basin to Red Rock Pass, west of Henrys Lake. This relatively narrow range is one of the most magnificent in the state with high rugged backbones and deep canyons.

Henrys Lake Mountains - This crescent-shaped range arcs around the north of Henrys Lake from Red Rock Pass on the west to the Madison Plateau of Yellowstone National Park southeast of the lake. Located east of the Centennial Mountains, these mountains are also a part of the Continental Divide between Idaho and Montana.

Big Bend Ridge - Approximately eight miles wide, the ridge extends northwest for 18 miles from the Henrys Fork near Ashton to the valley of Island Park Reservoir. It reaches an altitude of 7,500 feet.

Big Hole Mountains - These mountains are west of the towns of Victor, Driggs, and Tetonia and parallel the Teton Range. The extension of these mountains into Wyoming from the south end of the Teton Basin is known as the Snake River Range.

Snake River Range - The South Fork of the Snake River parallels the range to the south. The Teton Basin is to the north. The range extends 40 miles from Wyoming into Idaho, and varies in width from 12 to 24 miles.

Sand Hills (Juniper Buttes) - A prominent group of hills, composed of gently sloping lavas northwest of St. Anthony, beyond the sand dunes.

Teton Range - Perhaps one of the most picturesque mountain ranges in the United States, their highest point, Grand Teton, is 13,766 feet above sea level. These pointed mountains form part of the Henrys Fork basin boundary located just across the state line in Wyoming. This range is a major visual feature seen throughout the basin.

Thurmon Ridge - This low, gently rising ridge is the prominent west background feature for the heavily used recreational stretch of the Henrys Fork, adjacent highway, and resort area starting at the Island Park Reservoir and extending south past Harriman State Park. Likewise, this ridge from its other side is the south background feature for the main body of Island Park Reservoir and adjacent land.

Targhee Peak (10,285) - The highest point in the Idaho portion of the basin, four miles north of Henrys Lake.

Black Mountain (10,237) - Located three miles north of Henrys Lake.

Mount Jefferson (10,196) - Located six miles southwest of Henrys Lake, west of Sawtell Peak. There are really two peaks, each rises steeply 600 feet above timber line, with almost vertical north faces. The summit elevation is the highest in the Centennial Mountains.

Bald Peak (Lionhead Peak) (10,180) - Located six miles northeast of Henrys Lake adjacent to Targhee Peak.

Sawtell Peak (9,866) - This prominent landmark south of Henrys Lake, northwest of Macks Inn, and North of Island Park, forms a backdrop to much of the Upper Island Park recreational area.

Taylor Mountain (9,855) - The highest point in the western part of the Centennial Mountains is located northwest of Island Park Reservoir.

Red Rock Mountain (9,512) - A companion peak to Mount Jefferson, located on the south side of Red Rock Pass, north of Mount Jefferson.

Reas Peak (9,371) - In the Centennial Mountains, located directly north of the middle of Island Park Reservoir.

Garns Mountain (9,016) - Located southwest of Driggs.

Oliver Peak (8,987) - Located south of Victor.

Ryan Peak (8,860) - Located west of Driggs.

Two Top (8,710) - These barren twins are directly east of the southern part of Henrys Lake.

Bishop Mountain (7,810) - Located south of the main body of Island Park Reservoir.

High Point (7,281) - A prominent point located southwest of Harriman State Park is seen from much of the recreation area below Island Park Reservoir.

Menan Buttes (5,619) - These broad, prominent, and picturesque twin crater buttes rise out of the lowland agricultural area near the junction of the Henrys Fork with the Snake River, just west of Rexburg.

Lakes, Reservoirs, and Rivers

Table 20 includes still-water areas of 20 acres or larger. There are many more lakes, most of which range from 1 to 5 acres.

Water areas are associated both with open meadows and with wooded areas. The many streams in the basin cover approximately 3,600 acres. This is probably an underestimate since now many narrow streams and smaller rivers with overhanging vegetation cannot be identified through photo interpretation. The principal creeks and rivers are:

Henrys Fork and Henrys Lake Outlet - While the Idaho Legislature has stated that the Henrys Fork originates at Henrys Lake, local usage is to assume that the Henrys Fork originates at Big Springs, located east and upstream from Macks Inn. Big Springs flows at a nearly constant 170 cubic feet per second. The continuation of the Henrys Fork nine miles into the upper basin above Big Springs is known as Henrys Lake Outlet. The Henrys Fork, including Henrys Lake Outlet, is about 117 miles long. This water area provides outstanding opportunities for recreation and is a major irrigation supply for the lower basin.

Sand Creek/Blue Creek/Pine Creek - Sand Creek and the noted tributaries originate along the west or desert side of Big Bend Ridge, and flow south into the Henrys Fork about five miles downstream of Ashton Dam.

Sheridan Creek - tributaries originate in the Centennial Mountains and flow into the west end of Island Park Reservoir.

Icehouse Creek - originates in the lower hills of the Centennial Mountains and flows into the upper end of Island Park Reservoir.

Sheep Creek and Yale Creek - originate in the east end of the Centennial Mountains and flow into the northeast end of Island Park Reservoir.

Table 20. Lakes and Reservoirs

Name	Size in Acres	Location
Island Park Reservoir	8,400	West of Town of Island Park
Henrys Lake	6,300	Upper End of Basin
Sheridan Reservoir	415	7 Miles Northwest of Island Park Res.
Ashton Reservoir	398	West of Ashton on Henrys Fork
Silver Lake	150	In Harriman State Park
Quayle Lake	≈160	13 Miles West of St. Anthony
Trudes Bay	90	Northwest End of Island Park Res.
Blue Creek Reservoir #4 (aka as Sand Creek)-for fishing	78	16 Miles North of St. Anthony
Lower Arcadia	68	11 Miles North of St. Anthony
Icehouse Creek Reservoir	64	4 Miles North of West End of Island Park Res.
Davis Lake	≈55	6 Miles West of St. Anthony
Blue Creek Reservoir #2	≈45	14 Miles North of St. Anthony
Lemon Lake	≈45	6 Miles West of Ashton
Fish Pond	40	2 Miles Southeast of Harriman State Park Headquarters
Hossner Pond	≈40	1 Mile West of Ashton
Upper Arcadia	40	11 Miles North of St. Anthony
Blue Creek Reservoir #3	39	16 Miles North of St. Anthony
Last Chance Pond	35	1 Mile South of Last Chance
Golden Lake	50	In Harriman State Park
Horseshoe Lake	30	Near Southwest Corner of Yellowstone National Park
Swan Lake	≈30	3 Miles South of Silver Lake
Elk Creek Reservoir	25	1 Mile North of Island Park
Railroad Pond	25	1 Mile Northeast of Fish Pond
Sheep Creek Reservoir	25	1 Mile North of East End of Island Park Res.
Bishop Lake	20	West End of Island Park Res.
Blue Creek Reservoir #1	≈20	14 Miles North of St. Anthony
Robinson Lake	20	Southeast Corner of Yellowstone National Park
TOTAL	15,900	

≈ means about aka - also known as

Duck Creek - drains the north side of the Mount Jefferson-Sawtell Peak area and flows into the west side of Henrys Lake.

Targhee Creek - drains the small but rugged area northeast of Henrys Lake. The creek empties into the east side of Henrys Lake.

Moose Creek - originates near the Wyoming border and flows into Henrys Fork from the southeast at Macks Inn.

Buffalo River - originates from many springs east of Ponds Lodge and flows into the Henrys Fork just below Island Park Dam at an average rate of 170 cfs.

Split Creek originates along the Wyoming border and flows west before moving into the ground-water system east of the settlement of Island Park. Many of the Warm River springs originate from this water source.

Warm River - originates from many springs and highland runoff along the Yellowstone Park boundary. The spring sources give the river a uniform base flow. Warm River discharges into the Henrys Fork just after it drops off the Island Park plateau east of Ashton.

Fish Creek - one of the tributaries of Warm River.

Robinson Creek - originates in the southwest section of Yellowstone National Park and flows into the Warm River just above its mouth. Steep walls and a deep canyon make the middle part of this stream one of the most picturesque in the State.

Rock Creek/Porcupine Creek - are two significant tributaries of lower Robinson Creek.

Falls River (Fall River) - is a large tributary of the Henrys Fork. It has a highly variable flow with runoff equal to the Teton River and perhaps higher peak flows. The unregulated flow varies from an average monthly flow of over 2,000 cubic feet per second (cfs) in May or June to near 400 cfs in the fall and winter. The total runoff is quite large, averaging 600,000 acre-feet. This river drains a major portion of southwest Yellowstone Park. There are many fast water areas along this river with a timbered deep, picturesque, lava canyon above Boone Creek. The lower river is recessed in rolling farmland. Federal agency maps use the term Falls River, while the local people and earlier U.S. Geological Survey water publications use the name Fall River.

Boone Creek - a tributary of Falls River that originates in the northern portion of the Teton Range. Only the lower four miles are in Idaho.

Conant Creek - also originates in the northern portion of the Teton Range and flows into the lower Falls River.

Squirrel Creek - a major tributary of Conant Creek, both of which originate in Wyoming.

Teton River - a 60 mile tributary of Henrys Fork. The Teton River drains a large portion of the southern part of the basin. The river originates from many streams in the Teton Range in Wyoming. It flows through a wide, agricultural, high-mountain valley before entering a lengthy 600-foot deep canyon that transects an agricultural plateau. The Teton River discharges into the lower Henrys Fork River near Rexburg. This river is a major tributary of the Henrys Fork, along with the Falls River. The unregulated flows are very similar to those of Falls River.

Bitch Creek - originates in the Teton Range of Wyoming and flows into the Teton River. The Idaho portion of Bitch Creek is about 15 miles long and lies within a rugged canyon which is inaccessible over much of its length. The name comes from the French word biche meaning doe.

Badger Creek - also originates in the Teton Range of Wyoming and flows into the Teton River. Its drainage area is smaller than that of Bitch Creek.

Teton Creek - originates in the Teton Range of Wyoming near the Grand Tetons and flows into the Teton River near Driggs.

Trail Creek and tributaries - originate in the southern Teton Range of Wyoming at the southern end of the Idaho Teton Basin. Trail Creek is the most upstream source of the Teton River.

Canyon Creek and Calamity Creek - originate east-southeast of Rexburg in the Big Hole Mountains. Canyon Creek flows into the Teton River in the lower portion of the Teton Canyon.

Moody Creek - also originates southeast of Rexburg in the Big Hole Mountains and flows into the lower Teton River near Rexburg, below Canyon Creek.

Other scenic features related to water are incised canyons (see alson Table 21). The named canyons of the basin are listed below. The order of listing will be from north to south.

Table 21. Named Canyons

Name	Location
Garner Canyon	East of Henrys Lake Outlet
Carrot Canyon	North of West Side of Island Park Reservoir
Dry Canyon	North of Island Park Reservoir
* White Elephant Canyon	Southeast Side of Sawtell Peak
Black Canyon	East of Macks Inn
Box Canyon	Below Outlet to Island Park Reservoir
Cooney Canyon	Southwest of Island Park Reservoir
* Porcupine Canyon	Adjacent to Cooney Canyon
* Smead Canyon	Adjacent to Cooney Canyon
* Bear Canyon	Close to Cooney Canyon
* Green Canyon	Close to Cooney Canyon
* South Fork Split Creek Canyon	Near Yellowstone Park Boundary
* Trail Canyon	Upper End of Warm River
* Flat Canyon	Northeast of Settlement of Warm River
Trail Canyon	Northeast of Settlement of Warm River
* Anderson Mill Canyon	West of Lower Mesa Falls
* Hale Canyon	West of Settlement of Warm River
* De Witt Canyon	North of Ashton
* Box Canyon	North of Ashton
* Kerr Canyon	North of Ashton
* Putney Canyon	North of Ashton
* Jump Out Canyon	North of Ashton
* Coleman Canyon	North of Ashton
Teton River	Northeast of Rexburg
Bitch Creek	Northeast of Rexburg
Canyon Creek	East of Rexburg
Moody Creek	Southeast of Rexburg
* Dry Creek Canyon	Off Moody Creek
* Limekiln Canyon	Upper End of Moody Creek
Pole Canyon	South of Victor

* See 1:24.00 scale topographic maps

The open meadows and valleys surrounded by forest are admirable scenic assets of the upper portions of the Henrys Fork basin. Table 22 is a listing of the named valleys and meadows.

Table 22. Valleys and Meadows

Name	Location
Henrys Lake Outlet Valley	Downstream from Henrys Lake
Shotgun Valley	The North Side of Island Park Reservoir
Toms Creek Meadow	One Mile East of Island Park
North Antelope Flat	South of Eastern Island Park Reservoir
Antelope Flat	South of Eastern Idaho Park Reservoir
Putney Meadow	Three Miles South of Southwest Corner of Yellowstone Park
Moody Meadow	Upper End of Moody Creek
Teton Valley	Valley Surrounding Driggs
Thousand Springs Valley	West of Garns Mountain (W. of Victor)
Harriman State Park (Main River Ranch portion)	Below Island Park

Recommended Action

1. Protect natural vegetation along lake and reservoir shorelands as well as along natural and recreational river shorelands.
2. Encourage development set-backs to preserve both water quality and aesthetics along lakes, reservoirs, rivers and streams.
3. Encourage development of greenbelts along rivers in urban and rural areas.
4. Encourage protection of outstanding scenic resources including canyon environments.

Aquaculture

Aquaculture or the hatchery production of fish has been undertaken in the Henrys Fork Basin. The Ashton hatchery, operated by the Idaho Department of Fish and Game, is ranked seventh in size among the thirteen State of Idaho hatcheries which produce non-anadromous (non-ocean migrating) fish. The Ashton facility is the hatchery serving the Upper Snake River. The non-anadromous State of Idaho fish hatcheries and their percent of total production in pounds are listed in Table 23.

The water temperatures at the Ashton hatchery are a little cooler (52°F) than at the larger production facilities at Hagerman, American Falls, and Nampa (57-59°F), so the growth rates are slightly lower at Ashton. Other water chemistry measurements at Ashton are clearly within limits for good growth rates.

Table 23. Percent of State Hatchery Production of Resident Fish

Hagerman	34%
American Falls	17%
Nampa	17%
Grace	10%
Mackay	8%
Hayspur (Blaine County)	7%
Ashton	4%
Clark Fork (North Idaho)	2%
Cabinet Gorge (North Idaho)	1%
McCall -- Distribution Center	
Henrys Lake -- Egg Production	
Eagle -- Research Use	

The Henrys Lake hatchery, located on the east shore of Henrys Lake, is used almost exclusively for the production of cutthroat trout eggs which are shipped to other state hatcheries. Fish rearing at the hatchery would not be efficient because of the effect of water temperature (46°F) on growth rates.

The State of Idaho's Warm River Hatchery, located about eight miles upstream of the mouth of Warm River or about 22 miles northeast of Ashton by road, was closed about 5 years ago. The hatchery had a water temperature of 50°F. The hatchery was closed because of restricted available land at the site, the need for installation of pollution control equipment, and higher production costs than at other hatcheries.

There are 30 identified warm water sources in the Henrys Fork Basin with water temperatures in the optimum growth range of 60°F and higher. Generally, these water sources are located in the lower valley, particularly in the Rexburg to Newdale area. A second potential warm water area for aquaculture use is in the Island Park caldera, an approximately twelve-mile circular area bordering the south side of Island Park Reservoir and extending to the southeast. Deeper wells drilled in the area are expected to produce water of suitable temperature for fish culture. However, private land in the area is very limited and has a high value for recreation use. The harsh winter climate in the Island Park area is also a limiting factor.

There are specific water chemistry needs for aquaculture. A preliminary review of some water chemistry from current wells suggests the water chemistry may be satisfactory. The pH level is generally in the range of 7.6 to 8.0. Although a level closer to neutral (7.0) may be optimum, the pH level in itself generally is not a limiting factor. Most of these waters appear to have suitable alkalinity, specific conductance, ammonia and nitrate levels.

In summary, there appears to be potential for private aquaculture development in the basin, although, in most cases some pumping of water will be necessary.

Sources

George W. Klontz and John G. King, Aquaculture in Idaho and Nationwide, Idaho Water Resources Research Institute, 1974.

Idaho Fish and Game Facts, Idaho Department of Fish and Game, 1989.

John C. Mitchell, Linda L. Johnson and John E. Anderson, Geothermal Investigations in Idaho, Part 9, Potential for Direct Heat Application of Geothermal Resources, Idaho Department of Water Resources Water Information Bulletin No. 30, 1980.

Domestic, Commercial, Municipal and Industrial (DCMI) Uses

Domestic water generally refers to systems providing water to one or more suburban or rural private households. Commercial refers to private water systems that serve places of business, including schools. Municipal refers to public water systems for private households, places of business, small manufacturing plants, and irrigation of lands within municipal boundaries. Industrial refers to private water systems for manufacturing plants.

Relative to the large amounts of water diverted for irrigation or required for instream use for fish and recreation or for hydroelectric power production, a minor amount of water is used for domestic, commercial, municipal and industrial (DCMI) needs. In Idaho, and in the Henrys Fork Basin, food processing is the largest industrial use of water. There is some industrial water use associated with lumber manufacturing, however, the major DCMI use is generally associated with municipal water delivery systems. For more populous areas of the nation, DCMI use is significant. For the Henrys Fork Basin it is quite low (Table 24).

Table 24. 1985 DCMI Use (acre-feet)

	Rural Domestic		Domestic, Commercial, Municipal		Industrial		
	Withdrawn	Consumed (24%)	Withdrawn	Consumed (22%)	Withdrawn	Consumed (8%)	Rounded Total
Madison	500	120	3,000	660	400	30	
Fremont	40	10	1,300	290	800	60	
Teton	10		400	90	Minor	–	
Withdrawal	550		4,700		1,200		6,500
Consumption		130		1,040		90	1,300

Total withdrawal in 1985 for DCMI purposes was 6,500 acre- feet--virtually all from ground water. This 6,500 acre-feet is one-half of one percent (0.5%) of the amount diverted for irrigation use (1,153,000 acre-feet) within the Henrys Fork Basin. Total consumption was 1,300 acre-feet. Projections to the year 2010 indicate a 35 percent basin-wide population increase from 1983 population levels. A simplified water use projection would use a proportional increase in domestic, commercial, municipal and industrial water use relative to the population level increase. The projected total water withdrawal for DCMI use in 2010 therefore is 8,700 acre-feet with a total consumption 1,700 acre-feet. The incremental use is 2,200 (8,700-6,500) acre-feet diverted and 400 (1,700-1,300) acre-feet consumed.

Because of the very small future needs for DCMI water use within the basin, there should be little conflict in meeting future needs. The small amount of water needed to meet all anticipated future DCMI growth likely will be provided from new ground-water appropriations.

New withdrawals of ground water within the impact area of the Swan Falls Agreement (see Figure 8) would be part of the trust water assigned for future DCMI use. Ground-water withdrawals in parts of the basin not in the Swan Falls impact area (Idaho Code 42-203B) are regulated by the ordinary water appropriation criteria.

Recommended Action

Future DCMI water needs will likely be met using ground water. Large commercial or industrial water users may have to purchase existing water rights or rely on the water bank.

Sources

Goodell, S.A., 1988, Water Use on the Snake River Plain, Idaho and Eastern Oregon, U.S. Geological Survey Professional Paper 1408-E, pp. E37-E44

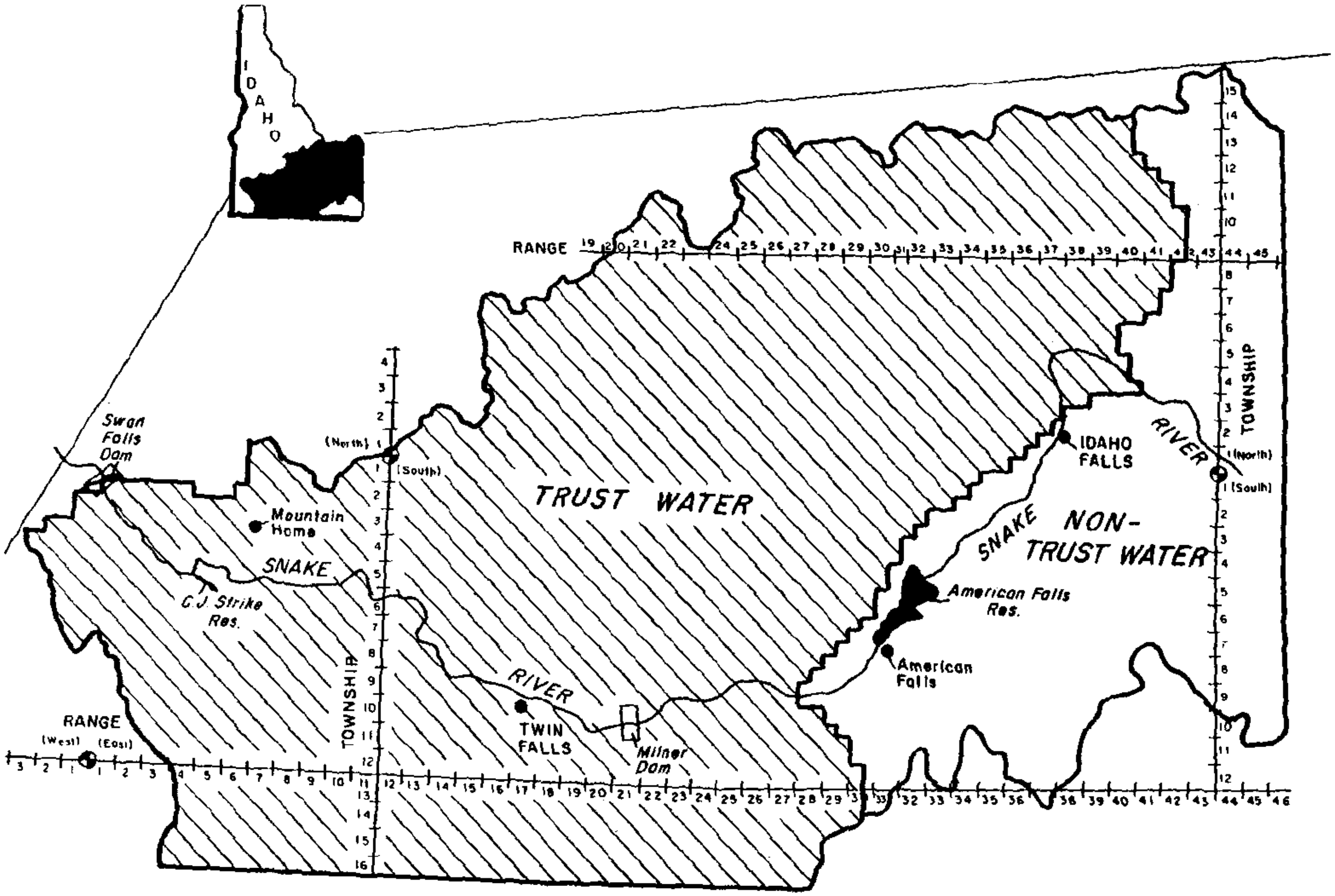


Figure 8:
Swan Falls Trust Water Area

Irrigation

Present Status

Irrigated agriculture and related food processing is the main economic activity in the Henrys Fork basin. Most crop production within the basin takes place in areas where mollisols are the general soil type. Mollisols of Idaho's highland plateau areas are similar to the fertile soils of the midwest, and the dryland farmed soils of the Moscow-Grangeville area of northern Idaho. Mollisols formed under considerable grass vegetation and generally are inherently fertile. They contrast to the aridisols of the lower main Snake River plain in that there is much less accumulated salts, lime, and clay and much more accumulated organic matter in the mollisols.

The primary agricultural product is potatoes. In the St. Anthony-Rexburg area this largely is fresh pack potatoes as well as some processing potatoes. Because of the shorter growing season in the St. Anthony-Ashton area and in Teton County, the potato acreage is largely seed potatoes. The primary rotation crops are barley and wheat, generally planted in the spring. In addition, significant livestock production occurs in all the basin counties.

The 1979 estimated total potentially irrigable and irrigated acreage as well as the water source and irrigation method are tabulated below by county (Table 25). A recent (1990) reanalysis using current inventory techniques shows the figures are quite close to being current.

Most of the potentially irrigable land is used for dryland grain production, of which 75 percent is spring barley. In Fremont County a minor amount of dryland potatoes are produced. The 1987 estimated acreages of irrigated land use by county are shown in Table 26. The other lands not listed by crop are largely wild hay, pasture and idle land. The barley, wheat and alfalfa lands, which support a livestock sector, are primarily a rotation crop for potatoes.

The increases in the amount of irrigated land between 1969 (a year in which data is available) and 1990 is noteworthy (see Figure 9). There have been significant changes in both surface-water supplied irrigation and ground-water supplied irrigation. Yet the largest change relative to the original acres is the ground-water supplied irrigation.

Table 25. Irrigated and Potentially Irrigable Acreage

County	Potential Irrigable	Total Irrigated	Irrigated Surface Water	Irrigated Ground Water	Irrigated Gravity	Irrigation Sprinkler
Fremont	87,000	124,000	104,000	20,000	23,000	101,000
Madison	73,000	113,000	60,000	53,000	41,000	72,000
Teton	47,000	84,000	71,000	13,000	13,000	71,000
TOTALS	207,000	321,000	235,000	86,000	77,000	244,000

Table 26. Acreage of Principal Crops

County	1987 Barley and Wheat	1987 Potatoes	1987 Alfalfa	1987 Other
Fremont	42,000	30,000	13,000	32,000
Madison	45,000	39,000	12,000	17,000
Teton	24,000	10,000	14,000	36,000
TOTAL	111,000	79,000	39,000	85,000

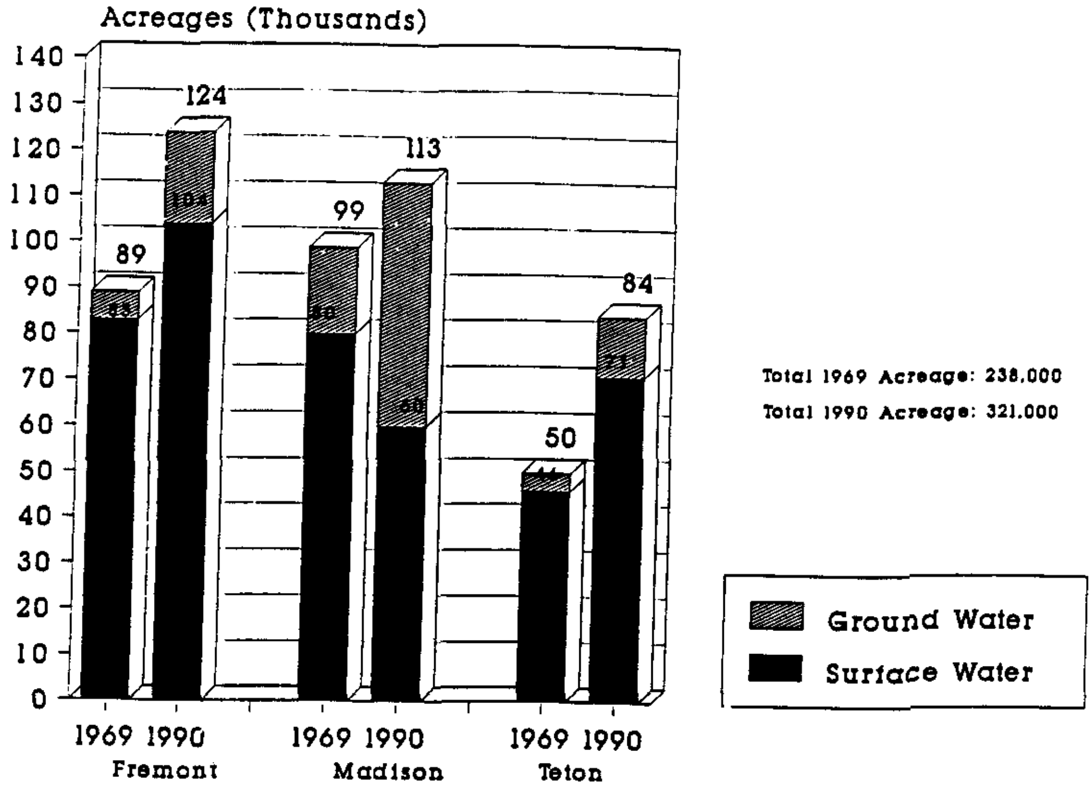


Figure 9. Increase in Irrigated Agriculture 1969-1990

Water Use

The acreages for the main diversion for most of the surface-water irrigated land in the lower Henrys Fork Valley are tabulated in the water supply section. The general location of all surface-water irrigated land and ground-water irrigated land is shown on the maps located toward the end of this section. Also shown are the potentially irrigable lands by a soil land classification rating of 1, 2 or 3.

The Henrys Fork, Lower Teton and Falls River water users are organized into the Fremont-Madison Irrigation District. They collectively have contracted all the storage in Island Park Reservoir and Grassy Lake Reservoir. These two reservoirs are owned and operated by the U.S. Bureau of Reclamation. Six irrigation companies within the irrigation district own and operate the Henrys Lake storage. The many irrigation companies own separate natural flow rights with differing priorities on streams within the basin. Storage reservoirs have water rights with priority dates interspersed with the priority dates of the natural flow rights. The amount of water diverted from natural flow or storage for each right holder is accounted for by Water District 01 (not an irrigation district) which has responsibility for administering water rights within the Snake River Basin above Milner Dam.

Center pivot irrigation in the Henrys Fork Basin.

During the late summer of a low water year, the Fremont-Madison Irrigation District water users continue to divert available natural flows; although, the natural flow rights belong to users below the mouth of the Henrys Fork because of earlier priority dates. This diversion of natural flow in lieu of release of Island Park or Henrys Lake storage is allowed up to the amount of such storage remaining. This water is made available to the lower users from storage water in American Falls Reservoir, Jackson Lake or Palisades Reservoir. The volumes released are charged against the Henrys Fork reservoir for accounting purposes. Thus, through exchange, part of the Island Park Reservoir and Henry's Lake storage may belong to downriver water users. If the reservoirs used in the exchange process fill during the subsequent water year, the water debt is canceled.

However, during a sequence of dry years a large share of Island Park and Henrys Lake storage could be held by others. To meet local storage water needs the Fremont-Madison Irrigation District would need to purchase rental pool water. The current rate is $2.75 per acre-foot. The rental pool is a yearly assignment of storage water by individual canal companies or groups in Water District 01.

As additional demands are placed upon the main-stem Snake River reservoirs, such as winter hydroelectric releases of rental water, there is a reduced chance of fill of these main-stem reservoirs. A last-fill rule assigned to nonirrigation rental water used below Milner Dam protects the Henrys Fork users from being impacted by additional rental water use. Irrigation companies that placed water into the rental pool that is used below Milner Dam are given a later fill for that portion of their allotment.

The following is a U.S. Bureau of Reclamation discussion of how they operate the federal water storage system in conjunction with natural flow water rights:

The Henrys Fork reservoirs are operated along with other Snake River reservoirs to enhance refill capabilities in subsequent years. Natural flows of the Henrys Fork tributaries often provide most of the water demanded for irrigation by direct diversion on the Henrys Fork even after the natural flow rights of these diversions are superseded by earlier rights downstream from Rexburg (downstream from the confluence of the Henrys Fork and Snake River). During the period when water diverted is rightfully stored, downstream demands entitled to natural flow are supplied from Snake River storage facilities.

Stored water is physically maintained in the farthest upstream reservoir in the system while storage use is accounted for according to ownership and contracted space. As the reservoirs are refilling during the subsequent winter, having the water upstream from where it was originally accrued by storage right allows maintenance of streamflows as the water is physically delivered to the correct storage right reservoir.

Having the water upstream also allows water to revert to the rights of the reservoir in which it is held at a rate greater the actual inflow to the reservoir once senior storage rights have filled. If water was held downstream and these reservoirs were filled, runoff occurring below upper basin dams would have to be bypassed and would be lost to the basin.

Since water is held upstream, once the water rights are full, inflow can accrue to upstream storage at the rate of inflow to the downstream reservoir. Federal storage contracts provide for the storage of water from other reservoirs in otherwise empty space. Therefore, water held in the upstream reservoir does not require replacement (from the rental pool) unless it is subsequently diverted. This rarely occurred prior to 1987, however, this practice has been repeated recently and is becoming accepted as standard practice.

Once all reservoirs are full, all the storage rights, regardless of how the water physically got there, are full. Because reservoirs have filled in most years in the Upper Snake River some misunderstandings have developed. Mainly the notion that if American Falls fills, then Henrys Fork reservoirs are entitled to their entire contents has been accepted as fact by many observers.

A more accurate statement is, "once the American Falls water right is filled on paper, regardless of physical contents, then Henrys Fork reservoirs will accrue water to their rights at a rate in excess of their inflows."

When a succession of dry years causes Fremont-Madison Irrigation District canals to divert more storage than they are entitled to, the excess must be purchased from the Upper Snake River Rental Pool. The pool is operated so that irrigators who have water supplies surplus to their present needs can share with those who run short.

After the needs of irrigators are fulfilled remaining water is available to uses below Milner Dam which historically has been utilized by power interests. Irrigators supplying water to the pool may stipulate that their water will not be used below Milner.

Space from which water is used below Milner reverts to last priority in it's refill in the ensuing year because use below Milner is an expansion of the purpose for which the stored water was originally appropriated. This last to fill provision protects the rights of others including Fremont-Madison Irrigation District.

The surface irrigation systems in the Ashton-Rexburg area divert from the Henrys Fork, Falls River and the Lower Teton River as shown in Table 27.

The Crosscut Canal takes water from the Henrys Fork and provides one-third to one-half its flow to the Fall River Irrigation Co. The remaining Crosscut Canal water is diverted to the Teton River above most of the Teton River diversions. Crosscut Canal flows are accounted for in the canal of the ultimate use.

Supplemental Water Needs

The average water diversions for the recent good water years of 1983, 1984 and 1986 is assumed to represent a full water supply. 1988 was a low water year. A rough estimate of the 1988 supplemental water needs can be made by subtracting the actual 1988 diversions from the average good water year diversion (Table 27). A review of rental pool transactions for 1988 shows about one-third of the estimated needs were provided by rental pool leases.

The use of other mechanisms to reduce water use perhaps should be considered. For example, placing some grain ground in a year-to-year government program for payment when no crop is harvested may return nearly as much net income as harvesting a full crop. Grain still might be planted and the limited forage plowed under as a rotation for potatoes. The grain forage may or may not receive one early irrigation.

Another drought-year tactic is to only irrigate hay for the highest yielding first cutting and then market or otherwise use the higher-value, late-season water. A year like 1988 in which a number of companies did not have a full water supply occurs with some regularity (an average of two years in ten). A much greater shortage occurred in 1977. The basinwide shortage of 45 percent had not occurred since the water-short years of 1931 and 1934, which gives it a reoccurrence interval of one year in twenty.

To provide facilities which furnish a full water supply for all users in all years would be quite costly. The U.S. Bureau of Reclamation (USBR) uses a guideline of an allowable shortage of up to 50 percent in any one year, up to an accumulated shortage of 75 percent in two consecutive years, or up to an accumulated shortage of 100 percent in a consecutive ten-year period. The Henrys Fork basin, on average, has a sufficient water supply using this guideline.

The basic economic supply-demand curve provides a graphical view of the difficulty of supplying a 100 percent long-term water supply. The graph (Figure 10) is drawn in general terms in order to show the basic economic principle. The cost per acre-foot of water becomes very expensive as efforts are made to approach a 100 percent supply. At the same time, the willingness to pay for new water decreases as the total quantity approaches 100 percent. Where supply and demand balance is an estimate of economic reasonableness. This is rarely at a 100 percent supply. Figure 10 is drawn for illustration purposes only and is not intended to represent current Henrys Fork conditions.

Table 27. Lower Henrys Fork Basin Diversions (acre-feet)

	1986	1984	1983	Average 1983-84&86	1988	Average less 1988	1977	Average less 1977
Henrys Fork								
Dewey	6,700	4,378	3,658	4,912	4,681	231	2,360	2,552
Last Chance	27,300	27,900	23,300	26,167	26,321	0	12,850	13,317
Farmers Friend	44,300	55,100	44,600	48,000	27,336	20,664[a]	8,650	39,350
Twin Groves	34,700	57,800	53,300	48,600	24,157	24,443[a]	17,830	30,770
St. Anthony Union	161,400	164,800	156,400	160,867	155,166	5,701	115,370	45,497
Salem Union	64,300	66,900	61,500	64,233	61,339	2,894	41,250	22,983
Egin	109,300	121,600	105,800	112,233	103,624	8,609	80,360	31,873
St. Anthony U. Feeder	28,700	46,400	37,800	37,633	27,328	10,305[a]	29,210	8,423
Independent	106,500	114,600	122,400	114,500	121,740	0	28,000	86,500
Consolidated Farmers	78,800	91,500	96,600	88,967	69,910	19,057[a]	47,270	41,697
Crosscut Canal	55,600[b]	54,900[b]	63,600[b]	58,000[b]	128,100[b]	(70,100)[b]	78,900[b]	(20,900)[b]
Subtotal	662,000	750,978	705,358	706,112	621,602	91,904	383,150	322,962
Falls River								
Yellowstone	3,136	1,561	2,172	2,290	3,506	0	1,468	822
Marysville	30,300	27,100	27,300	28,233	24,523	3,710	24,250	3,983
Farmers Own	18,900	16,600	15,800	17,100	15,034	2,066	11,590	5,510
Conant Creek	3,463	1,613	3,187	2,754	3,919	0	2,696	58
Boom Creek	512	280	327	373	695	0	850	0
Squirrel Creek	2,158	2,269	2,596	2,341	1,755	586	1,092	1,249
Orme	123	79	234	145	815	0		145
Enterprise	20,000	20,700	22,700	21,133	25,004	0	20,100	1,033
Fall River	86,800	118,450	95,800	100,350	87,074	13,276[a]	66,800	33,550
Chester	15,100	25,700	25,600	22,133	8,376	13,757[a]	4,890	17,243
McBee	500	780	964	748	113	635	61	687
Silkey	4,748	3,717	3,453	3,973	5,855	0	3,650	323
Curr	17,200	16,600	13,300	15,700	12,135	3,565[a]	9,840	5,860
Subtotal	202,940	235,449	213,433	217,274	188,804	37,596	147,287	70,464
Lower Teton River								
Canyon Creek	5,845	6,659	6,159	6,221	4,050	2,171[a]	1,590	4,631
Wilford	42,200	51,200	69,500	54,300	33,840	20,460[a]	14,960	39,340
Teton Irrigation	23,100	16,100	21,500	20,233	22,102	0	18,140	2,093
Siddoway	1,388	0	0	463	2,477	0		463
Pioneer	2,860	2,660	3,810	3,110	2,959	151	282	2,828
Stewart	3,543	2,233	1,884	2,553	2,786	0	930	1,623
Pincock-Byington	2,817	4,846	3,697	3,787	1,806	1,981[a]	1,154	2,633
Teton Island Feeder	121,700	117,200	130,500	123,133	95,763	27,370[a]	55,690	67,443
North Salem	1,972	502	0	825	1,364	0	48	777
Roxana	5,006	4,098	5,000	4,701	6,087	0	2,610	2,091
Island Ward	7,817	5,617	7,884	7,106	7,711	0	3,130	3,976
Saurey-Sommers	4,046	4,229	4,157	4,144	6,087	0	3,090	1,054
McCormick-Rowe	345	329	272	315	464	0	103	212
Pincock-Garner	1,999	4,699	2,531	3,076	2,665	411	958	2,118
Bigler Slough	1,115	1,797	2,148	1,687	537	1,150[a]	80	1,607
Woodmansee-Johnson	2,462	3,364	2,586	2,804	1,705	1,099[a]	1,610	1,194
City of Rexburg	5,546	6,760	6,383	6,230	3,929	2,301[a]	2,450	3,780
Rexburg Irrigation	54,500	42,300	45,200	47,333	55,883	0	39,310	8,023
Subtotal	288,261	274,593	313,211	292,022	252,215	57,094	146,135	145,887
Total	1,153,201	1,261,020	1,232,002	1,215,408	1,062,621	186,594	676,572	538,836

[a] Significant 1988 Shortages.
[b] Crosscut Canal numbers not included in Henrys Fork subtotal.

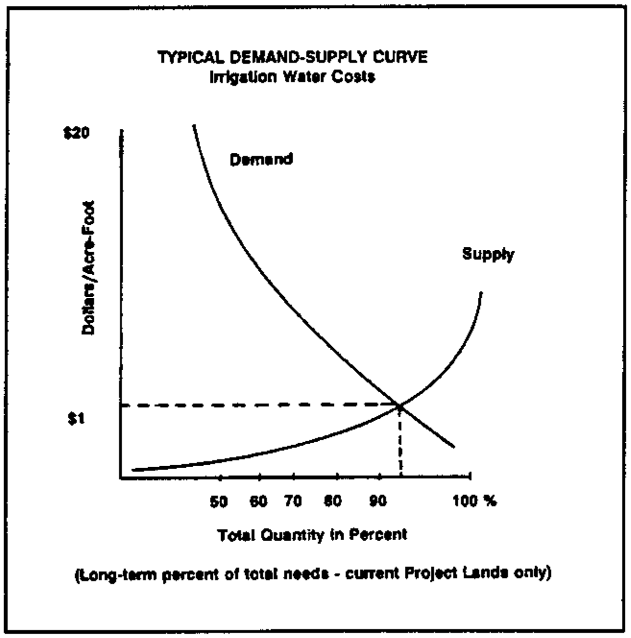


Figure 10. Typical Demand-Supply Curve

Various mechanisms have been proposed for the Henrys Fork Basin to provide a supplemental water supply. For years, the most discussed approach has been to construct new surface-water storage at the Teton damsite. Several other potential surface-water storage sites are discussed in the water supply chapter of this plan.

Recent reevaluations of the Teton site have indicated that costs would exceed benefits for any federal project likely to be built. Only limited project benefits could be credited to water used for supplemental irrigation. The same circumstances are likely to apply at other sites within the basin.

Another constraint on developing new water-storage sites is the lack of unappropriated water in the basin. Existing reservoirs downstream as far as American Falls on the Snake River would all have water rights senior to any new development. As opportunities to lease water from the water bank increase, the amount of water "carried over" in existing reservoirs will decrease. These senior reservoirs would have to fill before water for new storage would be available.

More efficient use of water (e.g. conversion to sprinkler) may result in reductions in the amount of water diverted from basin streams and reservoirs, perhaps making more water available for new storage. The Fremont-Madison Irrigation District, in cooperation with the Bureau of Reclamation, is currently reviewing their water use and operations. The review could lead to a quantification of supplemental irrigation needs and identify ways to improve water use efficiency. The impacts of new ground-water consumption within the basin will have to be considered. There may be a reduction in surface-water availability within the basin because of ground-water use.

Water Savings

Typical irrigated crops in the basin consume 20-30 percent of the water diverted. An enclosed water-delivery system would reduce water losses. Such a system would practically eliminate transportation losses from the open-ditch systems. Open-ditch transportation losses typically range from 20 percent to 30 percent of the river diversion amounts. This is a sizeable amount of water; although, on-farm losses are larger, ranging from 35 to 60 percent of the river diversions on a large canal system. Small amounts of the river diversions pass through the canal and return directly to the river. A small amount of water is consumed by water evaporation and phreatophytes. Any reduction in transportation losses would be beneficial during a dry water year. However, the cost per acre-foot of water saved would be quite high.

The Marysville, Yellowstone, Squirrel Creek, and Conant Creek irrigation companies investigated a joint gravity pressure distribution system in 1981. The proposed project assumed a zero interest loan from the U.S. Bureau of Reclamation, and separately funded hydroelectric facilities. Even with significant water savings and a revenue stream from power production, the likely benefits were not felt to justify the costs at that time.

Significant increases in the financial benefits from water conservation will require changes in Idaho water law. Provisions barring expansion of use, restricting the transfer of priority date, protecting third parties from damage, and loss of ownership through lack of use need to be addressed before conserving water will be truly attractive to water users in Idaho. Assuming that these questions will be addressed over time, there are opportunities in the basin for significant water savings.

Most analyses shows a more cost-effective method would be to provide for more efficient on-farm water application methods. A major shift to sprinkler irrigation has been occurring within the basin. Any increase in the financial incentives associated with water conservation would likely accelerate the shift to sprinklers in the basin. Water is a relatively inexpensive commodity in the basin, except during periods of prolonged drought. Few other non-farm water efficiencies are being adopted at this time.

Water Safety

Large open-ditch water transport systems are a very economical method of transporting water over long distances. There generally is no electric or other power need. Unfortunately, deaths in canals are a usual occurrence in Idaho. Seven lives were lost in 1988, and six more in 1989. Covered or fenced ditches would have been an impossible expense when these systems were built years ago. In most areas there have been few, if any, safety changes to these transport systems. In urban areas a few smaller ditches have been covered.

Fencing and covering ditches are practical safety measures in some areas. However, large laterals and canals are sometimes used for recreation. Fencing and covering these canals would restrict public access. If canal companies encourage recreational use, they could be subject to liability actions.

Another component of a water safety program is public awareness of irrigation ditch hazards. The Idaho Water Users Association has an Otto Otter elementary education program which largely centers on classroom instruction to third grade students. The school contact is arranged by the local irrigation organizations. Although this Otto Otter program is widely used in southwestern Idaho, it is little used in the Henrys Fork basin.

There are other public awareness approaches. Periodic public announcements of water safety hazards are important. The recreation chapter touches on a greater use being made of a learn-to-swim campaign. Part of the solution rests with the water delivery organizations and part of the solution rests with the public, including public officials and the school systems.

Potential for New Irrigation

The Henrys Fork Basin has a substantial amount of land suitable for irrigation development. The 197,000 acres shown in Table 28 is broken down by land class. In addition to soil suitability, the potential for irrigation development depends on the cost of water.

The soil classes identified in the table were evaluated about 25 years ago using criteria which do not fully reflect the economic feasibility of current sprinkler application methods. An updated classification would probably upgrade many of the Class III and IV soils.

Lands identified as Class IV (non-irrigable) may be developable with current technology. The 25 year old data show Class IV lands predominately in the Sand Creek-Camas Creek Plateau located north of the Henrys Fork and northwest of St. Anthony. Recent U.S. Soil Conservation Service (SCS) mapping, which uses climate as a criteria, also placed these soils in a Class IV designation. This is also the case for some of the higher productivity silt-loam soils (#93 Fremont County). If the SCS did not use climate as a criteria, these soils generally would be mapped as Class III. Figure 17 results from the recent SCS mapping of Fremont County. For the entire county, if climate was disregarded, the classification generally would be upgraded one class rating and in a few places by two classes.

Table 28. Irrigable Acres by Class

	Class I	Class II	Class III	Total
Fremont	18,000	55,000	13,000	86,000
Madison	24,000	32,000	7,000	63,000
Teton	15,000	28,000	5,000	48,000
TOTAL	*57,000*	*115.000*	*25,000*	197,000

U.S. Bureau of Reclamation soils classification criteria do not downgrade soils because of climate. Because of the potential high economic return from these soils as illustrated by the current potato production in the adjacent Hamer area, these described SCS Class IV soils in the Sand Creek-Camas Creek area might more appropriately be shown as Class III soils.

Areas of currently irrigated and potentially irrigable land within the basin are shown on Figures 11-17. There are three areas that appear to have the greatest potential for further irrigation development. These are the Drummond-Lamont area, the Canyon Creek dryland farmed area and the Camas Creek Plateau area. In the higher elevation reaches of all these areas, potato production would primarily be for seed use.

The most extensive of these developable areas is the Drummond-Lamont dryland farmed area and its lower elevation westward extension. In this area ground water in sufficient quantities for irrigation appears to be difficult to develop. As mentioned in the water supply section, a ground-water study of the area is needed. Well enhancement techniques that are used in the petroleum industry have been used where water well yields are low, but water is highly valued. Future development in this area may require the application of such techniques (e.g. hydrofracing or using explosives).

The most obvious method of providing irrigation water to the Drummond-Lamont area is by supplying surface water via canal. Several off-stream storage sites as well as a Falls River site are discussed in the water supply section. An accompanying long-term lease of rental water would be needed.

A second small area that has potential for some additional irrigation development is in the Canyon Creek area. A few of these lands that lay just south of the Teton River could be served by high-lift pumping from the Teton River. Replacement water or new water developed upstream would be needed during most periods. Although highly controversial, one source might be ground-water pumped into the Teton River at the lower end of Teton Valley. Most of the higher ground would need an elaborate water supply. Some water is available for new storage from Canyon Creek; however, some imported water, probably from the upper Teton River, would need to be placed in off-stream storage for use on these lands.

The third area that has potential for further irrigation development is on the Sand Creek-Camas Creek Plateau. As described previously, these lands were identified as Class IV lands. That classification is because the soil has a higher than standard amount of sand. These generally are loamy sand and sandy loams. The contradictory nature of the classification is that this soil generally is very good for the growing of high value potatoes under sprinkler irrigation. Water can be provided directly from underlying ground water, although consumption here may impact the Mud Lake area. No extended arrangements need be made for canal systems, storage reservoirs or for exchange arrangements.

The main controlling factors are the adequacy of the water supply effect on other users, public interest criteria, and the cost for power to lift the water. Much of the area appears to have water lifts in the 300 to 600 foot range (see the depth to ground-water map located in the water-supply section). The overlying land generally is controlled by the Bureau of Land Management. A transfer into private ownership would be needed.

In addition, there currently is a moratorium on approving new wells within the Sand Creek-Camas Creek Plateau. The moratorium will last at least until 1993 when a U.S. Geological Survey (USGS) study of the impacts of new development on the water available at Mud Lake is completed. It would have been useful if the study also investigated the impact on Mud Lake of reduced gravity irrigation in the Egin Bench-Rexburg area. This might be helpful as a sequel to the study.

Perhaps of lessor importance, but still a barrier to development, is the trust water area set-aside as part of the Swan Falls Agreement (Idaho Code 42-203C). The Swan Falls impact area includes all ground water tributary to the Snake River below Milner Dam including the Thousand Springs source water. This source area extends into the Henrys Fork Basin (Figure 8). The criteria for allowing ground-water development in the trust water area, including water wells in the Lower Henrys Fork Basin, is whether the development affects the minimum stream flow at the Murphy gage below Swan Falls Dam. Additionally, development per year in the trust water area is limited to no more than 80,000 acres in any four year period. Public interest criteria which must be considered include the direct and indirect benefits to the economy, the project economic impact upon electric rates and the cost of alternate energy sources as well as the promotion of the family farming tradition.

On May 15, 1992 the Idaho Department of Water Resources established a moratorium on the processing and approval of permits for new consumptive uses of ground or surface water in the Snake River Basin above Weiser, Idaho. The moratorium does not apply to applications for domestic purposes. This action is in response to six consecutive years of drought, and will likely be withdrawn when streamflows return to normal levels.

Recommended Action

1. Encourage the development of new irrigation where environmental concerns can be met.
2. Promote new irrigation development on the Class IV lands north and northwest of St. Anthony which appear to overlay an excellent supply of ground water.
3. Encourage ground-water development where conjunctive use problems with surface water do not arise or where the conjunctive use problems can be mitigated.
4. Support incentives for the efficient use of water.
5. Encourage increased irrigation canal safety, through structural improvements, through public awareness and through learn to swim programs.
6. Develop measures and identify funding sources to provide supplemental irrigation water.
7. Quantify the need for a supplemental water supply for water short years on presently irrigated lands for each irrigation company. For shortages not capable of being met from the rental pool, a cost analysis of methods to meet the shortages should be developed.
8. Educate the public about existing water use practices in the basin and the water law that constrains both use and changes in use.

Figure 11: Irrigated and Potentially Irrigable Land - Egin Bench, Rexburg-Wilford, and Rexburg Bench

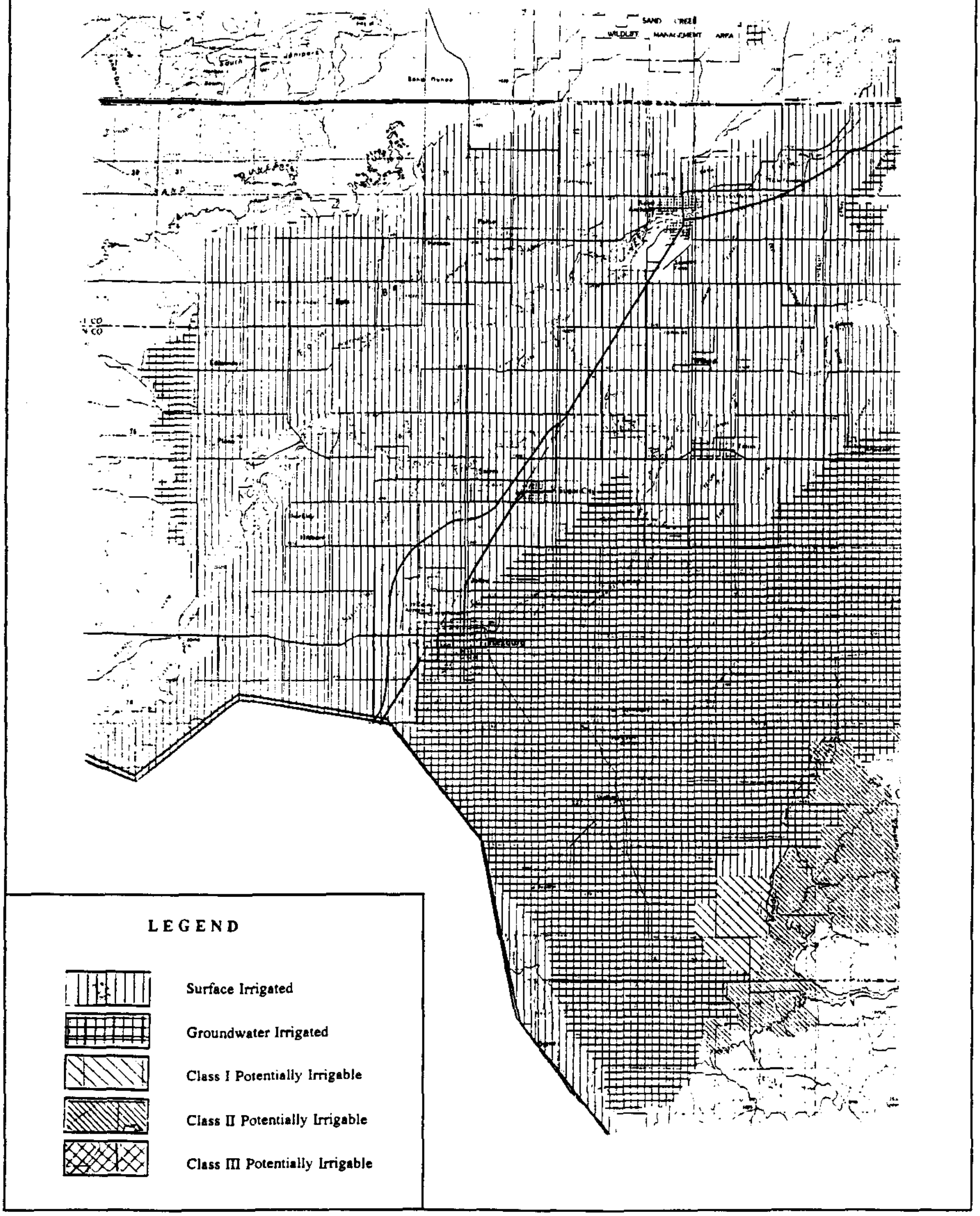


Figure 12: Irrigated and Potentially Irrigable Land - Canyon Creek and Eastern Rexburg Bench

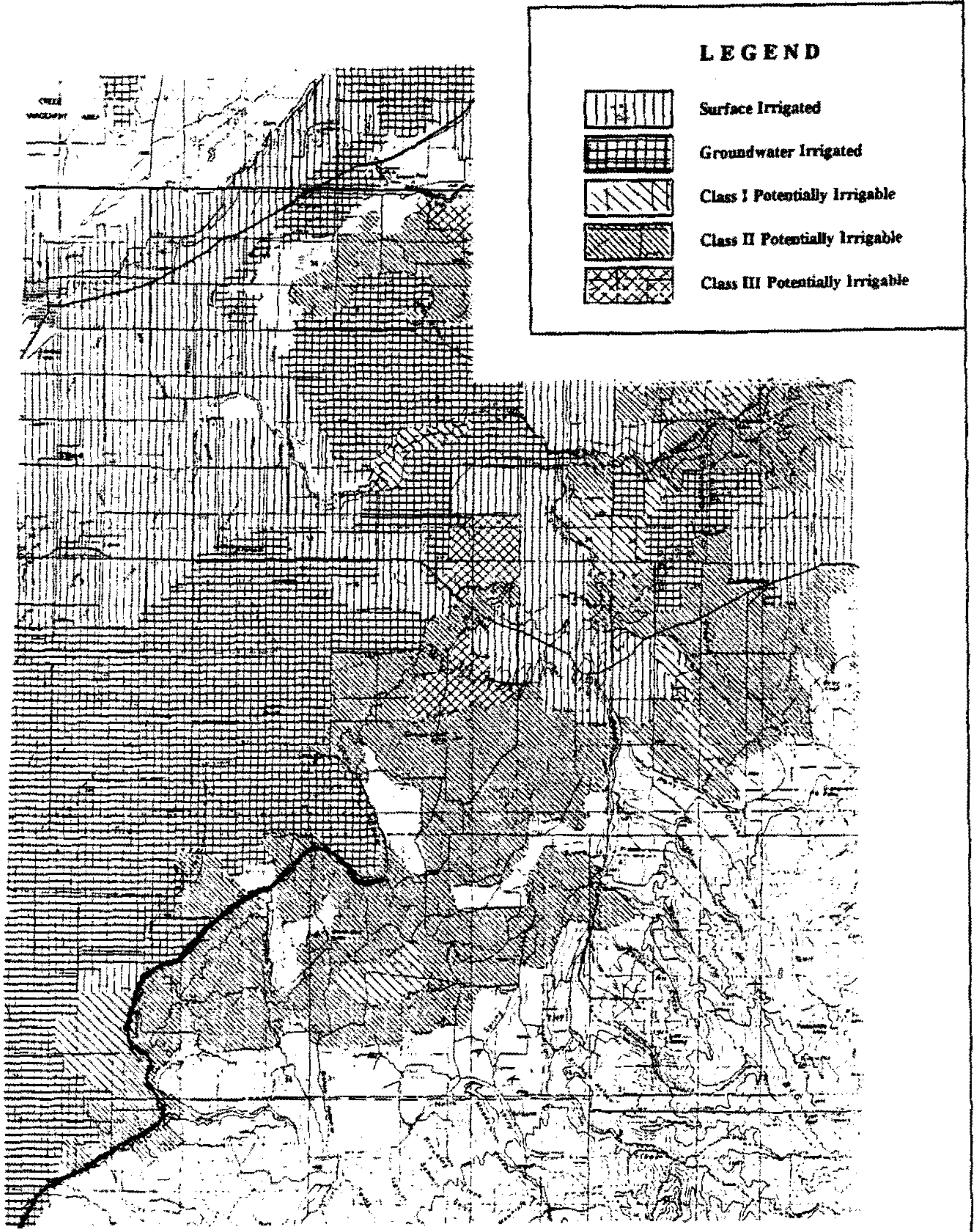


Figure 13: Irrigated and Potentially Irrigable Land - Teton Basin

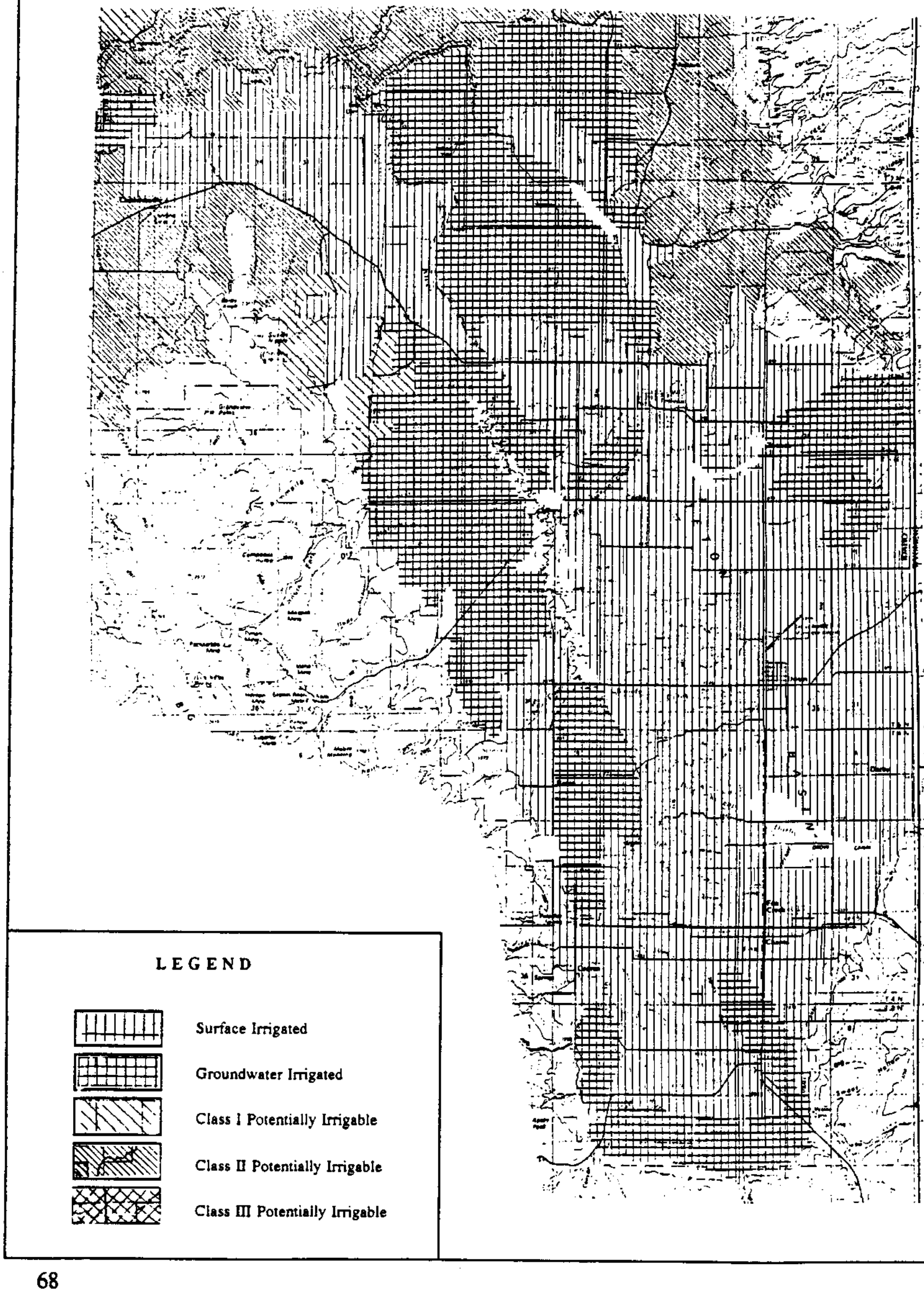


Figure 14: Irrigated and Potentially Irrigable Land - Ashton and Drummond-Lamont Plateau

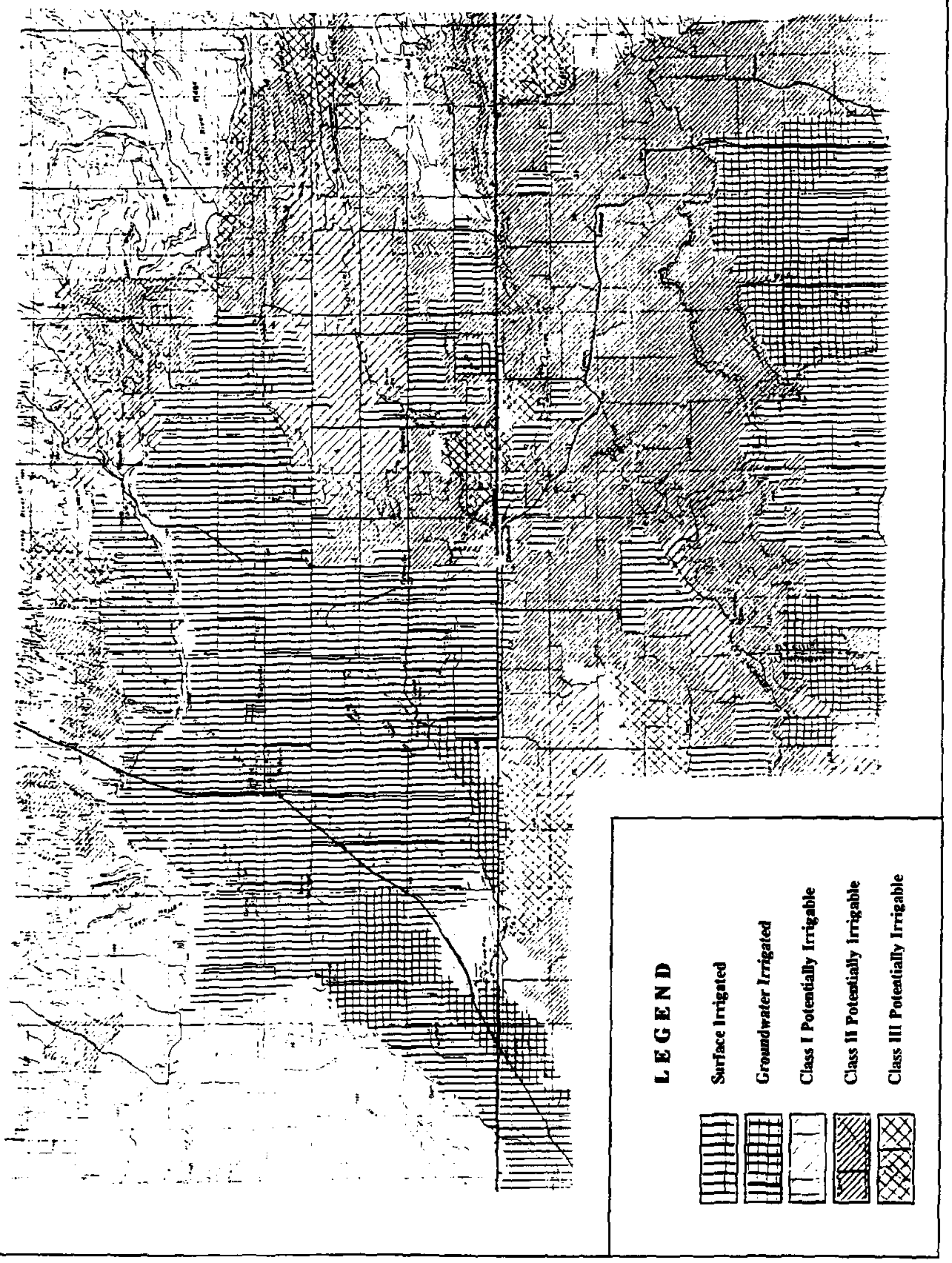


Figure 15: Irrigated and Potentially Irrigable Land - Island Park Reservoir

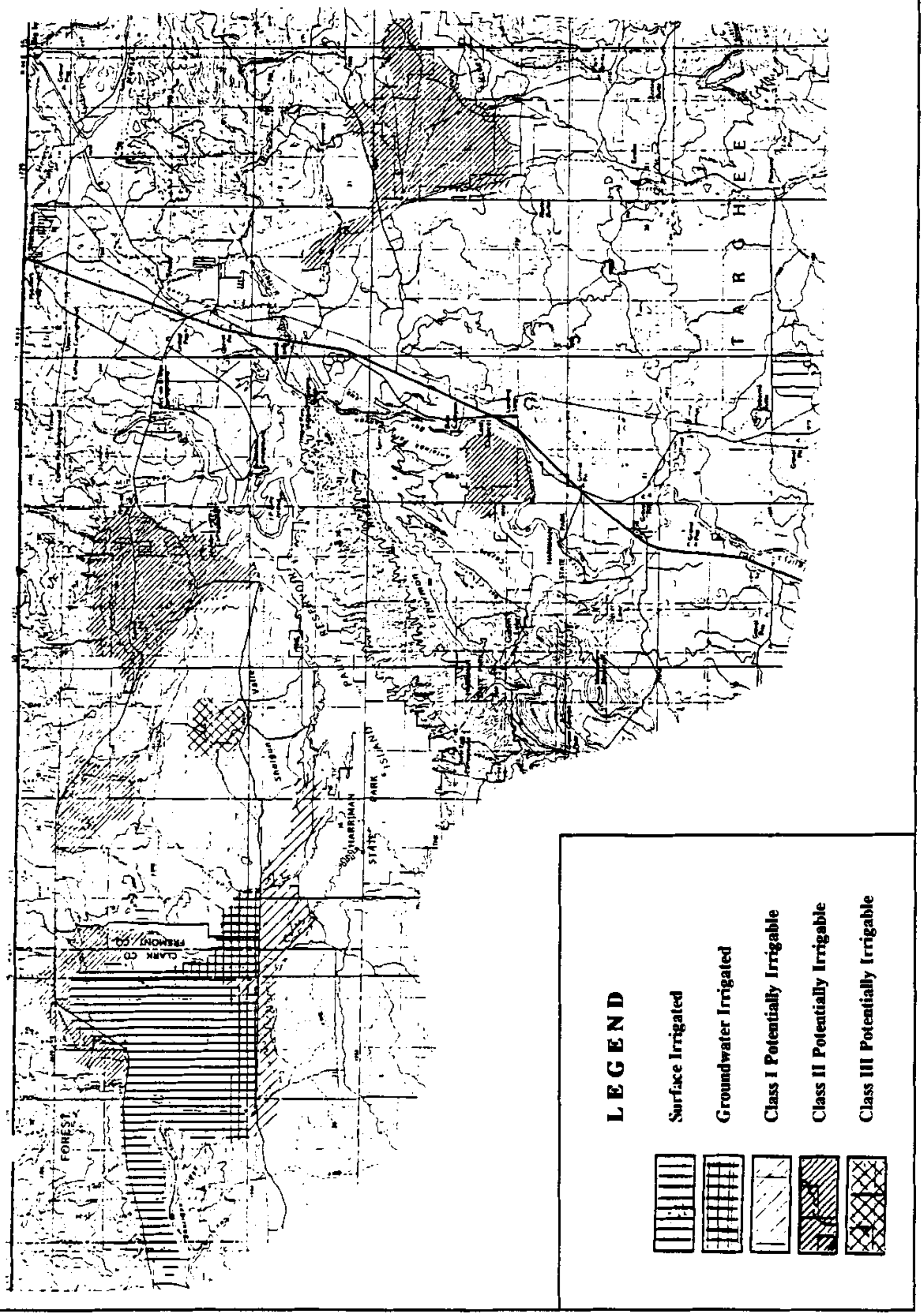


Figure 16: Irrigated and Potentially Irrigable Land - Henrys Lake

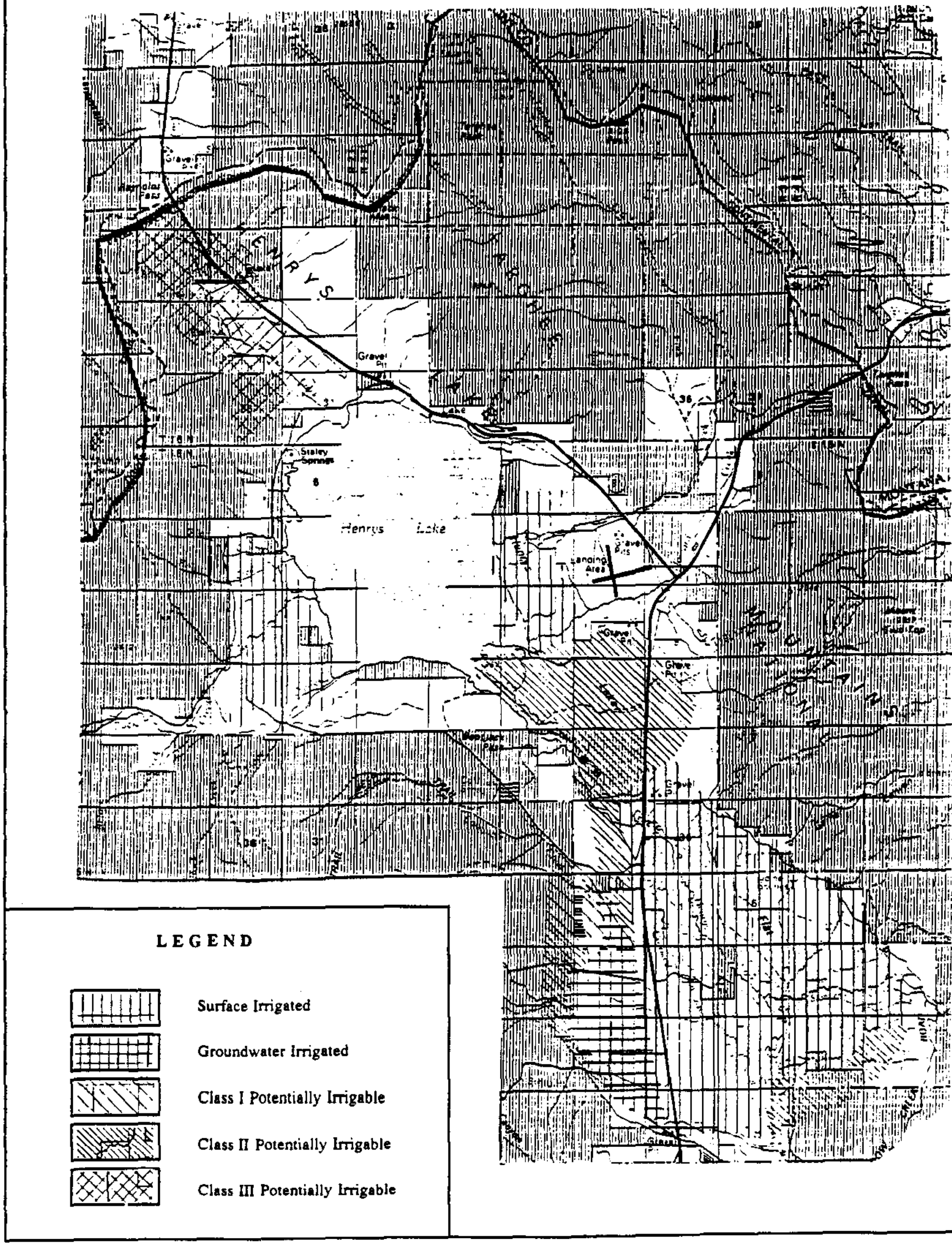
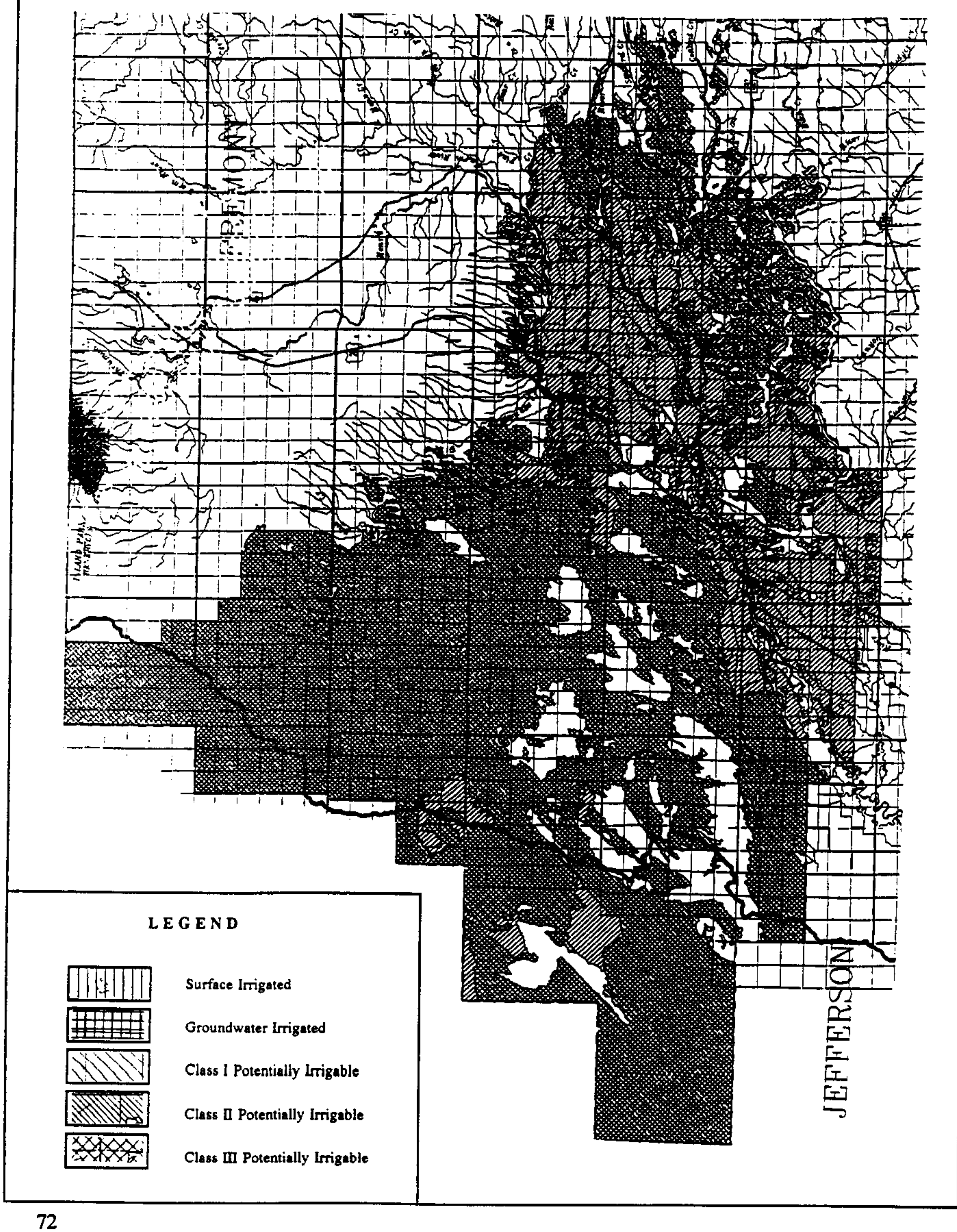


Figure 17: Irrigated and Potentially Irrigable Land - Sand Creek and Camas Creek Plateau



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Livestock Water

The 1988 inventory of livestock in the basin is shown in Table 29. As a general rule, the State of Idaho allows 12 gallons of water per day per head for beef cattle, horses, and mules. Up to 35 gallons per day per head may be appropriated for dairy cows. Four gallons per day may be used for each hog, while goats and sheep are limited to no more than two gallons per day per head. A more conservative, and perhaps more realistic estimate of stockwater use (USGS Circular 1001) assumes summer water use for cattle is nine gallons per day with winter use at one-half that amount. The average water use, therefore, is three-fourths the summer use (6.75 gpd). Feeder cattle and calf use is reduced to three-fourths of that amount (5 gpd) because of their reduced average size from adult cattle. The equivalent of five sheep and hogs per cow for water use is assumed. Sheep and hog usage also is reduced by one-quarter because of the inclusion of all age groups in the numbers given. One sheep or hog, therefore, needs approximately one gallon per day. The total livestock water usage shown in Table 29 for 1988 was 440 acre-feet per year. A consumptive use rate of 86 percent (USGS Circular 1001) gives a consumptive use of 380 acre-feet.

Table 29. 1988 Livestock Numbers and Water Usage

	Beef Cows	Dairy Cows	Feeders & Calves	Sheep	Hogs
Madison	9,800	2,200	15,000	3,900	1,090
Fremont	8,700	1,800	11,500	11,000	630
Teton	4,900	1,700	5,900	15,000	30
TOTAL	23,400	5,700	32,400	29,900	1,750
Present water usage in AF	177	43	184	34	2
Total = 440 AF					
Future water usage in AF	236	57	245	68	4
Total = 610 AF					

Current Idaho cattle numbers are about 75 percent of the peak for the last 15 years, while sheep and hog numbers are less than one-half the previous high. It is possible livestock numbers could return to these peak values. Future water use is projected to be equal to the historic high. This gives a Henrys Fork Basin livestock water use of 610 acre-feet per year or a consumptive use of 520 acre-feet.

Livestock water use is very low relative to other uses. For accounting purposes, the Idaho Department of Water Resources assumes livestock consumptive use to be inconsequential. Using the U.S. Geological Survey's numbers, current livestock consumption might increase by 140 acre-feet to a total of 520 acre-feet.

Recommended Action

1. Encourage livestock operators to file a claim for instream watering rights where there are or potentially will be upstream water users.
2. Educate livestock operators on the requirement that any stream-bank construction to alter the natural drinking pattern done after 1971 requires a water right.
3. Provide for instream watering of livestock in such a manner as to limit erosion, pollution and interference with instream recreation.

Sources

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Mining

There are some potentially commercial mineral deposits in the Henrys Fork Basin, however commercial production currently occurs only on a sporadic basis other than for sand and gravel extraction. The primary use of sand and gravel is for road construction. The 40 to 60 developed deposits, appear to be sufficient to serve local needs. Two quarries located east of Rexburg also provide crushed basalt for road aggregate. To produce asphaltic concrete, some nonconsumptive water is used for washing the crushed aggregate. Local construction also uses a minor amount of sand, gravel, and water for concrete production.

Local coal deposits have been mined sporadically in open-pit operations. The best quality deposit in Idaho occurs at the headwaters of Horseshoe Creek, located ten miles west of Driggs. The coal ranges from subbituminous to bituminous and is low in ash content. Lower grade coal, known as lignite, is found in thin beds in several Idaho areas, primarily in southwest Idaho. Lignite is better used for gasification or for carbonization instead of as a heat source. Carbonization is an initial step in the production of ammonia, synthetic fibers, and asphalt.

The Horseshoe Creek coal deposit is about five miles long and two miles wide, and is part of the Teton Basin coal field which extends nearly 15 miles in a southeast direction along the Big Hole Mountain Range. Nine separate beds over 14 inches thick have been described in this formation. The two largest beds are five and nine feet thick, although the nine-foot layer has an inner layer of sandy clay about one foot thick. The beds are extensive, but the coal grades to a lower quality to the southwest near the Pine Creek campground outcrops (Sec. 24, T3N, R44E). Because the coal beds dip steeply to the southwest, open-pit mining is limited. However, there is some potential for future development of this deposit. There likely will be no direct consumptive water use for coal mining. Even short distance movement to a valley floor-plant use would probably be by conveyor instead of with a slurry pipeline.

Similar to coal in origin, the small peat deposits located along the Teton River near Driggs and Victor also have had past commercial uses. Other locations in Idaho, Bear Lake (near Montpelier) and the Kootenai River area, have more extensive deposits. The Teton River deposits have some potential for soil conditioner use.

Another potential mineral resource in the basin is phosphate. Most Idaho phosphate deposits are located south of the Henrys Fork Basin. However, there are phosphate deposits within the Big Hole Mountain Range in the same sedimentary rock formation as the coal deposits previously described. These deposits extend into southeast Madison County with levels up to 18 percent phosphatepentaoxide ($P_2 0_5$). Additionally, there are phosphate deposits in the Centennial Mountain Range. About 1700 acres currently are under lease four miles north of Sheridan Reservoir, northwest of Island Park Reservoir at the Idaho border. A limited amount of phosphate ore has been taken from this deposit to reduction facilities outside the basin, but mining has not continued. Phosphate rock is also found east of Henrys Lake around Howard Creek. A by-product of phosphate mineral producing is vanadium, largely used in hardened steel. All of these phosphate deposits evidently dip to such a degree that open-pit mining is not feasible. This reduces the economic potential of these deposits relative to other Idaho deposits.

Oil and gas potential in the basin centers in the same Big Hole Mountains where coal and phosphate deposits are located. The geologic structure in the Teton Basin-Big Hole Mountains-Snake River Range area is an extension of the overthrust belt of Wyoming. In Idaho some of the potential reservoir rocks are too highly fractured to make good traps for oil and gas. Recent volcanism is an additional negative influence upon the collection of oil and gas into reservoirs. Federal land between the Teton Basin and the Snake River is covered with oil and gas leases. Several exploratory holes have been drilled within this area with no success.

Some oil shales in the Big Hole Mountains-Snake River Range have yielded as much as 38 gallons of oil per ton. However, these oil shale beds are thin, of limited areal extent, and generally dip steeply making open-pit mining difficult.

There is one known decorative building stone quarry located north of Island Park Reservoir in the Tin Cup Creek area. The only other minable product in the basin is gem stones. While the potential economic importance of gem stones is not great, for the part-time collector there are a few noteworthy occurrences of gem stones in the Henrys Fork Basin. The best source of jade in Idaho appears to be in the bedrock of Bitch Creek, perhaps extending down as far as the canyon mouth of the Teton River. The quality is poor to medium with an occasional piece of "excellent" gem quality.

Variscite, a mineral with similar characteristics to turquoise but with a rich yellowish-green color, has been reported in a private claim in the Mount Two Top area, east of Henrys Lake. This mineral results from phosphate-impregnated water seeping through aluminous rocks.

With various coloring, chalcedony is a translucent relative of crystalline quartz found in pegmatities, a large-grained, slow-cooled granite. Agate is chalcedony, with impurities causing patterns and bands, of a quality suitable for gem cutting. Jasper is an impure opaque variety of chalcedony. These chalcedony minerals have from time to time been reported in Fremont County, however, good prospecting sites may only be located outside the Henrys Lake Basin. The naming of Crystal Butte located 23 miles north of St. Anthony relates to these chalcedony minerals but the current availability of the mineral is questionable.

Sources

Land Management Plan for the Targhee National Forest, 1985.

Columbia-North Pacific Region Comprehensive Framework Study, Appendix IV, Land and Minerals, Subregion 4.

Mineral and Water Resources of Idaho, U.S. Geological Survey Special Report No. 1, November 1964.

Gem Minerals of Idaho by John A. Beckwith, The Caxton Printers, Ltd., 1987.

Navigation

There is no commercial navigation in the Henrys Fork Basin. Waterway use for recreational purposes does take place and is discussed in the recreation section.

Title to the beds of all navigable bodies of water was granted to the State of Idaho at statehood. Only in rare exceptions has this title been transferred. With title, "The State will exercise its authority over beds of navigable lakes and streams in their present location as far as use of the beds are concerned to provide for their commercial, navigational, recreational or other public uses," Kootenai Environmental Alliance v. Panhandle Yacht Club, 105 Idaho 622, 671 P.2nd 1085 (1983).

Title rests with the State for Henrys Lake, the Buffalo River (mouth through Sec. 21, T13N, R44E *(above Buffalo Springs)*), and the Henrys Fork *(mouth to Henrys Lake including Big Springs)*. In addition, for streams capable of floating six-inch diameter cut timber during normal high water, a public right-of-way below the ordinary high-water marks must be allowed (Idaho Code 36-1601). This allows for public use of the above listed water areas, but also all the other main water courses in the basin. Such use does not include access across private land.

Discussion of navigation related goals, objectives, and recommendations is within the recreation section.

Recreation

Recreational opportunities in the Henrys Fork Basin cater to local residents and visitors from throughout the United States. Proximity to Yellowstone and Grand Teton National Parks contributes to recreational use, but the basin charms visitors with its own outstanding attractions: Big Springs, Mesa Falls, Harriman State Park and fishing in Henrys Lake or the Henrys Fork of the Snake River. Sightseeing, nature study, fishing, boating and winter sports attract thousands of people annually to the basin.

The 1987 Idaho Leisure Travel and Recreation Study estimates that nine percent of all Idaho leisure travelers visit or travel through Region VI, which includes the Henrys Fork basin. (Region VI is composed of Fremont, Teton, Bonneville, Madison, Jefferson and Clark counties.) Only about one third of the travelers are visiting the Region as a major destination; two-thirds of the travelers to the Region are passing through, on their way to other destinations. Twenty percent of all Region VI travelers are headed for Yellowstone or Grand Teton National Park (Harris et al., 1988). The Henrys Fork basin, however, provides annually more than 1,000,000 visitor days of recreation use. A visitor day is defined as 12 visitor hours, e.g., one visitor spending 12 hours or 12 visitors spending one hour involved in a recreation activity. Recreation visitor days in the basin average an annual 1.4 percent increase, with dispersed use growing more rapidly than the use of developed facilities. Approximately 50 percent of the recreation visitors to the basin are from out-of-state. About three-quarters of the Idaho users are from the local counties (USFS-BLM, 1980; IDPR, 1983; 1989; U.S.F.S., TNF, 1985; 1989; Harris et al., 1988; Nellis, 1989b).

Federal agency personnel estimate and record recreational use on federal lands as Recreational Visitor Days (RVDs). To estimate RVDs, a sample is taken by patrol personnel. Table 30 describes and estimates recreational use in the basin, and separately estimates recreational use along three river segments. Recorded RVDs do not reflect total recreation use. Visitor use estimates are unavailable for all activities and areas of the basin.

Estimated use suggests a significant difference between summer and winter use as do entrance data for Yellowstone National Park (see Table 31). The 1987 Idaho Leisure Travel Study indicates that the largest proportion of travel to the region occurs in the summer (about 40%), with equal proportions (about 20%) spread across the other three seasons (Harris et al., 1988).

Recreation is a primary use of the northern portion of the basin, generally upstream of the town of Ashton, and the upper Teton basin. Camping and sight-seeing are the most popular summer activities. Fishing, boating, and swimming are the largest direct water-use activities. In the fall over a third of the leisure travelers to the basin are hunting, and almost 60 percent of all winter travelers participate in winter sports (Harris et al., 1988). Water-based recreation averages a five month season, from May to the first week of October. Table 32 summarizes 1987 Region VI resident and tourist surveys of recreation activity.

Accessibility

Recreational use is a function of access to points of interest. In the basin, recreational use is greatest at attractions near major roadways. U.S. Highway 20/191 traverses the basin, and is a main artery for traffic to the Henrys Fork, Island Park Reservoir, Henrys Lake and Yellowstone National Park. National Park Service (N.P.S.) records indicate that 40 percent of all visitors to Yellowstone

Table 30. Recreation Use - Henrys Fork Basin

Summer

Developed Sites	Close to Island Park Reservoir, Henrys Lake, Henrys Fork, Moose Creek, Buffalo River, Warm River, Rock Creek
Undeveloped Sites	Close to streams and rivers - widely distributed
Dispersed Activities:	
Hiking/Backpacking	Lionhead Mtn. Area, Two-Top Mtn. Area, Henrys Fork, Warm River
ORV Riding	Roads throughout the basin, Sand Mountain
Boating/Swimming	Henrys Fork, Teton River, Falls River, Warm River, Bitch Creek, Henrys Lake, Island Park Reservoir
Fishing	Lakes, rivers, and streams throughout the basin
Viewing	Along primary roadways and rivers

Winter

Developed Sites	Grand Targhee (in Wyoming)
Concentrated Use	Island Park Siding, between Coffee Pot Rapids & Island Park Reservoir, Big Springs Area
Dispersed Activities:	
Skiing (X-C)	Warm River Trail, Bear Gulch, Buffalo River, Harriman State Park
Snowmobiling	Trails and roads throughout the basin

Source: USFS-BLM, 1980

Estimated Use and Annual Recreational Visitor Days

Activity	Percent of Total Use
Dispersed:	
Driving for Pleasure	20
Trails	6
Reservoirs & Lakes	7
Rivers & Streams	6
Backcountry	16
Subtotal	55
Developed:	
Boating	1
Campgrounds	18
Picnic Areas	1
Hotel, Lodge-Resort	3
Private Organization Sites	5
Recreation Residence	6
Winter Sports	8
Other	3
Subtotal	45

Activity	RVDs
Sight-Seeing	172,800
General Day Camping	140,800
Snowmobiling*	87,800
Fishing	80,000
Picnicking	63,100
Recreation Cabin Use	57,200
Boating, Swimming and Water Play	34,000
Hunting**	29,000
Motorcycle/Trail Riding	27,200
Horseback Riding	21,500
Hiking and Walking	18,100
Organization Camping	10,200
Skiing and Snow Play*	9,000
Bicycling	4,400
Sand Mtn. ORV Riding	4,000
Nature Study	3,800
Other	29,600
TOTAL	792,000

* Primarily Winter	12½%	97,000
** Primarily Fall	3½%	29,000
Mostly Summer	84%	666,000

Source: U.S.F.S., Targhee National Forest, 1985; U.S.F.S., TNF, 1990 - RVD estimates for 1988; IDPR, 1990 - Henrys Lake and Harriman State Parks attendance records for 1989 and 1990; U.S. BLM, Medicine Lodge Wilderness EIS 1988, - estimate of Off-Road Vehicle RVDs at Sand Mountain.

Estimated Recreational Visitor Days in River Corridors

	Henrys Fork Big Springs to the Warm River 1987	Henrys Fork Big Springs to the Warm River 2000	Warm River Warm River Springs to Henrys Fork - 1987	Falls River Yellowstone Park Boundary to Targhee NF Boundary - 1987
Camping: Developed	69,500	100,000	11,400	4,500
Dispersed	9,400	14,000		
Boating/Water Play	2,000	2,000	3,800	
Fishing	24,900	36,500	6,700	2,000
Hiking	1,000	1,500	1,200	3,500
Viewing/Scenery	35,600	41,500	17,200	11,500
Snowplay		5,500		
Total	142,400	201,000	40,300	21,500

Source: U.S.F.S., Targhee National Forest, Wild and Scenic Rivers Preliminary Study, 1989.

Table 31. Yellowstone National Park-West Gate Entrance (1989):

January	11,000	May	77,000	September	141,000
February	16,000	June	146,000	October	46,000
March	8,000	July	224,000	November	6,000
April	14,000	August	197,000	December	9,000

travel through the West Yellowstone gate, and will therefore cross the Henrys Fork basin. Entrance through West Yellowstone in 1989 was 895,000 visitors (N.P.S., Yellowstone National Park, 1990). National Park visitors use facilities in the Henrys Fork basin on their way to and from Yellowstone and Grand Teton, or as an alternative camping or lodging base when the Parks are crowded. Preliminary figures for 1991 indicate an annual increase of approximately seven percent since 1989.

The road network and access to Henrys Lake, Island Park Reservoir and the Henrys Fork, between Big Springs and Riverside Campground, is fairly extensive. U.S. Highway 20/191 crosses the river at Macks Inn and Osborne Bridge, and parallels the river for a short distance at Last Chance. Access to the upper Teton drainage, Canyon Creek and Moody Creek is provided by state Highways 32 and 33, and county and Forest Service gravel or dirt side roads. A Forest road off of Highway 33 also provides access to the Grand Targhee ski resort. The ski resort is located above Alta, Wyoming, just across the state line, but the only road access is through Driggs, Idaho. Numerous Forest roads, both all season and paved, provide access to developed recreation sites both on public and private lands. Spur roads head to the Centennial Mountains and the adjacent Madison River drainage. U.S. Highway 20/191 meets the Henrys Fork again near St. Anthony, and below St. Anthony rural roads provide frequent access to the river.

Access to the Henrys Fork between Riverside Campground and the Warm River confluence is limited. From Riverside Campground to the Targhee Forest boundary, the Henrys Fork is accessed in six places with unimproved roads and foot trails. Undeveloped trails, resultant from big game and fisherman use, parallel both sides of the river from Riverside Campground to Lower Mesa Falls. The Targhee National Forest plans to develop a hiking trail parallel to the Henrys Fork from Osborne Bridge to the Warm River confluence, to improve access to the river along this stretch (U.S.F.S., TNF, 1989).

In 1989 State Highway 47 was classified as the Mesa Falls National Scenic Byway, by the U.S. Forest Service. The paved two-lane road provides an alternative scenic loop to U.S. Highway 20/191 between Ashton and Harriman State Park. The road provides access to the Falls River, the Warm River, and the Henrys Fork between Ashton and the Warm River confluence. Recreation use and traffic is expected to increase in the area with designation of the Scenic Byway, planned developments at Upper and Lower Mesa Falls and an overlook facility at Sheep Falls (U.S.F.S., TNF, 1989).

Table 32. Activity Participation Rates for Region IV Residents and Travelers

Activity	Percent of Resident Households with at least One Participant	Occasions per Household*	Annual Activity Occasions	Percent of Resident Travelers	Percent of Non-resident Travelers
Fishing from Boat	39	2.6	291,500		
Fishing from Bank/Dock	59	3.7	411,300		
Fishing (Lakes/Reservoirs)				32	32
Fishing (Streams/Rivers)				75	77
Swimming (Beach)	18	1.1	122,800		
Swimming (Lakes)				8	8
Swimming (Rivers)				24	8
Visiting Beach (not swimming)	15	0.5	60,200	12	15
Power Boating (River)	7	0.1	15,200		
Power Boating (Lake)	18	0.6	67,000		
Power Boating				23	2
Water Skiing	15	0.8	88,600	3	0
Non-Motorized Boat (Lake/Reservoir)	12	0.7	80,200		
Non-Motorized Boat (River/Stream)	16	0.9	98,500		
Rafting				19	11
Canoeing				15	21
Other Tubes/Boats				19	3
Nature Study	85	8.5	947,400	50	60
Hiking/Walking	88	35.6	3,960,700	39	30
Camping	64	5.8	642,500	28	32
Snow Activities	49	8.5	946,000		
Skiing				35	43
Snowmobiling				41	23
Snow Play				18	41
ORV Driving	44	4.5	504,500		
4 x 4 ORV				70	30
Motorcycle/ATV				29	70
Bicycling/Horseback Riding	61	12.7	1,412,900		
Bicycling				21	56
Horseback Riding				79	44
Sight-Seeing	88	21.4	2,374,700	71	79
Hunting	50	7.7	854,500		
Big Game Hunting				89	55
Waterfowl Hunting				8	39

* Four month period

Source: Idaho Department of Parks and Recreation. *1989 Idaho Outdoor Recreation Plan.*

The Falls River has good access from its mouth upstream to Yellowstone Dam, located two miles above the Targhee Forest boundary. Two graveled roads parallel the river, the Cave Falls Road, and the Ashton-Flagg Ranch Road. These roads are not kept open during the winter, but are groomed for snowmobile use. From Yellowstone Dam upstream past the Idaho border the only access is by trails.

Much of the lower portion of the Warm River is visible from Idaho State Highway 47, located near the canyon rim. The highway is only kept open to Bear Gulch during the winter, however, this plowed stretch provides spectacular views of the river during that time. Warm River is generally inaccessible by road, however, a two lane dirt road accesses the Warm River Spring. The river may also be accessed by foot via the abandoned Yellowstone Branch of the Union Pacific and Oregon Short Line Railroad. The rail bed parallels the river, and now serves as a high-standard recreation trail. In summer the trail is managed for non-motorized use and in winter it is used by snowmobiles and cross-country skiers.

There are extensive well maintained all-season forest access roads throughout the plateau between the Henrys Fork and Yellowstone National Park. These roads allow for sightseeing in the area. Most Forest Service Roads and county roads, located on the plateau above Ashton, are not kept open during the snow season.

Fishing

The sport fishery of the Henrys Fork above St. Anthony attracts fishermen from throughout the nation with a reputation as one of the best trout fishing areas in the United States. With an annual use of nearly 80,000 visitor days in the basin the net economic value of the Henrys Fork fishery is estimated at $2.8 million (Loomis, 1985). The Henrys Fork above Ashton is possibly the most important fishing stream in the State of Idaho. Angler hours vary by segment and year in response to regulations and fish population fluctuations. Despite variability, total angler hours increased over 27 percent from 1976 through the 1980s, (U.S.F.S., TNF, 1990; IDFG, 1990; Angradi and Contor, 1989; Brostrom, 1987; Rohrer, 1984; 1981; Moore et al., 1983; Jeppson, 1982; 1981; Coon, 1977; 1978). Angradi and Contor (1989) found that approximately 45 percent of the anglers surveyed on the Henrys Fork were Idaho residents, and 55 percent were nonresidents. Ninety-one percent of the Idaho residents were from eastern Idaho.

Outfitters use the Henrys Fork and the Teton River extensively for commercial fishing/float trips. To date nine outfitters are licensed to operate on the Henrys Fork, and six outfitters are licensed to operate on the Teton River by the Idaho Outfitters and Guides Licensing Board.

Sorg et al. (1985) found that the net economic value (consumer surplus) of a fishing trip on the Henrys Fork was worth $37. This means the typical angler would be willing to pay an additional $37 per trip over and above current expenditures. The gross value is the sum of expenditures (transportation, lodging, food, tackle) and the consumer surplus, which totaled $82 per trip for the Henrys Fork. The gross value for Henrys Lake totaled $160, and $107 for fishing on Island Park Reservoir in 1982. Comparative estimates of gross value for other Idaho fishing areas are listed in Table 33.

Table 33. Comparative Values of Coldwater Fishing (1982 Survey)

Henrys Fork	$ 82
Teton River	73
Henrys Lake	160
Island Park Reservoir	107
Snake River (above Am. Falls)	63
Swan Valley	73
Blackfoot River	59
Blackfoot Reservoir	78
American Falls Reservoir	55

Source: Sorg et al., 1985 Net Economic Value of Cold and Warm Water Fishing in Idaho

Hunting

The Idaho Department of Fish and Game estimated 40,000 hunter days for 1989 in the Game Management Units of the basin. Bird hunting estimates totaled an additional 16,900 hunter days in the three basin counties (IDFG, 1989). The total number of hunter days in Idaho has increased approximately five percent annually since 1983 (IDFG, 1990). Consecutive annual estimates for hunting in Units 60, 61, 62, 64 and 65, Management Units of the basin, indicate annual fluctuations in deer and elk hunter days (see Table 34). Units 60 and 61 are the most used while Unit 65 is the least used (see the following map). The variability in hunter days is due to fluctuations in big game populations and controlled hunt permits. The net economic benefit for deer and elk hunting in the basin is over $2,000,000 based on a $50 per day value (Sorg and Nelson, 1986; U.S.F.S., TNF, 1985).

Table 34. Big Game Hunter Days Estimate

Year	Unit 60	Unit 61	Unit 62	Unit 62A	Unit 64	Unit 65	Total Estimate
1983	15,550	17,400	6,210	6,270	5,410	1,760	52,600
1984	9,150	12,190	3,430	3,480	4,750	1,250	34,250
1985	13,210	17,940	4,240	3,820	6,650	2,260	48,120
1986	15,730	11,240	6,030	4,800	7,120	3,330	43,250
1987	15,430	16,310	5,760	3,920	7,330	2,360	51,110
1988	15,770	17,410	6,420	4,670	6,000	3,160	53,430
1989	11,520	11,930	4,840	4,410	5,130	2,280	40,110

Source: Idaho Department of Fish and Game Harvest Estimates

Wildlife Observation

Great opportunity for wildlife observation is available in the Henrys Fork basin. The basin is rich in prime wildlife habitat and sanctuaries. Nature study ranks high in Region VI recreation activity surveys (see Table 32). The Idaho Leisure Travel surveys (1987) also indicate that nature study is a popular activity in the region year-round (Harris, et al., 1988). The Idaho Department of Fish and Game estimates over 1,400 visitor days annually for wildlife education, photography and viewing at the Sand Creek and Cartier Wildlife Management Areas (see Table 35). Harriman State Park is popular with bird watchers and offers environmental education programs to approximately 2,000 local school children each fall.

The Idaho Department of Fish and Game owns and manages recreation areas in the Henrys Fork basin. IDFG Managed Access Areas are listed below, and are located on Figure 18.

Henrys Fork	
Sand Creek Wildlife Management Area	Camping, fishing, waterfowl, upland bird, and big game hunting
Ashton Reservoir	Camping, boat ramp, fishing
Chester Reservoir	Camping, fishing
Davenport Island	Fishing
Warm Slough	Camping, boat ramp, fishing, waterfowl, upland bird and big game hunting
Cartier Wildlife Management Area	Fishing, waterfowl, upland bird and big game hunting
Moody Creek	Fishing
Teton River	
Badger Creek	Fishing
Harrops Bridge	Fishing
Cache Bridge	Boat ramp, fishing
Raineer	Camping, boat ramp, fishing, waterfowl hunting
Bates Bridge	Boat ramp, fishing
Teton Creek	Boat ramp, fishing
Fox Creek West	Camping, boat ramp, fishing, waterfowl hunting
Fox Creek East	Camping, fishing, waterfowl hunting

Table 35. Wildlife Management Area User Days		
Use	Sand Creek User Days	Cartier User Days
Fishing	10,000	90
Hunting	5,920	310
Education and Scientific	60	200
Photography	50	-
Wildlife Observation	400	20
Sight-seeing	600	120
Other Recreation Activities	6,240	10
Total	23,000	700

Source: Idaho Department of Fish and Game, Region 6 Wildlife Management Area Plans 1986-1990

Walking, Hiking, and Trail Riding

Recreational visitors make use of maintained hiking, skiing and snowmobiling trails in the basin. Trails frequently follow basin streams, however, developed trails along the Henrys Fork and the Falls River on Forest Service land are limited. Two short trails parallel the Henrys Fork: one at Upper Coffeepot Campground and another at Box Canyon Campground. Another short trail between Big Springs and Big Springs Boat Launch is planned for the near future. Undeveloped trails, resultant from big game and fisherman use, parallel both sides of the Henrys Fork from Riverside Campground to Lower Mesa Falls. Developments being studied for the Henrys Fork from Osborne Bridge to the Warm River confluence include a hiking trail paralleling the river (U.S.F.S., TNF, 1989).

Other developed trails following streams include the Targhee Creek Trail, in the northeast corner of the basin, the Moose Creek, Bitch Creek and Canyon Creek trails, and along the Warm River an abandoned railroad right-of-way trail (U.S.F.S., TNF, 1989). In the Teton Basin, several trails extend up drainages and over the mountain passes into Grand Teton National Park. Warm River is generally inaccessible by road, however, the abandoned Yellowstone Branch of the combined Union Pacific and Oregon Short Line Railroad company parallels the river, and now serves as a high standard recreation trail. In summer the trail is managed for nonmotorized use and in winter it is used by snowmobiles and cross-country skiers.

Camping

Numerous campgrounds situated along basin reservoirs, lakes and rivers, afford visitors opportunity for an intimate lakeside or riverside experience, and often provide easy foot access to the water. Over 22 public, developed recreational sites, containing picnic tables and campsites, are available in the basin. Existing facilities are generally operating within or below capacity, but some campgrounds are over-utilized during summer weekends. The most popular campgrounds are located adjacent to major water courses. Public campgrounds containing picnic tables and campsites are located on Figure 18 (U.S.F.S., TNF, 1985; 1989). Public campground sites and estimated use are listed in Table 36. Small city parks are located in several local communities and private recreation facilities: lodges, inns, resorts and restaurants, are common along reservoir and lake shorelines and major roadways.

Fremont County maintains the William Frome County Park on the northwest side of Henrys Lake. The site provides an open area for camping, parking, a boat ramp and dock facilities. Two State Parks are located in the basin: Henrys Lake and Harriman. The principal activities at Henrys Lake (680 acres) are fishing and camping. Harriman State Park (4,060 acres along the Henrys Fork, 11,700 acres total holdings) attracts fishermen, bird watchers, hikers, horseback riders and cross-country skiers to its wildlife preserve. Attendance figures for Henrys Lake and Harriman State Parks are shown in Table 37. Expansion is planned at Henrys Lake Campground to 50-60 units (IDPR, 1990).

The Targhee National Forest operates 16 developed sites in the basin. Four campgrounds are at Island Park Reservoir, six along the Henrys Fork (three above and three below Island Park Reservoir), one on the Buffalo River, one at Howard Spring, two in the upper Teton drainage, and two on the Warm River.

Warm River Campground is unique in offering wheelchair and other handicapped visitors exceptional access to the river. This 285 person capacity campground is often full during the summer months. The campground is also used as a snowmobile and cross-country skiing trailhead during the winter. The Warm River Fish Hatchery has been dismantled and the site is slated for development as a trailhead, picnic, and scenic attraction area by the Targhee National Forest.

Along the Falls River the Cave Falls Campground, located in Wyoming, is receiving increased use over time. This campground has 23 units plus a group use site. Yellowstone National Park has developed an overlook, trail system, and picnic facilities just above the campground and up to Cave Falls.

There are no developed recreation facilities on BLM land in the basin, but the BLM has designated the sand dune area west of St. Anthony as a special recreation management area for off-road vehicles (ORVs). Most BLM land is used at times for such dispersed activities as hunting, fishing, camping and rock climbing. The BLM does not have reliable estimates of the total recreational use of its lands in the basin, but annual use of the Sand Mountain dunes area is estimated at 4,000-5,000 Recreational Visitor Days. Two developments, a campground and a day-use facility, are planned for the Sand Mountain recreation area. The campground would contain 40-50 units for overnight camping and would be located north of the Sand Hill Resort. The day-use facility would consist of a parking area to provide access to the open sand dunes. It would be located south of the Sand Mountain recreation area boundary (BLM, 1988).

Figure 18:
Campgrounds, Sportsman Access, and Boating Access Points

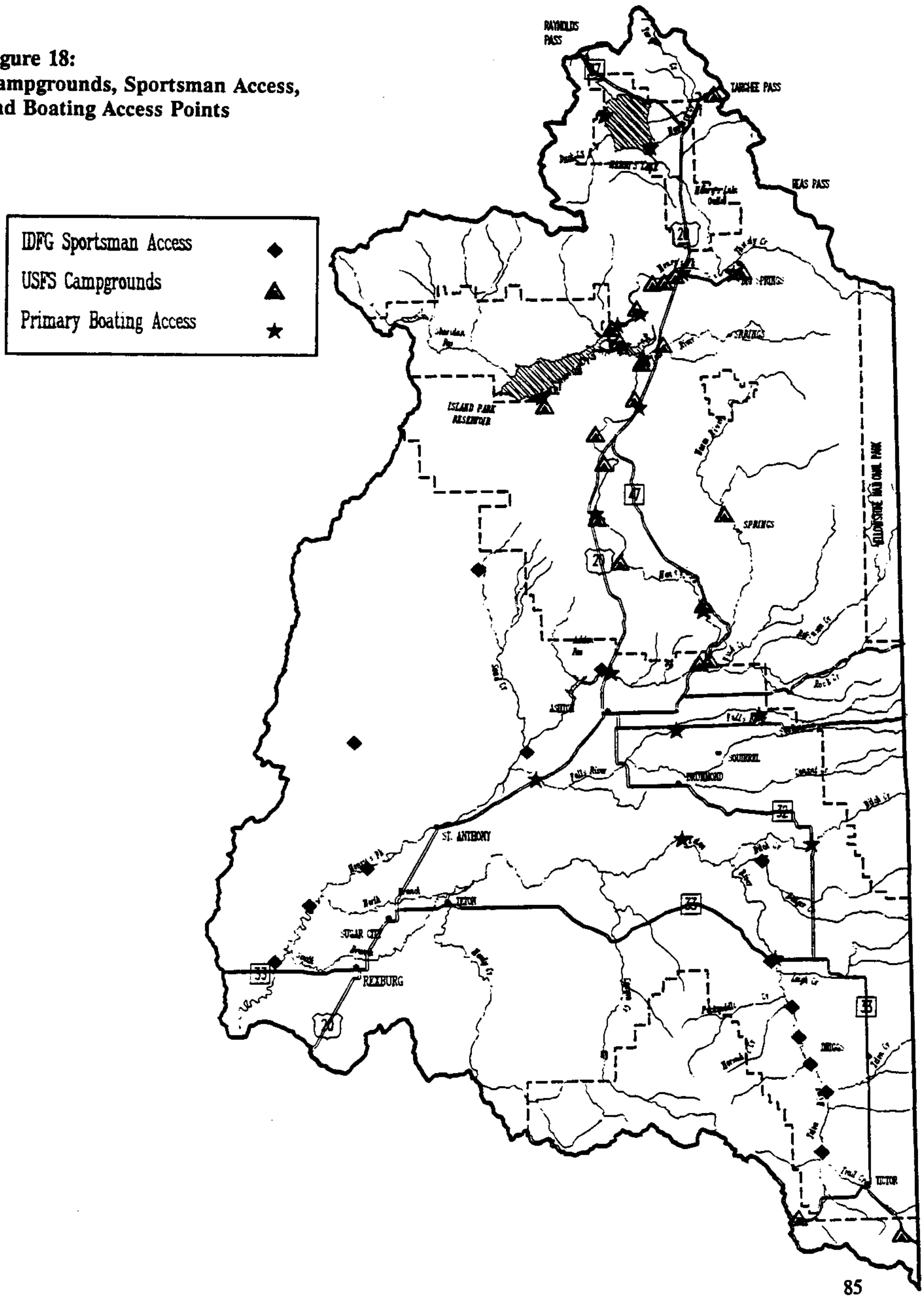


Table 36. Henrys Fork Basin Developed Public Campgrounds

	Units	Visitors	RVDs	
State of Idaho				
Henrys Lake	33	28,860	20,590	
Harriman	Group Camping	28,210	16,130	
Targhee National Forest (1988)				
Buttermilk	66	12,850	19,280	
Mill Creek	12	2,220	3,330	
McCrea Bridge	25	5,970	8,960	
West End	25	8,780	13,160	
Howard Spring		19,380	400	(Picnicking)
Big Springs	15	2,190	3,280	
Flat Rock	45	10,240	15,370	
Upper Coffee Pot	14	5,520	8,270	
Buffalo	127	22,760	33,170	
Box Canyon	19	4,200	7,370	
Riverside	55	9,700	7,470	(Picnicking)
Pole Bridge	20	2,300	4,600	
Grandview	5	650	1,300	
Warm River	12	5,600	11,200	
Pine Creek	11		1,340	
Mike Harris	12		2,560	
Fremont County				
William Frome	Open Camping			

Source: Targhee National Forest - Island Park Ranger District, Gene Hardin; Ashton Ranger District, Doug Muir; Teton Basin Ranger District, Linda Merigliano Nellis, 1989b; Idaho Department of Parks and Recreation, 1990

Table 37. Henry's Lake and Harriman State Parks Attendance Figures

		Campers			Day Users	
Henry's Lake State Park	**Resident**	**Non Resident**	**Total**	**Resident**	**Non Resident**	**Total**
1980	3629	4596	8225	7915	4362	12277
1981	4041	4629	8643	4098	2016	6114
1982	3410	4227	7647	2685	999	3684
1983	4092	4822	8914	5232	769	6001
1984	5154	4389	9543	9908	3648	13556
1985	5016	4389	9405	12892	4367	17259
1986	4492	4484	8976	15917	5672	21589
1987	9664	4730	14394	12208	5384	17592
1988	3785	4266	8051	7143	3139	10282
1989	4372	1789	6161	17571	5127	22698
		Campers			**Day Users**	
Harriman State Park	**Resident**	**Non Resident**	**Total**	**Resident**	**Non Resident**	**Total**
1982	-	-	-	9146	2910	12056
1983	-	-	-	8235	3546	11781
1984	-	-	-	8376	4964	13340
1985	417	62	479	12895	10434	23329
1986	665	332	997	13562	10361	23923
1987	853	70	923	15043	10164	25207
1988	1487	584	2071	15746	8654	24400
1989	1484	540	2024	16025	10158	26183

Source: Idaho Department of Parks and Recreation, 1990.

Boating/Floating

In 1981 approximately four miles of the Henrys Fork, from the Big Springs boat ramp to the U.S. Highway 20/191 crossing at Macks Inn, were designated as a National Recreation Trail by the U.S. Secretary of Agriculture. Termed the Big Springs Water Trail, this trail is the first water trail in the National Recreation Trail System, testifying to its unique float-boating opportunity. This calm water stretch of the Henrys Fork offers abundant opportunity for wildlife viewing. The area is administered by the Island Park Ranger District of the Targhee National Forest. During the summer, the Macks Inn Resort rents canoes, rafts, tubes and paddle boats, and offers a shuttle service between Macks Inn, the Big Springs boat ramp, and Upper Coffee Pot Campground. Because of its close proximity to several resorts, a corridor highway, and summer homes, and its relatively short floating time and easy access, the Big Springs-McCrae Bridge stretch of the Henrys Fork receives recreational use throughout the week during the summer. The Targhee National Forest has plans to improve their launch site on the upper end of the Big Springs Water Trail with a parking lot, small boat ramp and toilet facilities (U.S.F.S., TNF, 1989).

Boating surveys done in 1983 and 1989 indicate an increase in boating recreation from Island Park Dam to the Last Chance Resort Village. This Whitewater Class II segment runs through a basalt canyon. Fir trees and a dense undergrowth of shrubs line stretches of the river through the canyon until it opens near Last Chance. Because the rim of the canyon is much higher than the water, developments on top cannot be seen by boaters. Boaters and fly fishermen have potential conflicts in this area, and for the next several miles, where there is easy access to the river. After passing Last Chance, the river enters the boundaries of Harriman State Park. There are no boating access points within the Park, however, several access points are available both above and below the Park. Local businesses provide boats for rent. The Targhee National Forest plans a parking lot, small boat ramp and toilet facilities for the Box Canyon and Last Chance boat launch areas (U.S.F.S., TNF, 1989).

Kayaker on the Falls River.

Below Riverside Campground the Henrys Fork enters a deep steep-sided canyon. This reach of the river offers a challenging float-boating experience characterized by steep rapids, rocks, and pools. Because of steep undisturbed slopes and the general lack of vehicle or trail access, the 18 miles of canyon to Sheep Falls affords visitors the solitude often associated with a primitive recreation experience. Boaters who go beyond Riverside Campground must plan ahead as there are few access points downstream, and they must take out before Upper Mesa Falls. In the first few miles below Lower Mesa Falls there are several Whitewater Class II+ and III rapids, including a seven-foot waterfall. This lower area has significant boating use. The river then becomes progressively easier going downstream. This section of the river is floated by commercial fishing guides in drift boats. Primary put-in and take-out points along the Henrys Fork are shown on Figure 18.

The primary recreation activity on both the Warm River and the Falls River is fishing. The Falls River has not been popular for floating above the Targhee Forest boundary because of the numerous waterfalls and cascades. Near the Warm River Campground floating is very popular. Most of the water play activities occur below the cascades, in the first 4.5 miles upstream of the campground. There has not been significant conflict between fishing and water play activities because fishing activity is concentrated around the early morning and late evening hours. Falls River, Bitch Creek and the Teton River are cited for boating potential in whitewater literature (Moore and McClaran, 1989). The last two miles of the Buffalo River, below Elk Creek, and one mile of Elk Creek, from the reservoir to its mouth, have good canoeing potential. The 4.5 mile section of the Upper Buffalo River, from Buffalo Springs (SW1/4, Sec. 21) to just below the old railroad grade, has good floating potential.

Henrys Lake, Island Park Reservoir, Ashton Reservoir and smaller lakes and reservoirs within the basin provide flat-water boating opportunities. Boat counts at Henrys Lake (IDPR, 1980-1990) indicate a 100 percent increase over 1980 figures. Most boating is associated with fishing. Data is not available for Island Park and Ashton Reservoirs. The east end of Island Park Reservoir has high boating use because of nearby summer home facilities.

Optimum instream flows for boating vary with the reach and the craft. Kayaks, rafts, driftboats and canoes are used on the Henrys Fork and tributaries. Motorized boats are used primarily at Island Park Reservoir, Henrys Lake and Ashton Reservoir. Irrigation releases from Island Park Reservoir enhance late summer boating on the Henrys Fork below the reservoir. Optimum stream flow and craft categories are listed in Table 38 by reach.

The non-motorized boating estimate for the Henrys Fork basin is 10,200 Recreational Visitor Days. Motorized boating is approximately 15,000 RVDs, primarily at Island Park Reservoir, Henrys Lake and Ashton Reservoir (U.S.F.S., TNF, 1990; IDPR, 1990). Most boating activity occurs between March and September, dependent on snowmelt variability and reservoir release schedules. Annual Outfitter and Guides Licensing Board reports and the 1983 and 1989 boater surveys, conducted by the Idaho Department of Parks and Recreation (IDPR), estimate boater use of the specific reaches shown in Table 39. Boaters responding to the IDPR survey (1983) said they chose boating on the Henrys Fork because of its accessibility, fishing opportunity, and scenery.

According to the IDPR 1989 boating survey, Idaho residents comprise 54 percent of the weekend boaters and 39 percent of the weekday boaters on the Henrys Fork from Big Springs to Island Park Reservoir. From Island Park Dam to Hatchery Ford, 63 percent of the weekend boaters and 45 percent of weekday boaters are Idaho residents. Ninety percent of the Idaho boaters are from eastern Idaho.

Launches on the Henrys Fork seem evenly split between weekends or holidays (47%) and weekday use (53%). Weekend use increased 17 percent over 1983 (IDPR, 1983; 1989). The IDPR Survey seems to indicate a drop in the number of boaters on the Big Springs Water Trail. However, IDPR personnel believe the drop may be due to a shorter survey day (hours/day) in 1989. Surveyors spent a longer day on the river in 1983.

Table 38. Optimum Stream Flow for Boating

	Optimum cfs	Craft
Big Springs to Island Park Reservoir	500-1750	Canoe, raft, kayak, powerboat, tubes
Island Park Dam to Hatchery Ford	1000-3000	Canoe, raft, kayak, drift boat
Lower Mesa Falls to Ashton Reservoir	1000-3000	Raft, kayak, drift boat
Ashton Dam to St. Anthony		Canoe, drift boat
Teton River	500-1000	Raft, kayak, drift boat
Falls River	500-2000	Canoe, raft, kayak, drift boat
Buffalo River	Unknown	Canoe, Kayak

Source: G. Moore and D. McClaran. 1989. Idaho Whitewater.

Table 39. Outfitter Reports and Boating Estimates

	1989		1988		1987		1986		1983
	Res	NonRes	Res	NonRes	Res	NonRes	Res	NonRes	
Henrys Fork: Big Springs to Island Park Reservoir									
IDPR Survey Estimate	3,130	3,640							8,377
Henrys Fork: Island Park Dam to Hatchery Ford									
Outfitters Total	48	613	27	619	86	509	41	636	
IDPR Survey Estimate	1,872	1,602							2,375
Total Estimate	1,920	2,215							2,375
Henrys Fork: Mesa Falls to St. Anthony									
Outfitters Total	25	764	32	707	76	375	29	259	
Henrys Fork: St. Anthony to Confluence									
Outfitters Total	55	31	47	8	30	14	-	-	
Teton River: Upper Put-in to Cache Bridge									
Outfitters Total	7	317	10	185	14	70	0	64	
Teton River: Cache Bridge to Harrop Bridge									
Outfitters Total	230	396	236	164	230	173	0	36	
Teton River: Harrop Bridge to Henrys Fork									
Outfitters Total	2	26	8	257	10	10	0	4	

Outfitters Total from Idaho Outfitters and Guides Licensing Board.
IDPR 1989 Boater Estimates are based on weekend and weekday averages for 12 surveyed weekends and 24 surveyed weekdays for the season May 29 to September 10, 1989 minus Outfitters.
IDPR 1983 Boater Estimates are based on weekend and weekday averages for 7 surveyed weekends and 14 surveyed weekdays for the season May 25 to September 3, 1983.

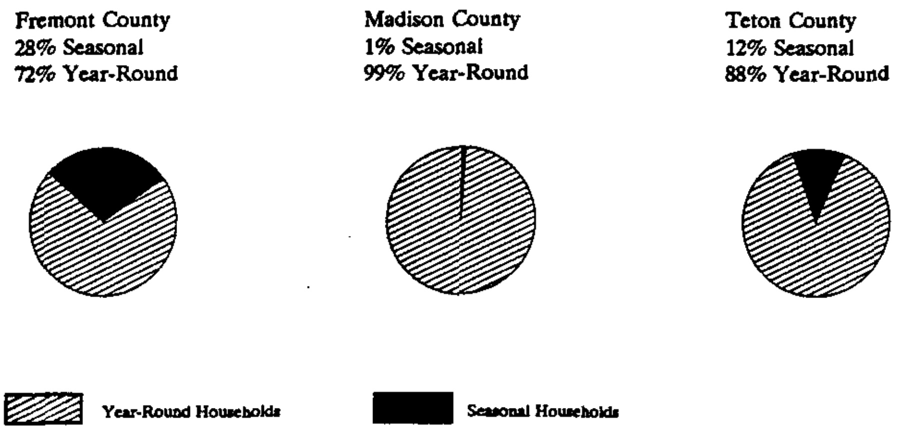
Special Recreation Use and Winter Sports

Special recreation uses in the basin include camping sites for large groups run by religious and scout organizations, second homes and the operation of winter sports areas. Private camps are scattered throughout the northern portion of the basin. Most of the recreation homes are adjacent to the Henrys Fork and U.S. Highway 20/191, or near West Yellowstone, Island Park Reservoir, or Henrys Lake. There are six recreation home areas located along the Henrys Fork: Big Springs, North Fork, Macks Inn, Box Canyon, Last Chance and Pinehaven. Moose Creek also has a developed summer home area. New recreation home building is prevalent at Henrys Lake, Island Park Reservoir and near Victor, in Teton County (Idaho Statesman, 1990;1989a)(see Figure 19).

With the increased popularity of winter recreation in the basin, many recreation homes are being used year-round (USFS-BLM, 1980).

Although Rexburg is not a major tourist center, it has developed an unusual travel economy. In the summer approximately 800 to 1,000 couples, largely from Sun City, Arizona, stay in empty student housing in and around Ricks College. Residents have been encouraged to develop events to keep the "sunbirds" coming back (Idaho Statesman, 1989b). The summer residents travel extensively throughout the basin and adjacent areas in day and extended-day trips.

Figure 19:
Secondary/Recreational Housing by County



Source: 1980 Housing Census, U.S. Department of Commerce

Recreation and the Economy

The 1987 Leisure Travel Survey found that the average expenditure of a group traveling to the northeast section of the state as a major destination was $143 for a two-day period. This average is greater than three other Idaho regions, but significantly less than expenditures in the Boise and Sun Valley areas (See Table 40, Harris et al., 1988). Nellis (1989a) reports that recreation-tourism dollars average 20 percent of total sales for Fremont and Teton counties (see Table 41). The tourism impact appears greater in Teton County because of its low population base. Activity centers on spill-over from high-priced development at Jackson, Wyoming, and the adjacent Grand Targhee ski resort.

The basin's winter recreation popularity appears to grow yearly. The Two Top Snowmobile Trail on the Targhee National Forest is now a designated National Recreation Trail. The Warm River Campground is a trailhead for snowmobiles and cross-country skiing along the abandoned river railway. Two roads along the Falls River are groomed for snowmobile use. Fremont County and the Targhee National Forest have cooperated to establish over 500 miles of groomed snowmobile trails in the basin. Winter weekend use in the basin often exceeds 2,000 snowmobiles per day (USFS-BLM 1980; Nellis, 1989b). Cross-country skiing is popular at Harriman State Park, Bear Gulch and Warm River. Two developed alpine ski areas are adjacent to the basin: Grand Targhee near Driggs, and Kelly Canyon located east of Ririe. Teton County is particularly dependent on Grand Targhee Ski Area tourism, although receipts from the ski resort are registered in Teton County, Wyoming (Nellis, 1990).

As a growth driving industry, tourism in the Henrys Fork basin has not done as well as Sun Valley, McCall, Coeur d'Alene, and Jackson, Wyoming. One reason for the lack of comparable growth may be lack of a focal point for the recreation industry. The Fremont County recreation area is large. A focal point that could be emphasized more is Henrys Lake. A successful major development near the lake could have spin-off effects throughout the Island Park plateau. Major winter season use, such as a ski development, would assist in providing a good growth foundation.

Table 40. Average Traveler Expenditures

Region	Average Group Expenditure - 2 days
1 Lakes	$116
2 Clearwater	109
3 Southwest	172
4 South-Central	153
5 Southeast	133
6 Northeast	143
7 Sawtooth/Salmon	256

Source: The 1987 Idaho Leisure Travel and Recreation Study: Analysis for Region VI.

Table 41. Comparative Sales in Tourism-Related Sectors: FY 1989

Sector County	% Sales in Idaho	% Fremont County	% Teton County	% Madison
Eating and Drinking Places	7.1	9.0	9.9	.1
Lodging	2.1	3.8	4.9	.01
Amusements and Recreation Facilities	1.8	4.9	1.5	.01
Outfitters and Guides	.02	--	4.1	--
Service Stations	1.1	2.2	2.4	.01
TOTAL	12.3	19.9	22.7	.12

Note: Sales from service stations do not include the sale of fuel. Service stations are included to cover truck stops and convenience stores that sell meals, groceries, and similar items to travelers.
Source: Nellis. 1989a.

The recreation economy in the basin also appears, in many respects, to be an immature industry. In comparison to the typical four-stage life-cycle of an industry: introduction, growth, maturity and decline, the Henrys Fork basin might be said to be only in a late introduction stage. There are many small operators attempting to provide services, but recreation needs are not being met, particularly for the large out-of-state market. As the basin's recreation industry moves through the growth stage, managers will develop new services, greater experience, and financing in order to capitalize on recreational opportunities.

Market expenditures do not reflect the full value or net economic benefit to consumers, do not account for any external costs associated with production, and ignore resource intangibles, for example, wildlife, scenic beauty, water quality, and recreational opportunity. This divergence between economic and market values requires the careful measurement of net economic benefit in evaluating resources. Input/output models, used to estimate impacts on revenues, wages, and taxes, etc., measure levels of economic activity, but not net benefit from that activity.

The economic net benefit to society is a sum of the producer's surplus (profit) plus the consumer's surplus (willingness to pay above the price). The net benefit measures the addition to well-being (welfare) in society from the use of a resource. To estimate the value of recreation, or the willingness to pay, it is necessary to rely upon methods of implicit pricing. Two standard methods used for this purpose are the travel cost method (TCM) and the contingent valuation method (CVM). Sorg and Loomis (1984) reviewed empirical estimate studies for recreation amenities. These studies, along with fishing and hunting surveys conducted in the Henrys Fork basin, report the net willingness to pay for recreational opportunities by participants (Sorg et al., 1985; Sorg and Nelson, 1985).

Recreation net benefits consist of user benefits and intrinsic or preservation value. User benefits are derived directly by recreationists in the course of on-site recreation activities like camping, fishing, boating, hiking, etc. In addition, people realize intrinsic or preservation value for the recreational opportunities of an area. Many people who do not currently participate in recreational use of an area, derive value from the existence of the natural quality of the region, from the opportunity to visit the site in the future, and from the knowledge that their children will be able to enjoy the natural resource in the future. The nonuser's willingness to pay for this existence value (Krutilla, 1967), option value (Weisbroad, 1964) and bequest value (Walsh et al., 1984) measures satisfaction with preservation of the natural quality of the area and the recreation opportunities it provides. Together these values are referred to as intrinsic value or preservation value, and they should be regarded in natural resource decision making (Weisbroad, 1964; Krutilla, 1967; Walker, 1990). Research has found that this intrinsic value accounts for 81 percent of the total willingness to pay for natural/recreational rivers (Walsh et al., 1984) or natural areas.

The most likely estimate of recreation benefits anticipates growth in recreation use at rates approximately equal to recent trends. RVDs are projected to increase at 1.4 percent annual rate, the same as the trend for developed recreation in the Targhee National Forest (U.S.F.S., TNF, 1985).

In 1989 dollars, real net benefit from recreation is approximately $100 million annually (see Table 42 and Table 43). Recreation net benefit estimates may err because the basin is not completely surveyed for recreation use. Without data to support an adjustment, no arbitrary compensation for unsurveyed activity was attempted. Recreation is potentially a major use of the Henrys Fork basin with large net benefits likely to accrue to residents of the region. Recreationists and tourists may also impact public facilities and services in any community. Visitors to the Henrys Fork basin sometimes need the assistance of local public safety services. The demand for public safety services could be much higher than normally expected in the area based solely on resident population.

Table 42. Estimated Net Value of Recreation Use in the Henry's Fork Basin (Real 1989 $)

Activity	Current Use Value $/Day	Hours/Day	Current Use Value $/RVD	RVDs	Current Use Value $/Year	Current Use Plus Preservation Value*
Sight-Seeing	3.47	4	10.42	172,800	1,800,576	9,476,716
General Day Camping	10.42	12	10.42	140,800	1,467,136	7,721,768
Snowmobiling	21.77	6	43.54	87,800	3,822,812	20,120,063
Fishing	21.30	4	62.65	80,000	5,012,000	26,378,947
Picnicking	10.79	4	32.37	63,100	2,042,547	10,750,247
Recreation Cabin Use	10.42	-	10.42	57,200	596,024	3,136,968
Motorcycle/Trail Riding	8.61	4	25.83	27,200	702,576	3,697,768
Hunting						
Big Game	48.72	7	83.53	24,200	2,021,426	10,639,084
Upland Bird	44.59	3	155.54	4,800	746,592	3,929,432
Boating						
Motorized	17.99	5	43.18	15,000	647,700	3,408,947
Non-motorized	23.77	7	40.75	10,200	415,650	2,187,632
Horseback Riding	14.58	-	14.58	21,500	313,470	1,649,842

Hiking and Walking	14.58	-	14.58	18,100	263,898	1,388,937
Organization Camping	10.42	-	10.42	10,200	106,284	559,389
Skiing and Snow Play	14.58	-	14.58	9,000	131,220	690,632
Swimming and Water Play	13.18	6	26.36	8,800	231,968	1,220,884
Bicycling	8.61	5	20.66	4,400	90,904	478,442
Sand Mtn. ORV Riding	13.30	5	31.92	4,000	127,680	672,000
Nature Study	3.47	4	10.42	3,800	39,596	208,400
Other	10.42	-	10.42	29,600	308,432	1,623,326

Table 43. Potential Increase (Likely Growth) in Net Value of Recreation (Real 1989 $)

Activity	Growth Rate % per Year	Use Value $ per Year [b]	Use Plus Preservation Value [a,b]
Sight-Seeing	1.4	2,297,534	12,982,278
General Day Camping	1.4	1,872,065	9,852,976
Snowmobiling	1.4	4,877,908	25,673,200
Fishing	1.4	6,395,312	33,659,536
Picnicking	1.4	2,606,289	13,717,315
Recreation Cabin Use	1.4	760,527	4,002,771
Motorcycle/Trail Riding	1.4	896,487	4,718,352
Hunting			
Big Game	1.4	2,579,339	13,575,471
Upland Bird	1.4	952,651	5,013,954
Boating			
Motorized	1.4	826,465	4,349,816
Non-motorized	1.4	530,369	2,791,417
Horseback Riding	1.4	399,988	2,105,198
Hiking and Walking	1.4	336,734	1,772,283
Organization Camping	1.4	135,618	713,781
Skiing and Snow Play	1.4	167,437	881,246
Swimming and Water Play	1.4	295,991	1,557,848
Bicycling	1.4	115,994	610,492
Sand Mtn. ORV Riding	1.4	162,920	857,472
Nature Study	1.4	50,524	265,918
Other	1.4	393,559	2,071,364

a - Use Plus Preservation Value is based on the assumption that use value equals 19% of total use plus preservation value (Walsh, Sanders and Loomis, 1984)

b - Levelized annual value over 40 year period with 3% real discount rate

Recommended Action

1. Encourage opportunities for dispersed recreation in primitive or natural areas.
2. Preserve access to outstanding scenic/recreational attractions and identify where additional access may be needed including access through private lands.
3. Seek a study of the recreational carrying capacity of the Henrys Fork from Big Springs to St. Anthony.
4. Designate state natural and recreational rivers in outstanding fish and wildlife, recreational, geologic or aesthetic areas.
5. Having adopted a plan for the Henrys Fork Basin, the State will oppose actions by any other entity which do not recognize and are not compatible with this plan.
6. Protect the quantity and quality of water that maintains and enhances good quality recreational experiences while providing for other water uses.
7. Encourage private sector commercial recreation development adjacent to public lands, or on suitable public lands if public need warrants.
8. Promote safety for all outdoor recreation including public campaigns relating to water safety, including learn to swim programs.

9. Encourage consideration of recreation as a significant planned use in new public and private water development projects.

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Timber, Grazing, and Dry Farming

Logging, grazing, and dry farming are land based activities generally guided or regulated by other agencies. Acreage in the basin, by category, is shown in Table 44. Water-related issues are water yield and water quality.

Table 44. Land Areas (in acres)

	Forest	Grazing	Irrigated	Dry Farming	Other Land and Water	Total
Fremont	518,000	418,000	124,000	87,000	63,000	1,220,000
Madison	46,000	76,000	113,000	63,000	16,000	306,000
Teton	60,000	96,000	84,000	47,000	9,000	294,000
	624,000	590,000	321,000	197,000	88,000	1,820,000

(Irrigated land and dry-farming land (potentially irrigable) acreage updated to 1990 acreage from 1976. Deduction made to grazing land in Fremont County for 9,000 acres.)

Timber

Of the forested land, approximately 55.5 percent, 347,000 acres, are classified as commercial (able to produce 20 cubic feet of wood per acre per year). Just under one-half of the commercial acreage is lodgepole pine while Douglas fir with some subalpine fir and spruce accounts for the other half. There also is a small amount (8%) of aspen acreage.

The 1988 North Fork fire in Yellowstone National Park burned about 20,000 acres of high plateau forested lands in the Henrys Fork drainage. The epidemic kill of most of the lodgepole pine forest by the mountain pine beetle has resulted in large timber sales to salvage mature and drying trees. Lodgepole pine stands will continue to deteriorate and be salvaged for the next 20 years. Timber harvests are administered by the Targhee National Forest, the Bureau of Land Management, the Idaho Department of Lands, and private owners.

Water Yield

The management of vegetation can impact runoff. For example, rangeland brush control will increase the water yield. The replacement of forest cover with a grass cover gives considerable increased water yield. This method of increasing water yield is a planning consideration on federal lands in the southwest states, but water yield is a limited consideration in the Northwest.

In the Henrys Fork basin the economic value of timber production and other forest uses relative to a limited need for additional water, other than in drought years, makes water yield a low consideration in forest management. For rangeland management the same is true.

The mountain pine beetle epidemic in lodgepole pine allows for a temporary increase of water yield. Estimates of the increased water yield are about seven percent. This increase will gradually diminish as new timber stands become established. For an average water yield of eight inches over 400,000 acres, the increased yield would be approximately 20,000 acre-feet. For the 20,000-acre North Fork fire with 20 inches of precipitation, a seven percent yield increase would be 2,000 acre-feet. A negative impact is that the runoff peak occurs earlier in the year.

Water Quality

On National Forest lands there appear to be good management practices in the Henrys Fork basin. For example, erosion and sedimentation are controlled with buffer strips next to streams. Riparian vegetation slows sediment transport and scouring, helping to modify and alleviate turbidity and bank erosion. State and federal water quality regulations control the amount and type of logging immediately adjacent to streams and rivers.

Grazing

On grazed land the maintenance of a good level of grass productivity will minimize sheet erosion or general soil erosion. Water quality is also impacted by the grazing of stream banks by cattle. Sheep are believed to do less damage because they are continuously controlled by a herder. The land management agencies appear to balance ecological and economic concerns in their grazing management practices.

Dry Farming

Best management practices established by the local Soil Conservation Districts provide guidelines for erosion control. Best management practices associated with soil tillage greatly reduce erosion and sedimentation. Soil Conservation District personnel have been educating growers about these tillage procedures. Most growers have been using soil conservation methods for several years. New techniques are being developed, such as chemical weed control for summer fallow land and no-till planting. These practices, as they become more accepted will, in turn, further reduce sediment runoff from dry-farmed land.

Sources

Land Management Plan for the Targhee National Forest, U.S. Department of Agriculture - Forest Service, 1985.

Medicine Lodge Resource Management Plan - Environmental Impact Statement, Idaho Falls District Draft 1984, U.S. Department of Interior - Bureau of Land Management.

Snake River Basin Idaho and Wyoming Cooperative Study Land Resource Data, U.S. Department of Agriculture - Soil Conservation Service, 1976.

Energy Conservation

Conservation, the more efficient use of electricity, is a key resource for meeting future electrical energy needs. Conservation resources are measures that enable residential and commercial buildings, appliances, and industrial and irrigation processes to use energy more efficiently. Less electricity is used to support the same level of amenity or production that existed before the conservation measure was implemented. For example, buildings that cut down heat loss through insulation and tight construction require less electricity for heating. Conservation also includes measures to reduce electricity losses in generation, transmission and distribution systems.

Conservation is a uniquely flexible resource. If the economy grows rapidly, the conservation resource expands quickly, but if the economy slows, the conservation resource grows slower. Some conservation programs automatically match growth in electrical demand. Such is the case when new buildings are mandated by code to be energy efficient. Each new building adds load to the electrical system, but also can save energy if it is better insulated. In this regard, cost-effective conservation resources may be lost if not secured at the appropriate time. For example, if new buildings do not incorporate conservation measures at the time of construction, it is much more costly, and sometimes impossible, to retrofit them.

The Northwest Power Planning Council estimates that 7,692 megawatts of cost-effective electric power are achievable region-wide through conservation and high efficiency operations. The estimate is based on a high electric-demand scenario through the year 2010. The Northwest Power Planning Council believes energy codes are the most effective means for securing savings from new buildings. It is, however, also emphasizing utility incentive programs to gain energy savings rather than relying entirely on regulatory authorities (NPPC, 1990).

Residential Sector

Space heating is by far the largest single use of electricity in the residential sector; water heating is second followed by refrigerators and freezers. About 60 percent of potential residential energy conservation would come from reducing the energy required to heat homes. Energy savings can be achieved by improving insulation, adding storm windows, and reducing air leakage. Table 45 provides representative thermal savings and cost data as an example of possible energy savings.

Table 45. Representative Thermal Data for 1,350 Square Foot House Located in an Idaho Mid-Level Mountain Valley. Costs for Retrofitting.

Features	Incremental Cost	Cumulative Cost	Annual Use Kwh/yr	Levelized Costs Cents/Kwh
Northwest Power Planning Council New Construction Standards if Adopted by a City or County				
Ceiling R-0 to R-19 (6 inch)	$ 651	$ 651	33,032*	0.179
Walls R-0 to R-11 (4 inch)	841	1492	25,949	0.513
Air Changes Per Hour 0.6 to 0.4	109	1601	23,874	0.718
Ceiling R-19 to R-30 (10 inch)	222	1823	22,658	0.787
Crawl Space R-0 to R-19 (6 inch)	1094	2917	16,762	0.801
Single to Triple Pane Windows	1898	4815	12,193	2.400
Ceiling R-30 to R-38 (12 inch)	163	4978	11,919	2.566
Idaho Residential Energy Standards (required for new construction after January 1, 1991)				
Wood to Insulated Outside Metal Doors	615	5593	11,359	6.344
Crawl Space R-19 to R-30 (10 inch)**	947	6540	10,751	6.727
Ceiling R-38 to R-49 (16 inch)				
Walls R-11 to R-19 (6 inch)				
Wall R-19 to R-26 (6 inch with foam boards and advanced framing)				

* Without any insulation, use is 48,709 Kwh/yr.
** The cost of this feature includes an estimate for extending the joist to accommodate R-30 insulation.

Source: 1989 Supplement to the 1986 Northwest Conservation and Electric Plan, Volume II, Northwest Power Planning Council, p. 3-21.

NOTE: The residential rate within the Fall River Rural Electric Cooperative service area is 4.8 cents per Kwh for usage above 1400 Kwh/month; a typical usage for electric heated house. For Utah Power and Light the cost is 5.8 cents.

For new residential buildings other than mobile homes, the meeting of specific conservation standards is being encouraged by the electric supply utility through lump sum payments to the owner or builders. Both utilities serving the Henrys Fork Basin, Fall River Rural Electric Cooperative and Utah Power & Light Co., are participating in the program. Idaho Residential Energy Standards required for new construction after January 1, 1991 will result in energy savings for most kinds of site-built homes.

Water heating energy savings are next in importance. Energy savings accrue from better insulated water heaters, pipe wraps and more efficient appliances that use hot water as well as the use of these appliances (for example, clotheswashers, dishwashers). For refrigerators and freezers, the National Appliance Energy Conservation Act was enacted in 1987. It sets an initial maximum energy consumption level for refrigerators and freezers (plus other home appliances) sold in and after 1990. The federal law also requires a review of the initial standards in 1990. California has set for implementation in 1993 more stringent standards that the Department of Energy is expected to generally follow after 1990.

Commercial and Industrial Sectors

Space heating, space cooling, and lighting dominate commercial energy consumption. Office buildings and retail stores consume almost 50 percent of the electricity used in the commercial sector. The energy conservation potential in commercial buildings is felt to equal that of residential buildings.

In the Henrys Fork Basin the primary industrial user of electricity is food processing. Since each industrial plant is different, it is difficult to estimate the exact amount of energy savings. However, cost-effective energy conservation appears possible since past reviews of similar industrial plants show considerable energy saving potential.

Irrigation Sector

Because of the large amount of irrigation in the Henrys Fork Basin, there are considerable energy savings available through the use of more efficient water application systems, and through water scheduling improvements. This savings is largely from system improvements in existing sprinkler systems but also in the design of new sprinkler systems for conversion from gravity to sprinkler irrigation. Many new systems are installed each year in order to improve labor and water efficiency. Worn bowls in deep well pumps, excess water use from worn sprinkler nozzles, main lines installed in a less than efficient size, and operating pressures all contribute to larger irrigation electric-use loads.

Total Conservation Potential

The Northwest Power Planning Council staff has made a region-wide estimate of the amount of cost-effective electric power conservation achievable by year 2010. The potential savings were calculated with a high electric-demand scenario. The following projected savings would be less with any of the four lower demand scenarios: medium high, medium, medium low, or low. Energy conservation potential in the basin has been estimated through the use of population ratios for the residential and commercial sectors, the employment ratio for the industrial sector, and the ratio of irrigated acres for the irrigation sector. Achievable electric energy conservation in the Henrys Fork basin, by the year 2010, is estimated at 12,800 kilowatts (average) in the following amounts per sector: Residential - 4,400 KW, Commercial - 4,200 KW, Industrial - 1,000 KW, and Irrigation - 3,200 KW. This compares with 23,000 KW of average generating capacity for present and active proposed power plants in the Henrys Fork basin.

Recommended Action

1. Encourage the development of programs to retrofit for heat conservation of existing residences, commercial buildings and businesses.

2. Encourage county and city governments to adopt Northwest Power Planning Council standards for new construction, including commercial and business buildings.
3. Support continued research and education programs on energy-efficient design of new irrigation systems.
4. Continue programs to make irrigators aware of irrigation energy conservation financing programs.

Source

1989 Supplement to the 1986 Northwest Conservation and Electric Power Plan, Volume One, pp 23-39, Northwest Power Planning Council.

Geothermal

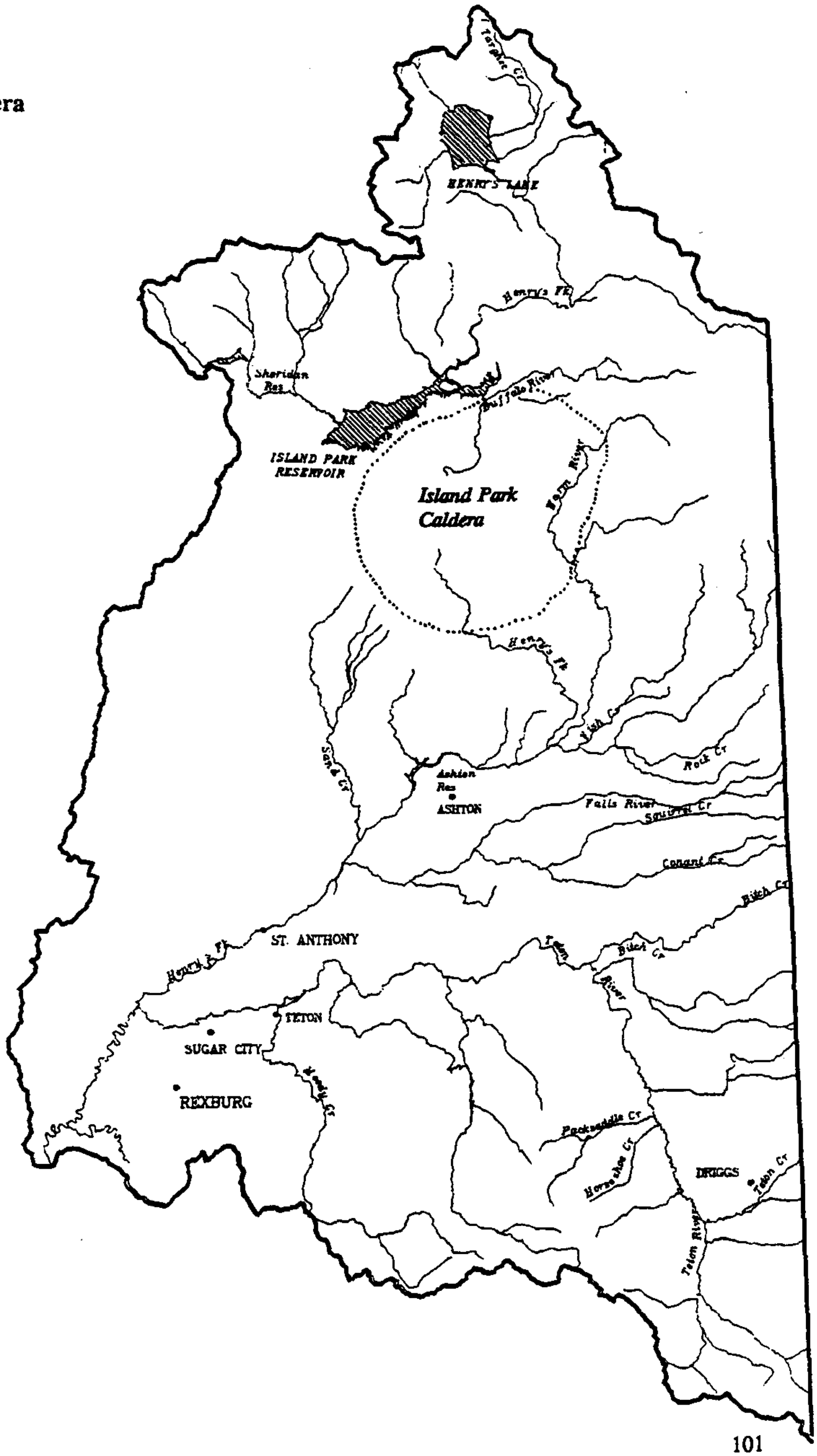
The geology of northern Fremont County suggests geothermal development potential. The Island Park caldera, a collapsed shield volcano, is somewhat egg shaped with a general north-south axis. The caldera extends from Island Park Reservoir south to Sheep Falls. The Henrys Fork flows south through, and just west of, the center of the caldera, then flows over the volcanic rim in a series of falls and rapids including Upper and Lower Mesa Falls (see Figure 20). The Island Park caldera generally has filled with sediment and appears as a level plateau.

In the vicinity of most volcanos, there are good geothermal prospects. In the Island Park area, the general absence of hot springs suggests an old geothermal system. Geophysical survey data implies that the caldera has cooled with little rock alteration, so the area is not now a very promising geothermal exploration target (see Hoover and Long, 1975).

Approximately ten years ago there was considerable interest in leasing areas near Island Park for geothermal purposes. In the early 1980's there were 200 lease applications within the caldera and east to the Yellowstone Park boundary. The Forest Service, after going through an environmental impact analysis, stated they will not consent to geothermal leases until the Department of the Interior shows that Island Park geothermal development will not adversely affect the Yellowstone National Park geothermal features, or the habitat of threatened or endangered wildlife, and that a valuable geothermal resource exists. Industry has not pursued further research in the area.

Geothermal potential exists south of Rexburg, and in the Newdale and Ashton areas. Chemicals in solution measured in selected samples in these areas indicated temperatures near 170°F. For direct home heating, water temperatures as low as 100°F have been used. With deep drilling, direct space heating potential may be available over wide areas of the lower Henrys Fork basin. Ground-water heat pumps may be used with normal depth wells, especially in the south Rexburg and Newdale areas where water in existing wells is around 80°F. The water chemistry suggests warmer water with

Figure 20:
Island Park Caldera



deeper drilling. Ground-water heat pumps are highly efficient with water in the 70° to 100°F range and are quite economic with normal ground-water temperatures.

Recommended Action

1. State and local government should encourage the use of ground-water heat pumps for space heating, especially for rural properties and others that have an existing well and for buildings located near known warm water sources.
2. Deep drilling for high-temperature water or for large uses of low-temperature geothermal water on the Island Park plateau is to be discouraged unless no damage to the Yellowstone thermal system can be shown.
3. A geothermal study in the Rexburg area as a basis for the development of a district heating project is encouraged.

Sources

Hoover, D.B. and C.L. Long, Audio-magnetotelluric methods in reconnaissance geothermal exploration: Proceedings, 2nd United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, 1975, v.2, p. 1,062.

Final Environmental Impact Statement of the Island Park Geothermal Area, U.S. Dept. of Agriculture-Forest Service and U.S. Dept. of Interior-Bureau of Land Management, 1980.

Mitchell, John C., Linda L. Johnson and John E. Anderson, Geothermal Investigations in Idaho, Part 9, Potential for Direct Heat Application of Geothermal Resources, Idaho Water Resource Water Information Bulletin No. 30, 1980. Also see separate plate 1 map.

Power Development

Hydropower has been the electric generator of choice in the Henrys Fork basin as it has for the state. The basin contains active hydroelectric generating plants, projects that are actively being pursued, and a number of potential sites that do not seem feasible at this time. Significant barriers to new hydropower development exist in that except for the Island Park project, federal law prohibits new projects on the Henrys Fork River. Minimum stream flows are in place on Warm River, Teton River, Bitch Creek, and the Henrys Fork. This comprehensive water plan will designate river reaches in the basin as state protected rivers where new hydropower projects are prohibited by state law.

The following listing serves to identify potential hydropower sites in the basin. Their identification does not constitute an endorsement or mean that they are proposed for development. Indeed, many of these projects will likely have additional barriers to development created by this plan.

Existing Power Plants

St. Anthony (FERC #2381) - This 500 KW power plant is located in Sec. 1, T. 7 N., R. 40 E, along the Henrys Fork in downtown St. Anthony. The plant was constructed in 1915. The design head is 18 feet. This project is owned by Utah Power and Light Co., a recently acquired division of Pacific Corporation of Portland, Oregon. The average annual generation has been 3,900 MWH for an average of 450 KW. Average generation is 90 percent of capacity. There is more capacity at this site. In 1982 the City of St. Anthony applied for a preliminary permit to construct an adjacent facility that would more than double the capacity (650 KW would be added). The filing, #6956, is no longer active.

Ashton (FERC #2381) - This power plant is located at Ashton Reservoir on the Henrys Fork, two miles west of the town of Ashton. The plant was originally constructed in 1917 with generating units number two and three added in 1925. The total nameplate rating is 5,800 KW with a total head of 56 feet. The power plant is owned by Utah Power and Light Co. Average generation is 4,000 KW from an annual average generation of 35,000 MWH (69 percent of capacity). There is a proposal to upgrade the oldest of the three generators from 1,300 KW to 3,400 KW. This would give a total plant rating of 7,900 KW. The upgrading of one generator would likely require some powerhouse rebuilding, but this is still a low cost improvement.

Felt (FERC #5089) - This is a recently enlarged power plant located on the Upper Teton River, just past where the river enters the canyon below Teton Valley and about 10 miles northwest of Tetonia. The power plant was built in 1921 using an actual head of 90 feet (80 feet design head). The original powerhouse contained three generators, one rated at 150 KW and two rated at 250 KW, with a single tunnel. In 1947 a 500 KW and a 720 KW generator were added in an adjacent new powerhouse with two new tunnels. In 1968 the original three units ceased operation. In 1980 generation was increased to 2,000 KW. In 1985 two more generators, totaling 5,500 KW, were added in a third powerhouse located 1500 feet downstream. The design head was increased to 159 feet and the facility used the two tunnels built in 1947. The original tunnel was routed to the 2,000 KW generating units. Total generating capacity is 7,500 KW. Total usable water flow is 884 cfs. The average generation is 3,400 KW (29,000 MWH) which gives a plant capacity of 44 percent. Fall River Rural Electric Cooperation of Ashton has leased the project to Hydro Valley Development, Inc., a subsidiary of Bonneville Pacific Co. of Salt Lake City.

Ponds Lodge (FERC #1413) - This 200 KW power plant with a 30-foot head is located at the mouth of the Buffalo River just below Island Park Dam on the Henrys Fork (Sec. 33, T. 13 N., R. 43 E., at the U.S. Highway 20 crossing of the Buffalo River). With a 1939 water right, production started in 1940. The electric power was used at the lodge. The power plant was damaged by lightening and fire in 1986 and is not now in production. In 1989 the Federal Energy Regulatory Commission license was transferred from Island Park Resorts Inc. to Buffalo Hydro Inc. The project must be rebuilt by October 31, 1993 to retain its license.

Briggs (FERC #8083) - This 300 KW power plant built about 1987 is located in Sec. 31, T. 7 N., R. 41 E. adjacent to the north side of the settlement of Teton. About two miles upstream of the powerplant, water is diverted from the Teton River into the Teton Irrigation and Manufacturing Canal (Teton Canal). From the canal the water drops about 20 feet back into the Teton River. The estimated average annual generation is 1,800 MWH or an average of 200 KW. The owner is Turbine Generator Service Inc. of Salt Lake City but they provide royalties to Robert and Carla Olson of Idaho Falls. The project has received exemption from licensing.

Potential Developments - Active FERC Filings

Island Park (FERC #2973) - This 4,800 KW power plant is to be located at the existing Island Park Dam where 74 feet (45 to 79) of head is available. The average annual generation is estimated at 26,900 KWH for an average of 3,100 KW. Fall River Rural Electric Cooperative, Inc. of Ashton is the project owner, while Bonneville Pacific Corporation of Salt Lake City is the project operator. The FERC license stipulates that project construction must start by October 17, 1992

Falls River (FERC #9885) - This proposed 7,500 KW power plant is located on the Falls River. The 46,000 MWH estimated annual generation would provide an average generation of 5,000 KW. The diversion point would be the existing Marysville Canal diversion from the Falls River in Sec. 35, T. 9 N., R. 44 E., two miles below the National Forest boundary. The powerhouse would be located six miles downstream where the canal is still within one-half mile of the river, and the drop to the river is about 130 feet. Enlargement of the canal is proposed to enable power production year-round. A reduction in power generation may occur during midwinter high icing conditions. The owner is Grant Durtschi, Environmental Energy Co. of Riverton, Utah. This project has been approved by FERC for construction with the requirements that construction start by May 24, 1993 and be completed by May 24, 1995.

Upper Teton River (FERC #10613) - This proposed 4,500 KW power plant is located on the Teton River. The 25,000 MWH of estimated annual generation would provide a 2,800 KW average. The diversion would be located just below the Tetonia dam site in Sec. 3, T 6 N., R. 44 E., just after the Teton River leaves the Teton Valley northwest of Tetonia. The proposal locates the powerhouse about two miles downstream in Sec. 33, T. 7 N., R. 44 E. The developer is Lower Patterson Inc. managed by Richard L. Graves of Gooding, Idaho.

Other Potential Hydropower Sites

The following discussion of potential hydropower plants only addresses the physical potential of hydraulic head and water flow (Table 46). Legal, environmental, and social issues have not been addressed and may preclude many of the identified potential projects. Total potential installed capacity in the basin is about 200 MW (200,000 KW). The 200 MW of installed capacity compares to a single coal-fired generating plant sized at 1,000 MW. Potential average generation basin-wide is 134 MW (134,000 KW) with an estimated annual generating plant factor of 67 percent. Probable installed sizes of potential hydropower projects range from 30,000 KW to very small installations. For comparison purposes, the Grace and Cove powerplant capacity in Caribou County is 40,500 KW while the present Ashton power plant is 5,800 KW. Table 46 lists potential hydropower sites in the basin.

All potential projects on the Henrys Fork from Henrys Lake (including Big Springs) to Ashton Reservoir are prohibited unless specifically approved by congress. This restriction is contained in PL 99-495, Section 15A(C), October 16, 1986.

Warm River - See "Surface Water Storage Sites" under "Water Supply" for information on this site.

Mesa Falls - Several development alternatives have been proposed for hydroelectric power in this area of the Henrys Fork. Preliminary indications are that an average of 18,000 KW (158,000 MWH) might be generated using three miles of the river for a 320-foot drop. As currently envisioned there are large environmental conflicts associated with such a development. Mesa Falls is a heavily used scenic attraction during much of the warm-weather recreation season.

Table 46. Potential Hydropower Sites - Henrys Fork Basin

Site	Stream	Useable Storage if any in ac-ft[1]	Conduit Length in miles[1]	Average Annual Flow in cfs[2]	Power Head in feet[1]	Average Annual Generation in avg. KW[1]
Warm River	Henrys Fork	75,000	-	1,440	220	22,000
Mesa Falls[4]	Henrys Fork		3	950	320	18,000
Lookout Butte	Henrys Fork		12	870	300	18,000
Teton	Teton R.	200,000	-	710	295	14,000
Anderson	Falls R.		6	745	260	(13,000)[3]
Sheep Falls	Falls R.		4'& 200' dam	430	400	12,000
Last Chance	Henrys Fork		7	≈900	190	11,000
Squirrel	Falls R.		-	745	140	(7,000)[3]
Judkins	Bitch Cr.		≈6	140	525	5,000
Tetonia	Teton R.		-	390	140	4,000
Warm River Butte	Warm R.		6	170	320	4,000
Partridge	Warm R.		3	150	270	3,000
Boone Cr.	Trib. to Falls R.		2.5	≈10	560	3,000
Lower Ashton	Henrys Fork		26' drop	≈1,500	25	2,000
Victor	Teton R.		4 & 120' dam	≈80	400	2,000
Canyon Cr.	Canyon Cr.		6 & 200' dam	≈40	675	2,000
Fish Cr.	@ Warm R. Butte		12	≈100	440	2,000
Buffalo R.	Buffalo R.		100' dam	≈190	175	≈2,000
Upper Badger	Badger Cr.		12 & 130' dam		440	≈2,000
Ashton (enlarge)				≈1500		≈1,400
Cross-Cut Diversion	Cross-Cut Canal		10' drop		10	1,200
Coffee Pot Rapids	Henrys Fork		45' drop	≈350	45	≈1,000
Enterprise	Falls River				100	600
St. Anthony Canal	St. Anthony Canal		1	250		≈400
Marysville Drop[2]	Marysville Canal		1	40	66	200
					Total	129,000
Present and Active Proposed Powerplants						23,000
Grace & Cove (for comparison)	Bear R.					18,000
C.J. Strike (for comparison)	Snake R.					79,000

[1] Water Power Resources of Idaho by USGS
[2] Tudor Report
[3] May be developed by an active proposed power plant
[4] Several options for same area

Hatchery Ford/Riverside Campground Diversion - A second proposal for the Mesa Falls area would pick water up below Hatchery Ford, and move it south into a small off-stream holding area. Water could be pumped into the holding area at night and removed for generation during peak demand periods. From the holding area, the water would be moved to Ashton Reservoir, a total distance of 7.5 miles with a net drop of 730 feet (see map at the end of "Water Supply").

An alternate method of developing the powerhead is to make the initial diversion at a point one-fourth mile below Riverside Campground. After a lift of 80 feet, the water would be moved southwest five miles to a reregulating reservoir at the north base of Big Bend Ridge. A three-fourths mile tunnel and a six-mile penstock would allow the development of 880 feet of net head at Ashton Reservoir.

The average generation might be near 30,000 KW or about 50 percent of nameplate rating. The in-place regulating capability at Ashton Reservoir would reduce construction cost over similar peaking projects elsewhere since a re-regulating reservoir would not be needed. Summer time minimum flow rights held by the Idaho Water Resource Board (1,000 cfs - April 1 to September 30) could prevent most natural flow diversions, however, releases from Island Park reservoir apparently would be available for diversion.

Lookout Butte - The five miles above the Riverside Campground generally has a very easy gradient. Ambitious development proposals would capture the river drop in this five mile reach with a 20-30 feet high diversion dam placed just above Riverside Campground. From the diversion dam a seven-mile parallel canal and/or penstock would move the water to Upper Mesa Falls. About 300 feet of gross head would be developed. The estimated average annual generation for the total reach could be 18,000 KW. The generators would be somewhat larger.

Teton - See "Surface Water Storage Sites" under "Water Supply" for this project.

Anderson - This project on the Falls River would divert water for a distance of approximately six miles. Roughly 260 feet of head would be developed. Average annual generation would be approximately 13,000 KW.

Sheep Falls (Falls River) - This project, identified in Waterpower Resources of Idaho, would have a 200-foot dam on the Idaho border in Sec. 17, T. 9 N., R. 46 E. From the reservoir a canal would extend downstream four miles. Average generation is estimated at 12,000 KW. An altered non-dam project would be a river level diversion two miles above the Idaho border, just below Cave Falls Campground. A ten-mile canal could extend downstream to the Yellowstone diversion. The canal would need to be a buried conduit to reduce wildlife disturbance.

Last Chance - The seven-mile reach of the Henrys Fork from Island Park Dam to the Osborne Bridge has 190 feet of drop with a fairly consistent grade, although the upper area is slightly more steep. Lower gradient hydroelectric potential is usually developed by diverting a portion of the river into an adjacent canal to keep a level gradient until dropped to the powerhouse. A total potential of 11,000 KW of average annual energy may exist in this river reach.

Squirrel - See Yellowstone Hydro, the Yellowstone Hydro project would develop the Squirrel proposal.

Judkins - See site labeled "Bitch Creek" under "Surface Water Storage Sites" in the "Water Supply" section.

Tetonia - See "Surface Water Storage Sites" under "Water Supply Section."

Warm River Butte - In Waterpower Resources of Idaho, this site would develop the power head between elevations 5,800 and 5,480 or 320 feet on the Warm River. The diversion point would be in Sec. 3, T. 10 N., R. 44 E., and a six-mile conduit would move the water to a powerhouse in Sec. 32, T. 10 N., R. 44 E. This would develop an average 4,000 KW of energy. Picking the water up only 15 feet lower would shorten the conduit length one mile and would allow using flow from Warm River Springs.

An alternative potential development could lift water about 200 feet, to the top of the plateau, from a point just above the cascades. At a distance of one and one-half miles, a net drop of 370 feet down Bear Gulch into the Henrys Fork would allow for the development of about 1,500 KW (3,000 KW peaking). About 70 cubic feet per second are available above the state designated minimum flow.

Cross-Cut Diversion - This site is located at the Henrys Fork diversion dam into the Cross-cut Canal (Sec. 14, T. 8 N., R. 41 E.), seven miles northeast of St. Anthony. A power plant could use a ten-foot drop at the diversion dam located just below the mouth of the Falls River. The estimated annual generation is 11,000 MWH or an average generation of 1,200 KW. By using two miles of the canal a total gross head of about 35 feet appears to be available. This design would require a three-fourths mile penstock.

Enterprise Hydroelectric - This site is located at the Enterprise Canal siphon crossing of the Teton River, about three miles northeast of Newdale. Annual generation is estimated at 5,500 MWH, a 600 KW average. Water from the Enterprise Canal would drop 100 feet. The water would be diverted from the Falls River, about five miles above its mouth, to the Enterprise Canal. The power plant could use only excess irrigation water so power generation would be higher in April or August than in June, a month of high irrigation use. The canal could also be used during the nonirrigation season except during maintenance periods or when icing problems cause difficulty.

Partridge - As identified in Waterpower Resources of Idaho, water would be diverted to a conduit at the confluence of Warm River and Partridge Creek in Sec. 20, T. 11 N., R. 44 E and moved three miles to a powerhouse at Sec. 33, T. 11 N., R. 44 E. The 250 feet of head would be developed between elevations 6,050 and 5,800. This project could develop an average 3,000 KW of energy.

Boone Creek - See "Surface Water Shortage Sites" under "Water Supply."

Lower Ashton - This project has been identified in a short reconnaissance report by the Corps of Engineers. A 25-foot drop through a structure on the Henrys Fork would average 3,000 KW or about 22,000 MWH of energy. A reservoir 2.4 miles long would be created immediately below Ashton Reservoir. The project was estimated at 55 mills per KWH with an interest rate of 12 percent.

Victor - This project would use water from Trail, Moose and Game Creeks located southeast of the town of Victor in Teton County. Waterpower Resources of Idaho suggests an average of 2,000 KW can be generated through 400 feet of drop at this site. This area now has a gravity sprinkler system using this water during the irrigation season. The need to maintain sprinkler pressure cuts in half the amount of potential generation during the irrigation season. There are two pressure reducing stations in this irrigation system. The pressure reducing stations would have some generating capacity other than during peak flow times. Nonirrigation season use of this system generally would only be possible for about 250 feet of elevation drop in the steel pipe portion of the system that takes water from Game Creek. The asbestos pipe used in other parts of this system is better used only for warm weather operations. New facilities would be needed to use Trail Creek water during the nonirrigation season.

Canyon Creek - See "Spring Creek" under "Surface Water Storage Sites" in the "Water Supply" section.

Fish Creek - Water could be diverted by canal at the 5,800 feet elevation level on Fish Creek. This would give 440 feet of head down to the 5,360 elevation level on Warm River. To make a project economical, water also would need to be collected from Robinson, Snow and Rock creeks at the 5,800 feet elevation level. Two one-mile tunnels would significantly shorten canal routes, however, five miles of canal would still be needed. The average annual generation is estimated at 2,000 KW with a power plant nameplate rating of 4,000 KW.

Buffalo River Hydro - See "Surface Water Shortage Sites" under "Water Supply."

Upper Badger - See "Surface Water Storage Sites" under "Water Supply."

Coffee Pot Rapids - About 45 feet of river drop within a distance of one-half mile on the Henrys Fork at Coffee Pot Rapids could be developed. The average annual energy available is estimated at 1,000 KW. Flows vary from about 250 cfs to near 600 cfs although average flows appear to be about 350 cfs.

St. Anthony Canal - At the Henrys Fork diversion dam, located about three miles east of St. Anthony, water could be taken into the St. Anthony canal. On the north side of the river, the water would move about one mile then drop 13-15 feet back to the river. Potential generation would be about 5,500 MWH from 800 KW generators.

Marysville Drop - A drop of nearly 66 feet in the upper end of the Marysville Canal, Sec. 36, T. 9 N., R. 43 E., is a potential hydropower site. The project could be used only during the irrigation season. The Falls River (FERC #9885) project has prior water rights during the nonirrigation season. This project could generate an average of 200 KW of electricity with a reported 40 cfs of water. This site is listed in the Tudor report.

Yellowstone Hydro - This potential 4,500 KW power plant is located on the Falls Rivers above the earlier described Falls River project. The 28,000 MWH estimated average annual generation would provide an average 3,200 KW. The diversion point would be the existing Yellowstone Canal diversion from the Falls River in Sec. 23, T. 9 N., R. 45 E., two miles upstream of the National Forest boundary. The powerhouse would be four miles downstream where the estimated drop from the canal to the river is 110 feet. This powerhouse location is just upstream of the Marysville Canal and the Falls River hydroelectric project. As with the Falls River project, enlargement of the canal would allow for power plant operation most of the year.

Other Projects - There are other potential hydropower sites in the basin. For example, the Henrys Fork drops 100 feet from Warm River to Ashton Reservoir, 60 feet between Ashton Reservoir and the Falls River, 90 feet between Falls River and St. Anthony, and 140 feet from St. Anthony to the Teton River, South Branch. The Falls River drops 350 feet between the Falls Hydroelectric Project powerhouse at the Reclamation Road river crossing and the Falls River mouth.

Recommended Action

1. The Idaho Water Resource Board makes no recommendation for specific project development at this time.
2. The Water Resource Board's policy concerning hydropower is: that energy conservation and efficiency improvements are the most desirable methods to provide additional power, that new hydropower resources be developed at existing structures whenever feasible, and that new projects should be carefully evaluated to insure that the benefits to the state outweigh any negative consequences.
3. Where state protected river designations prohibit new hydropower development, the Water Board will consider petitions to amend the comprehensive state water plan on a case-by-case basis. Where the benefits outweigh any negative consequences the Board will initiate the amendment process and seek public input.

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Flood Control

Within the Henrys Fork Basin there are two areas which exhibit significant flood problems -- the Lower Teton River (both the north branch and the south branch) and the Lower Henrys Fork below Ashton Reservoir. The highest flood peaks are caused by winter rain and low elevation snowmelt over frozen ground, but the more common flooding is from springtime snowmelt which may be augmented by rain.

Only a relatively small portion of the total land area is susceptible to flooding. However, many of the flood-prone areas are located in the more intensively settled areas. Generally, these areas are narrow strips along the stream and include good farmland, rural settlements and urban strips. Floods seldom cause loss of life but often result in damage to land and buildings, highways, railroads and irrigation facilities.

Large floods on the Teton River have an average reoccurrence interval of every four years, although, recently, they have been more frequent. General Teton River inundation occurs with a discharge over 4000 cubic feet per second (cfs) which is exceeded about one year in four. Normal bank full capacity appears to be 2000 cfs, which is exceeded almost every year. Strengthening of the partial flood control levees as a part of the emergency follow-up work after the Teton Dam flood, has increased river capacity in urban and other selected areas. However, these levees do not provide complete protection, and in many areas there are no levees. On the Teton River the particularly hazardous period is early spring when ice jams are common. Ice jamming is accentuated by natural stream obstructions and poorly designed bridges and irrigation weirs.

Instantaneous flow near the town of Teton from a periodic flood of a 10 year, 50 year, 100 year and 500 year interval are respectively: 4,800 cfs, 9,000 cfs, 13,000 cfs, and 21,000 cfs. The highest flow of record is 11,000 cfs on February 12, 1962 except for the Teton Dam failure (1,700,000 cfs). Most years the maximum flow occurs in May or June. Estimates are that 60 percent of the flow moves through the South Branch Teton River and 40 percent of the flow moves through the North Branch.

Given the relative low flows that cause inundation outside the stream channel (2000 cfs) there is a high frequency of flooding. The 100 year floodway area is 11,000 acres for 23 miles of stream along two branches. At a purchase value of $1,500 per acre, including buildings, the total property value would be just over $16,000,000.

There are nine bridges over the Teton River with bridge beams so low that there is a damming of water for a 100 year flood (ACE, 1977; FEMA, 1990). Most of the bridges are county-owned. The worst three bridges have such low beams even a ten year flood appears to cause a water rise of four to five feet. This damming raises the river level at these constrictions and accentuates the flooding of surrounding land. The constriction in turn allows for some riverbed filling, generally on the upstream side of the bridges.

Even bridges repaired after the 1976 Teton Dam failure are a problem. The bridges may not have been raised sufficiently to clear a 100 year flood or even a 50 year flood. Flood control from the Teton Dam project was assumed when a state-owned bridge, built just prior to the Teton Dam flood, was designed. The flood left the bridge but washed out the approach road which was replaced. Another state bridge was built with lower flood flow criteria than those used by the Corps of Engineers. This bridge shows a gouging of the riverbed which suggests constriction at the bridge, with a resulting upstream water level rise and adjacent flooding.

A bridge design with closely spaced piers can similarly contribute to flooding because they collect brush and/or ice blocks. Winter ice-jam floods are more common at higher elevations. Railroad bridges are examples of the closely spaced pier design. The design of some water diversion structures also may need to be reviewed to make sure there is not unnecessary damming or brush collection during flood conditions.

A review of the river profile shows several county bridges have riverbed gouging under the bridge, or a significant drop in the riverbed just downstream from the bridge. Both are a major indication of constriction which results in an increase in upstream flooding. The following table lists the Teton River bridges, the distance the beams are under water in a 100 year flood, and the amount of water level rise from the downstream to the upstream side of the bridge. All county bridges are in Madison County except as noted. On the Lower Henrys Fork there is one state bridge (Highway 33), one Madison County bridge, one Fremont County bridge and one railroad bridge for which flood constriction flow data is not available. Further study is needed to determine flood levels on the lower Henrys Fork.

Proper bridge design will pass a 50-year flood with two feet of clearance below the beams, and pier spacing and river channel width limit water level rise to one foot. A 100 year flood generally increases the river level rise an additional one foot over the 50 year flood so the 50-year flood design criteria will generally pass a 100-year flood. (A 500-year flood generally raises the water level only an additional foot over the 100-year flood.)

Table 47. Teton River Bridges

Bridge Location	Depth Bottom of Bridge Under 100 Year Flood	Water Level Rise Downstream to Upstream Side of Bridge in 100 Year Flood
South Branch (Fork) Teton River		
County Bridge - Two miles west of Rexburg then north ¼ mile	5½ feet	2½ feet
County Bridge - Secondary system one mile west of Rexburg then 3/4 mile north - Hibbard-Egin Road	4 feet	3 feet
U.S. 20 - Two bridges	¼ foot	zero
Union Pacific Railroad - North side of Rexburg	½ foot	2 feet (very close pier spacing)
State-U.S. 33 - North edge of Rexburg - Current data	1 foot	1½ feet
County - Sugar City road two miles east of Rexburg then ¼ mile north	4 feet	1½ feet
County - Secondary system - Moody Road - Two miles north then two miles west of Rexburg	2½ feet	6 feet
County - Three miles north then two miles west of Rexburg	6 feet	6 feet
State - Idaho 33 - Current data	3 feet	5 feet
Fremont County - Teton Road - Secondary system-One-half mile north of Teton	½ foot	1 foot
North Branch (Fork) Teton River		
County - Secondary system - One Mile west then three miles north of Rexburg	zero	minor
County - Secondary system - Salem- Parker Road - Kilgore Road - Four miles north of Rexburg	zero	minor
County - One mile east then one mile north of Salem	zero	zero
U.S. 20 - Two bridges	zero	zero
Union Pacific Railroad	zero	minor (very close pier spacing)
County - One-half mile north, one mile east and three-fourths mile north of Sugar City	zero	minor
Madison and Fremont Counties - One mile west of Teton then one mile north	4 feet	2½ feet
Fremont County - Teton Road - Secondary system one-half mile north of Teton	½ foot	minor
Falls River - Fremont Count - one and one-half miles north of Chester	2 feet	zero
(Elevation data not available on other Falls River Bridges)		

A flood relief channel known as the Newdale Diversion has been proposed for the Teton River. In Sec. 15, T. 7 N., R. 41 E., a diversion structure would be placed in the river at the mouth of the canyon, just above the Newdale Road crossing three miles north of Newdale. A 10-foot dam would divert a major portion of Teton flood water to the Henrys Fork in the vicinity of St. Anthony. Further study would determine the best alignment of an approximate four-mile canal. Accompanying levees may be needed at the Henrys Fork junction with the Teton River. Drilling done as part of a preliminary study for a 23,000 acre-foot reservoir at this site, indicates heavy water losses through the south bank. Water loss will be much less without a storage structure.

For the Henrys Fork the flood hazard starts just below Ashton Reservoir, north of St. Anthony. The critical area appears to start further downstream at a point located four miles below St. Anthony. Similar to the Teton River, ice-jam flooding associated with spring snowmelt appears to be the major problem. At the Henrys Fork, Rexburg gage the bank-full river capacity is about 4500 cfs (generally exceeded two years out of three), while the largest flood of record is 16,400 cfs. A U.S. Corps of Engineers Special Flood Hazard Report is not available for this lower Henrys Fork reach so the periodic flood level peaks are not known.

There is minor control of the Henrys Fork at Island Park Reservoir and at Henrys Lake. These reservoirs provide only limited flood control since they are in the upper third of the drainage basin.

In addition, flood control operation criteria for the reservoirs provides a very low amount of dual flood control-irrigation space, 23,000 acre-feet at Island Park and none at Henrys Lake Reservoir.

Recommended Action

1. A reconnaissance flood control study on the Lower Henrys Fork below St. Anthony is needed. The study should include a USBR/IDWR review of the feasibility of more dual flood control-irrigation space being provided in upstream reservoirs and exchanged for irrigation space in main-stem Snake River reservoirs.
2. Encourage the Corps of Engineers to undertake flood control studies on the Lower Teton River. A first phase would be to determine the current channel capacity.
3. Bridges within the basin should be reconstructed to current design standards. Low bridges can cause water level increases during flood conditions. Such construction would reduce any possible liability for flood damages.
4. Any new public or private water storage reservoir, including off-stream reservoirs, should have some flood control space combined with the other uses of the reservoir.

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Water Quality

In general, the groundwater quality of the Henrys Fork basin appears to be good in both the highlands and the agricultural valleys. The exception might be warm water areas where fluoride may be high. In the Ashton area and near the mouth of the basin, the bicarbonate and calcium levels that govern water hardness are higher than in most other areas of the basin. A concern with groundwater in the basin is bacterial levels. In a 1979 study of the Eastern Snake River Basin, 20 percent of tested wells exceeded total coliform standards, and 11 percent exceeded fecal coliform standards. Coliform bacteria are bacteria that live in the intestinal tract of living organisms. Fecal coliform bacteria live in the intestinal tract of warm-blooded animals. Not all fecal coliform are disease causing bacteria, however, they are an indicator of the possible presence of disease causing bacteria and viruses. More stringent control of well construction since 1979 may have reduced the problem. (See "General Water Quality" in the Appendix.)

Much of the highland groundwater eventually becomes surface water at springs or streams. Surface water in the basin, most of the time, is of quite good quality. In the upper basin plateau areas the few exceptions relate to a marginally high fluoride condition in Big Spring Creek, the Buffalo River, Warm River, and the Falls River. There also are some summer periods when there is such a significant inflow of nutrients (phosphorous and nitrogen) that there is considerable aquatic growth in surface waters. Much of this nutrient inflow appears to be natural, although septic tank effluent may be contributing a significant amount. Further study is needed to distinguish the contribution from each source. The aquatic growth reduces the clarity of the water, but provides a food base for fish. In the lower reaches of the basin irrigation return flow, as well as early season spring runoff from tilled agricultural land, adds nutrients, sediment, and related organic matter to the streams.

General Contaminants

The two water-born chemicals that allow for algae growth in water are the plant nutrients phosphorous and nitrogen. Phosphorous is common in several rock types in the upper Henrys Fork basin. The phosphorous is available as a dissolved mineral but the larger source is sediment with attached phosphorous. With so much phosphorous available in basin rock, a major goal is to keep down soil erosion. In water having a total phosphorous concentration greater than 0.025 mg/l, algal densities are high enough to significantly reduce water clarity.

Nitrogen is usually present in the soil, particularly in biological matter. Some nitrogen may enter the basin from precipitation, chiefly from snow (see R. G. Wetzel, Limnology, W. B. Saunders Co., 1975). Excessive concentrations of nitrate and ammonia (NH_3) in water generally result from leaching of organic and inorganic material. Nitrate does not enter into ion-exchange reactions so it tends to stay in solution and does not attach itself to soil particles. This can result in relatively high concentrations in groundwater, particularly near agricultural areas where fertilizers may contribute to nitrate concentrations unless special slow release types of nitrogen fertilizers are used. Ammonia does break down but attaches to soil particles. Biologic organisms further breakdown ammonia to nitrites and then to nitrates, both nonattaching.

Since both phosphorus and nitrogen are essential to normal plant growth, dense undesirable algae "blooms" occur in water bodies that receive excessive amounts of these nutrients. Warm water temperatures (over 68°F) also contribute to heavier algae growth. The Henrys Fork is nitrogen limited and therefore more responsive to changes in nitrogen levels.

Excessive algae growth occurs in shallow, wide, unshaded river reaches during the summer. Some algae growth is needed to provide food for macroinvertebrates. Excessive algae growth, however, detracts from visual enjoyment of the water, and sudden algae decomposition depletes dissolved oxygen. Dissolved oxygen is an indicator of the ability of a stream to sustain fish populations. The State of Idaho has set water quality standards for cold water fisheries. Dissolved oxygen levels must be above 6 mg/l, and the maximum daily average temperature is limited to 19°C (66°F). For salmonid spawning dissolved oxygen must be above 6 mg/l or exceed 90 percent saturation, whichever is greater, with a maximum daily average water temperature below 9°C (48°F).

Related to the negative impact of excessive algae growth in water is the impact of turbidity. Turbidity is a cloudiness of the water caused by suspended solids or sediments. As with algae growth, turbidity detracts from the visual enjoyment of the water body. Suspended solids greatly reduce the amount of sunlight needed to produce the instream vegetative matter used by macroinvertebrates. Consequently, there is a reduction of lower-level organisms and a reduction in available fish, especially of the salmonid family. Suspended materials settle out on the stream bottom in areas of reduced flows such as pools, backwaters, and in-between gravels. This causes fish spawning redds to be covered by sediments, which in turn suffocates the developing fry. Additionally, the sediments fill in gravel areas on the stream bottom which are hiding and reproduction areas for macroinvertebrates. This directly reduces the numbers and kinds of food salmonids feed upon. Other minor impacts caused by sediments include gill abrasion, increased stress, and lack of feeding caused by an inability to see the target food.

Idaho water quality requirements contain three different standards for fecal coliform levels in both primary contact and secondary contact waters. A geometric mean limits actual count to 200 colonies per 100 milliliter (ml) sample for secondary contact recreation such as water skiing and 50/100 ml for primary contact recreation such as swimming. In addition, primary contact waters are not to have actual counts more than 500 colonies per 100 ml at any one time, nor can they contain 200 colonies per 100 ml in more than 10 percent of the samples taken over a 30-day period. Secondary contact waters are not to have actual counts more than 800 colonies per 100 ml at any time, and no more than 400 colonies per 100 ml in 10 percent of the samples taken over a 30-day period.

Water used for domestic water supplies have standards generally relating to man-caused contaminants. Most of these are positively-charged cations. These cations and the anions cyanide, fluoride, and nitrate with their maximum allowable concentrations in mg/l are:

Arsenic	0.05	Barium	1.00
Cadmium	0.01	Chromium	0.05
Cyanide	0.20	Fluoride	1.40 - 2.40
Lead	0.05	Mercury	0.002
Nitrate	10.00	Selenium	0.01
Silver	0.05		

Similarly, standards in mg/l have been established for the following pesticides in open water bodies:

Endrin	0.0002	Lindane	0.004
Methoxychlor	0.10	Toxaphene	0.005
Trihalomethane	0.10	2,4-D	0.10
2,4,5-TP silvex	0.01		

As part of a regulations program, about 50 additional pesticides can be monitored in drinking water after it leaves a treatment plant or moves into a distribution system. Regulatory control is not currently set by specific maximum allowable concentrations but by general control criteria. In addition, groundwater used for public drinking supplies shall not exceed the following standards in mg/l. If these standards are exceeded, new water delivery systems must treat the water to reduce these chemicals:

Copper	1.00	Chloride	250.00
Hydrogen sulfide	0.05	Iron	0.30
Manganese	0.05	Sulfate	250.00
Zinc	5.00	Alkyl benzene sulfonate (ABS - plastic)	0.50
Phenols	0.0001		
Benzene	0.005	Vinyl chloride	0.002
Carbon tetrachloride	0.005		
Total dissolved solids	500		
Temperature	80°F		
Color	15 units		
Odor	3 units		
General bacteria	500/ml		

A maximum ground-water source turbidity standard, regardless of treatment, has been established at five nephelometric turbidity units. New requirements on coliform bacteria have been adopted by the Federal Government. The new requirements state the ground-water source shall contain no coliform bacteria. Treatment will be required on any public drinking water source having coliform contamination.

Maximum contamination levels have also been established for specific radioactive chemicals and radioactive particles in drinking water systems. On the Island Park plateau, outside the Caldera area, and along the Big Hole Mountains, and in other areas over felsic (rhyolite) material, the potential exists for the occurrence of radium-226 in groundwater. Only community water systems are now sampled for this hazard. Community systems in general are not located in these areas. Individual wells located in areas with rhyolitic bedrock should be tested for radium.

Nonpoint Source Pollution

Both surface water and groundwater quality control has centered on controlling "point source" discharges, such as from a municipality or an industrial plant. Nonpoint source pollution comes from many sources and is carried into the stream by runoff.Primary nonpoint source impacts to water quality in the Henrys Fork watershed are from agricultural activities including irrigated crop production, pastureland, rangeland and minimal amounts of non-irrigated crop production. There are additional impacts from forest practices, on-site wastewater systems, channelization, riparian vegetation removal, streambank modification and flow modification (IDHW, 1988). Cold water biota and salmonid spawning are only partially supported in many of the tributaries to the Henrys Fork and Henrys Lake Outlet. In the Henrys Fork below St. Anthony primary and secondary contact recreation are potentially at risk. The primary pollutants are sediment from agricultural activities and hydrologic/habitat modifications, nutrients and bacteria from agricultural activities, and wastewater systems.

The Teton River watershed, above its divergence, is impacted by irrigated and non-irrigated crop production, rangeland activities, channelization, dam construction and riparian vegetation removal. Tributaries to the Teton are impacted by pastureland, flow modification, riparian vegetation removal and streambank modification. From Trail Creek to Highway 33, the Teton River and its tributaries, only partially support cold water biota and salmonid spawning. From Bitch Creek to the Teton damsite cold water biota and salmonid spawning are either not supported or only partially supported. Primary and secondary contact recreation are potentially at risk. The primary pollutant in the Teton River is sediment from agricultural impacts and hydrologic modification. Additional problems are thermal modification and flow alteration.

Agricultural impacts from irrigated crop production, pastureland and rangeland are the primary sources of nonpoint source pollution after the Teton River diverges into its North and South Forks. Non-irrigated crop production and some animal holding areas contribute additional nonpoint source impacts, primarily from channelization of streams. The primary pollutants from nonpoint source activities are nutrients, sediment and bacteria from agriculture. Cold water biota and salmonid spawning are only partially supported in this river segment. Primary and secondary contact recreation are potentially at risk.

Shallow aquifers in the lower Henrys Fork and in the Teton Valley are of special concern because of the considerable use of the aquifer for drinking water, the shallow depth to water, the application of significant amounts of chemicals and the relatively porous nature of the subsoil.

A number of new regulations have been adopted on nonpoint source discharges. Among those which have an impact on the Henrys Basin are the Forest Practices Act (Title 38, Chapter 13, Idaho Code), and the Idaho Surface Mining Act (Title 47, Chapter 14, Idaho Code).

Specific Water Bodies

Island Park Reservoir - In 1981 water quality was impaired somewhat by algal blooms and occasional high fecal coliform bacteria counts. Algae blooms provide conditions which aggravate ammonia toxicity; excessive algae decomposition depletes dissolved oxygen below the stratified zone.

Island Park Reservoir has a relatively shallow depth (generally less than 50 feet) with little stratification because of wind action during the ice-free months.

Algae blooms in Island Park Reservoir are stimulated in the summer by a natural occurring phosphorus concentration of 0.04 mg/l. A USBR study suggests, septic tank drainage from recreation areas does not contribute significantly to reservoir phosphorous loading (Zimmer, 1981). The dissolved orthophosphorous (non-biological in origin) concentration was exceptionally high (0.60 mg/l) in springs emerging from both developed and undeveloped shorelines. Ground-water flows and bank storage thus appear to play a dominant role in the phosphorous dynamics of the reservoir.

The occasional high counts of fecal coliform bacteria may originate with livestock operations or inadequately treated sewage at recreation facilities in the area. The installation of adequate sewage treatment facilities will hopefully solve this problem.

Henrys Lake - The lake is less than 30 feet deep so there is little temperature stratification during the ice-free period, largely because of wind action. Reduced oxygen levels occur with depth due to decomposing aquatic vegetation in the fall. Once ice covered, dissolved oxygen levels may be very low. Efforts are underway through a state Clean Lakes Project to address water quality problems. The Yellowstone Soil Conservation District will address the impacts of erosion on private agricultural land bordering the lake and its tributaries. Fremont County and the Division of Environmental Quality are assessing the impact of septic tanks on the lake.

Henrys Fork and Tributaries - Water quality of the Henrys Fork and major tributaries is high when sampled above irrigated agricultural areas. Temperatures are cold enough (less than 66°F) to support coldwater fisheries year-around. Dissolved oxygen has exceeded the 6.0 mg/l minimum for the period of record.

Bacteria counts seldom exceed State standards except for the reach below Macks Inn on the Henrys Fork. Immediately downstream of Macks Inn, total coliform exceeded Idaho standards on all sample dates except one (Holte et al. 1973). Seasonal recreational use of the upper Henrys Fork and subsequent sewage loading lowers water quality to the point of precluding water contact recreation. Much of this area has recently been sewered. Wastes are pumped to a sewage treatment plant. Water quality in the reach should be much improved.

The nutrient content of the Henrys Fork and its tributaries is moderately high. Mineral content increases with progression south through the basin. Nutrient content sharply increases where irrigation return flows enter the streams. Between St. Anthony and Rexburg (23 miles), hardness increases 60 percent, sulfate increases 30 percent, nitrate increases 15 percent and total phosphorous increases 30 percent. Most phosphorous loading to the Henrys Fork is from Island Park Reservoir. Turbidity increases also, but sporadically. Mean turbidity at Rexburg is only slightly above upstream concentrations. Maximum summer temperature does not seem to increase downstream perhaps because downstream reaches are partially recharged with cold groundwater flows below irrigated areas in the lower basin. Summer temperatures are adequate for salmonid rearing throughout the Henrys Fork. Dissolved oxygen is suitable for salmonid rearing throughout the reach although summer lows approach 6.0 mg/l at Rexburg.

In the upper basin nutrient supplies are balanced for good attached benthic algae and aquatic macrophyte growth, but excessive growths do not usually occur in the free-flowing river because of turbulence and low water temperatures. Slowing waters sufficiently will cause algae blooms, particularly where the river is unshaded, wide, and shallow.

Special Resource Waters

Waters of the State may be designated "Special Resource Waters". Special Resource Water designations predate Idaho's anti-degradation legislation, and are aimed primarily at protecting beneficial uses against point source pollutants. Designation recognizes at least one of the following characteristics:

1. The water is of outstandingly high quality, exceeding both the criteria for primary contact recreation and cold water biota; or
2. The water is of unique ecological significance; or
3. The water possesses outstanding recreational or aesthetic qualities; or
4. Intensive protection of the quality of the water is in the paramount interest of the people of Idaho; or
5. The water is a part of the National Wild and Scenic River System, is within a State or National Park or wildlife refuge and is of prime or major importance to that park or refuge.
6. Intensive protection of the quality of the water is necessary to maintain an existing, but jeopardized beneficial use.

In the Henrys Fork basin the general criteria listed above were applied to designate the following rivers and streams as Special Resource Waters:

- Henrys Fork from its source to its mouth
- Buffalo River from its source to its mouth
- Warm River from its source to its mouth
- Falls River from its source to its mouth
- Teton River from its source to the North and South branches.

No new point source can discharge, and no existing point source can increase its discharge, above the design capacity of the existing wastewater treatment facility to any water designated as a Special Resource Water, or to a tributary of or to an upstream segment of a Special Resource Water, if pollutants in that discharge can or will result in a reduction of the water quality of the special resource water. As long as a point source discharge is regulated by an order, decree, compliance schedule, or valid discharge permit, the discharge or facility will not be subject to additional restrictions.

Nonpoint source activities that are being conducted in accordance with rules, regulations, and best management practices, or in the absence of referenced best management practices, conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts, will not be subject to conditions or legal actions. If water quality monitoring and surveillance show that water quality criteria are not being met, or that beneficial uses of special resource waters are being impaired as a result of a nonpoint source activity by itself, or in combination with other point and nonpoint source activities then the Director of the Idaho Department of Health and Welfare may prepare a compliance schedule or institute administrative or civil proceedings.

The following are approved best management practices for the purpose of Idaho Department of Health and Welfare Rules and Regulations:

Idaho Forest Practices Rules
Idaho Department of Health and Welfare Rules Governing Solid Waste Management

Idaho Department of Health and Welfare Rules Governing Subsurface and Individual Sewage Disposal Systems
Rules and Regulations and Minimum Standard for Stream-Channel Alterations as adopted by the Water Resource Board

Stream Segments of Concern

Idaho Executive Order 88-23 provides for designation of Stream Segments of Concern through public nomination and the Water Quality Advisory Working Committee. Designated Stream Segments of Concern will receive priority for water quality management and monitoring by state and federal agencies. A coordinated water quality monitoring program will be implemented to provide current and ongoing data, report on the status of beneficial uses and monitor the effectiveness of Best Management Practices in meeting water quality standards and protecting existing beneficial uses. Designated Stream Segments of Concern in the Henrys Fork basin are:

Henrys Lake
Falls River - Headwaters to Henrys Fork
Warm River - Warm River Springs to Henrys Fork
Robinson Creek - Yellowstone NP to Warm River
Fish Creek - Headwaters to Robinson Creek
Porcupine Creek - Headwaters to Robinson Creek
Rock Creek - Yellowstone NP to Porcupine Creek
Teton River - Headwaters to Bitch Creek

Recommended Action

1. Study the impacts upon the fishery of phosphorous and nitrogen loadings to Henrys Lake, Island Park Reservoir, the Upper Henrys Fork and the Upper Teton River. Studies should consider all sources including livestock. Administrative entities are encouraged to take early action to implement corrective measures.
2. Determine the impact of lessening and of increasing the level of nutrients introduced from ground-water movement to surface water of homesite waste water near the above water bodies.
3. In the lower Henrys Fork basin and in the upper Teton River basin, determine the best method to eliminate or reduce bacteria levels in each rural drinking water well.
4. Determine radium-226 levels in each rural well located in rhyolitic rock areas.
5. In the lower Henrys Fork basin, study the impact of agriculture nitrogen movement into the perched water system and subsequently into the Henrys Fork and Teton River. Similarly, determine the impact of pesticide movement in the water system.
6. To provide control of sheet erosion in sloping cropped land, agricultural agencies should maintain their research and educational programs for improved best management practices.
7. Develop methods to reduce the sediment load of irrigation field and dryland farm runoff to improve fishery resources in the lower Henrys Fork and lower Teton rivers. These methods may enhance aquifer recharge which benefits out-of-basin areas. Tail water pump-back systems may be part of the solution. Cost-share methods of implementation should be developed to carry out this objective.

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Water Supply and Water Conservation

Current Water Supply

Average precipitation varies greatly from less than 10 inches in the lower valley near the mouth of the Henrys Fork, to over 70 inches in the Teton peaks. Precipitation at the higher elevations varies from 25 to 40 inches (Figure 21). Weekly long-term temperature and precipitation data for Ashton, Idaho Falls, and Island Park Dam are in the Appendix. Table 48 is a water budget for the basin based on watermaster records and estimates of other water use. Precipitation averages 24.1 inches over the entire 3,220 square miles of the basin (including the Wyoming portion). This translates into 4,139,000 acre-feet of water.

For the areas covered by watermaster records, consumptive use is 27 percent of diversions. Ground-water recharge is 64 percent of the diversion. Return flows average 9 percent of the diversions. River outflow from the basin averages 1,400,00 acre-feet. The watermaster's records indicate approximately 700,000 acre-feet of diverted water percolate to the subsurface and recharge the groundwater. An additional 500,000 acre-feet are estimated to recharge the aquifer either directly from precipitation or as leakage from surface water. Approximately 200,000 acre-feet of this annual recharge are pumped and consumptively used within the basin. The remaining precipitation (1,000,000 acre-feet) evaporates or is used by vegetation.

Table 48. Water Budget - Henrys Fork Basin

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

Table 49 shows the estimated annual flow based on 1985 conditions at various gages for the low flow year of record, 1934; a recent low flow year, 1977; the average flow, and for a high flow year, 1984. Graphs of maximum, average, and minimum daily flow for two stations on the lower Henrys Fork and Teton Rivers are also presented (Figure 22). These graphs show the extreme variation in flow throughout the year. A bar-chart of annual flows for the Henrys Fork near Rexburg shows a great variability from the 1,400,000 acre-feet average. The yearly surface outflow varies from 600,000 to 3,000,000 acre-feet. Gages at Ashton and on the Teton River at St. Anthony do not show comparable variability. River diversions are fairly constant (Figure 23). Water storage in the basin is provided by the reservoirs listed in Table 50.

Table 49. Annual Flows (Adjusted to 1985 Development Levels)

(1000 acre-feet)

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

There is some storage on the Henrys Fork, although, Henrys Lake Reservoir is located so high in the headwater area that the average runoff into the reservoir is only about 40,000 acre-feet. Island Park, Grassy Lake and Sheridan reservoirs generally fill even if emptied the previous year. The reservoirs owned by the Idaho Department of Fish and Game are used for fish and wildlife purposes so storage water generally is not released. For the Teton River drainage there is no storage, while for the similar-sized Falls River there is only minor storage available.

Table 50. Water Storage Reservoirs in the Henrys Fork Basin

Storage Reservoir	Owner	Built	Active Capacity in Acre-Feet	Stream
Island Park	USBR	1938	127,000	Henrys Fork
Henrys Lake	Private	1923	90,000	Henrys Fork
Grassy Lake (Wyoming)	USBR	1939	15,000	Falls R. Trib.
Sheridan	Private	1947	3,398	Sheridan Cr.
Silver Lake	IDPR	1915	2,548	Thurman Cr.
Lower Arcadia	Private	1912	882	Sand Cr. Trib.
Blue Cr. #4	IDPR	1960	390	Sand Cr. Trib.
Golden Lake	IDFG	1915	360	Thurman Cr.
Upper Arcadia	Private	1912	300	Sand Cr. Trib.
Bergman (Wyoming)	Private	1953	201	Squirrel Cr. Trib.
Blue Cr. #3	IDFG	1965	168	Sand Cr. Trib.
Upper Blue Cr.	IDFG	1950	166	Sand Cr. Trib.
Upper Mikesell	Private	1945	130	Sand Cr. Trib.
Blue Cr. #2	IDFG	1940	77	Sand Cr. Trib.
Lower Mikesell	Private	1940	70	Sand Cr. Trib.
Blue Cr. #1	IDFG	1977	56	Sand Cr. Trib
TOTAL			230,000 AF	

In order to better understand the low percentage of consumptive use in the basin (27 percent of diversions) a canal-by-canal listing of water diversion, use, and groundwater recharge is provided in Table 51 for a full water supply year, 1986, while Table 52 illustrates a poor water year, 1977. Figure 24 is a schematic of the basin's canal system. Irrigated land is broken down into three water supply sources. A summary of water use is shown in Table 53.

A great deal of water is diverted from the Henrys Fork. Diversion is 16.6 acre-feet per acre (662,000 acre-feet) in a good water year and 9.5 acre-feet per acre (383,150 acre-feet) in a very poor water year. The historic method of irrigation in this area has been by subirrigation. Several of the canals have some water in them year-round. This water almost entirely moves into and raises the perched ground-water level. Since 1939 Island Park Reservoir has filled so the winter nonirrigation season release of water for groundwater recharge almost without exception has not influenced the filling of the reservoir. See Figure 25 for a view of variability of the diversions by month and the amount of winter diversions.

On the Egin Bench on the north side of the Henrys Fork, the regional water table varies from 40 feet deep at Plano to 100 feet deep at Parker. Figure 26 shows the current irrigation method and change from 1966 when virtually the entire area was subirrigated. On the south side of the Henrys Fork, changes are being made in irrigation methods, but at a slower rate. Subirrigation on the south side of the river appears to be incidental to flood irrigation. The geologic section (Figure 27) of the Lower Henrys Fork Valley shows high summer water levels for the Sugar City-Hibbard area. The levels may no longer be as high because of a major shift to sprinkler use in the area.

Figure 21:
Precipitation Contours

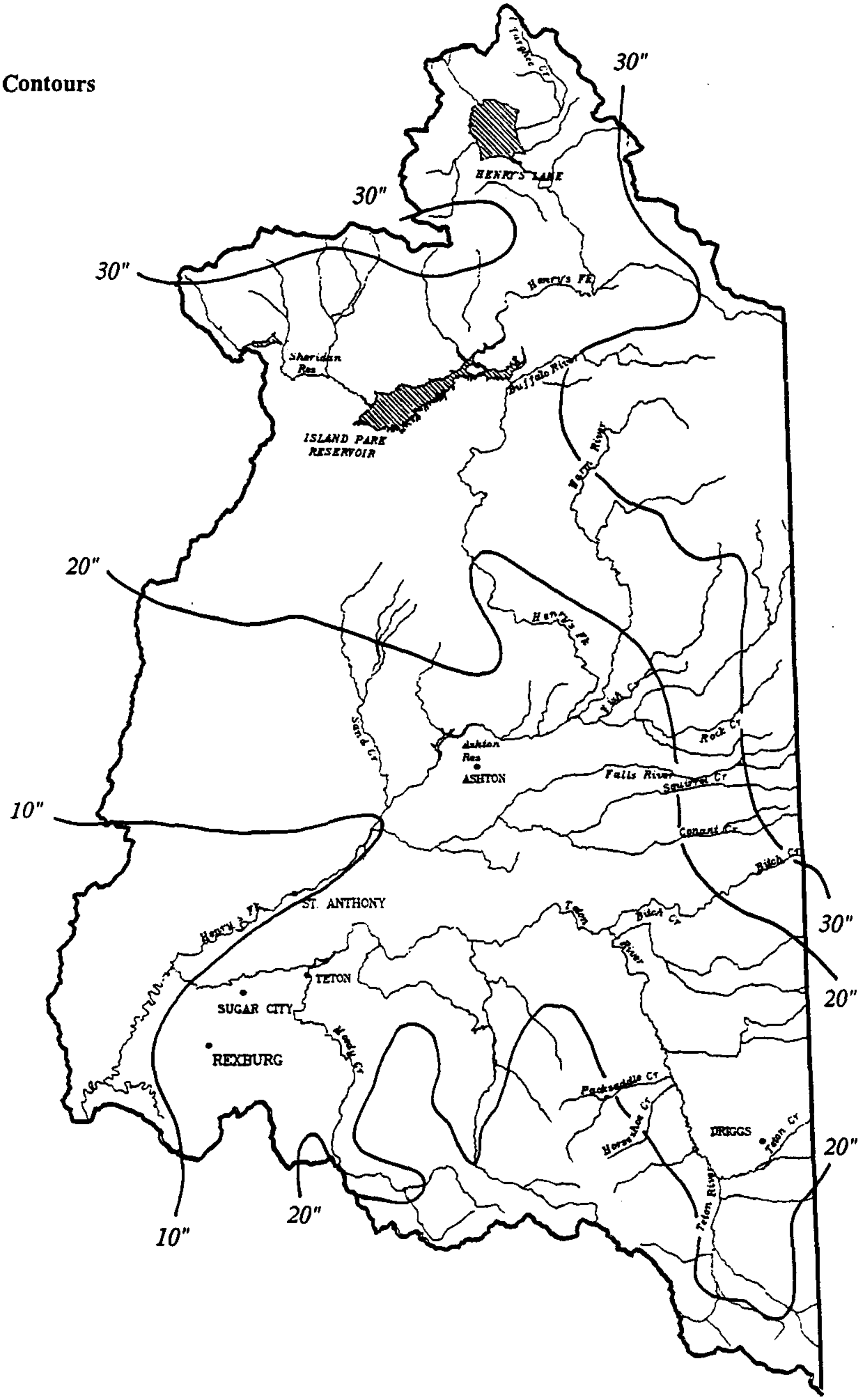
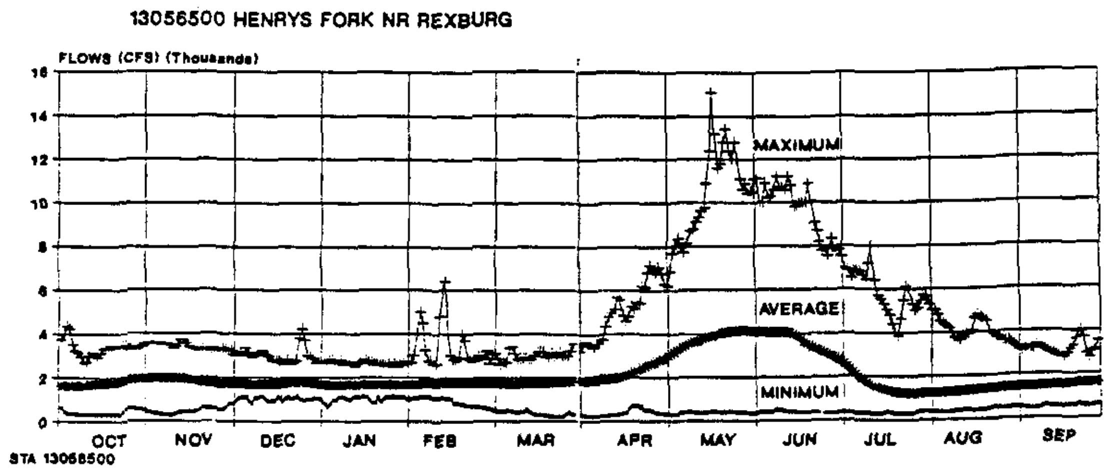


Figure 22:
Annual Discharge - Henrys Fork



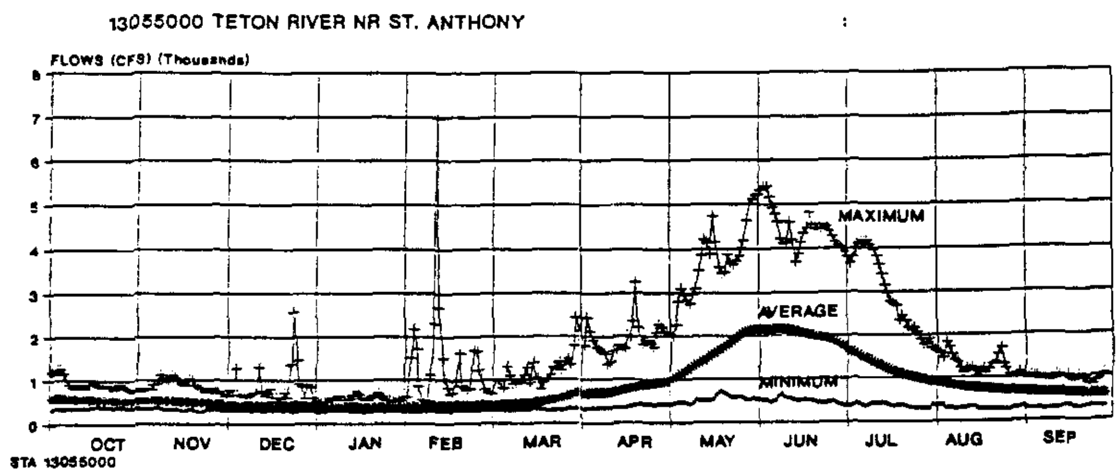
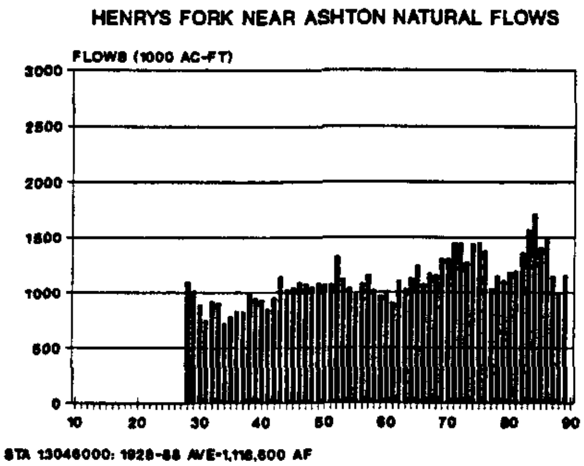
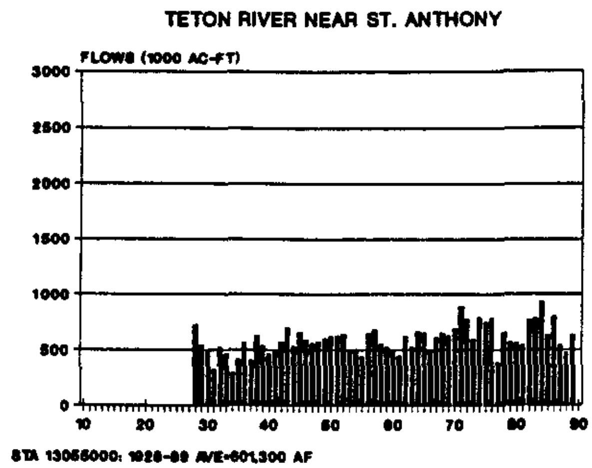
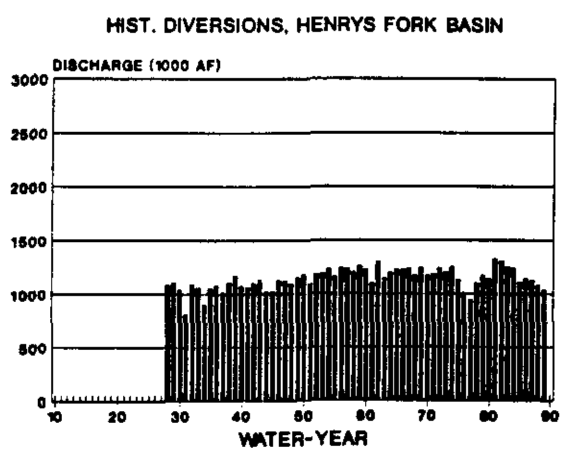


Figure 23:
Discharge and Diversions - Henrys Fork







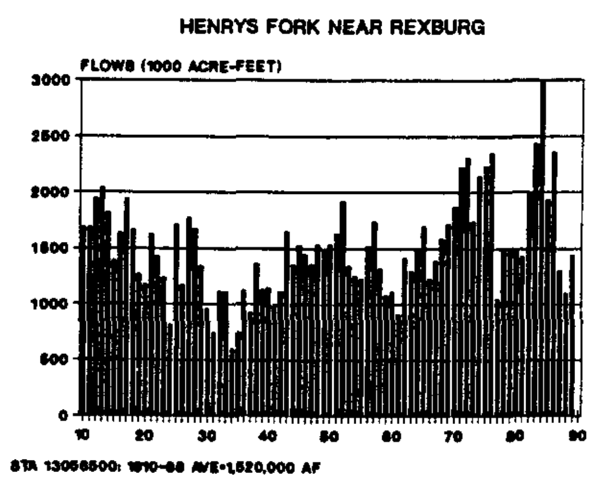


Table 51. Canal Records - 1986

Name	Recorded Acres	Calculated Acres*	Diversion Ac-ft	Ac-ft/Ac	% Return Flow	Return Flow Ac-ft/Ac	Consumptive Use Ac-ft/Ac	Groundwater Recharge Ac-ft/Ac	Total Recharge Ac-ft
Dewey	1,200		6,700	5.6	5	0.3	2.1	3.2	3800
Last Chance	1,860	2,630	27,300	10.4	10	1.0	2.1	7.2	19,000
Farmers Friend	3,025	2,250	44,300	19.7	14	2.8	2.1	14.8	33,400
Twin Groves	2,500	2,420	34,700	14.3	10	1.4	2.1	10.8	26,100
St. Anthony Union	9,700		161,400	16.6	10	1.7	2.1	12.9	124,900
Salem Union	5,500	4,367	64,300	14.7	8	1.2	2.1	11.4	50,000
Egin	7,000	6,030	109,300	18.1	10	1.8	2.1	14.2	85,700
St. Anthony U. Feeder	2,300		28,700	12.5	10	1.2	2.1	9.1	21,000
Independent	6,000	6,525	106,500	16.3	3	0.5	2.1	13.7	89,600
Consolidated Farmers	6,000	2,432	78,800	>12.5	6	0.8	2.1	9.6	23,300
Subtotal	45,085	39,854	662,000						476,800
Falls River									
Yellowstone	2,100		3,136	1.5	0	0.0	2.1	0.0	0
Marysville	16,000		30,300	1.9	0	0.0	2.1	0.0	0
Farmers Own	5,800		18,900	3.3	5	0.2	2.1	1.0	5800
Conant Creek	1,680		3,463	2.1	0	0.0	2.1	0.0	0
Boom Creek	2,180		512	0.2	0	0.0	2.1	0.0	0
Squirrel Creek	1,165		2,158	1.9	0	0.0	2.1	0.0	0
Orme			123		0		2.1		
Enterprise	5,890	1,340	20,000	14.9	10	1.5	2.1	11.3	15,200
Fall River	9,000	6,780	86,800	12.8	14	1.8	2.1	8.9	60,400
Chester	1,400	1,240	15,100	12.2	5	0.6	2.1	9.5	11,700
McBee	125		500	4.0	5	0.2	2.1	1.7	200
Silkey	1,080		4,748	4.4	5	0.2	2.1	2.1	2200
Curr	1,300		17,200	13.2	10	1.3	2.1	9.8	12,800
Subtotal	47,720	40,790	202,940						108,300
Lower Teton River									
Canyon Creek	2,200		5,845	2.7	0	0.0	2.1	0.6	1200
Wilford	2,630	2,005	42,200	21.0	17	3.6	2.1	15.4	30,800
Teton Irrigation	2,500	2,954	23,100	7.8	39	3.0	2.1	2.7	7900
Siddoway	240		1,388	5.8	5	0.3	2.1	3.4	800
Pioneer	300		2,860	9.5	5	0.5	2.1	7.0	2100
Stewart	480		3,543	7.4	5	0.4	2.1	4.9	2400
Pincock-Byington	260	243	2,817	11.6	0	0.0	2.1	9.5	2300
Teton Island Feeder	10,400		121,700	11.7	11	1.3	2.1	8.3	86,500
North Salem	450		1,972	4.4	5	0.2	2.1	2.1	900
Roxana	880	665	5,006	7.5	5	0.4	2.1	5.1	3400
Island Ward	3,300	4,493	7,817	>12.5	6	0.8	2.1	9.6	43,100
Saurey-Sommers	275	289	4,046	14.0	10	1.4	2.1	10.5	3000
McCormick-Rowe	160		345	2.2	0	0.0	2.1	0.1	0
Pincock-Garner	480	370	1,999	5.4	0	0.0	2.1	3.3	1200
Bigler Slough	240	180	1,115	6.2	0	0.0	2.1	4.1	700
Woodmansee-Johnson	1,320	1,295	2,462	1.9	10	0.2	2.1	0.0	0
City of Rexburg	950	250	5,546	22.2	9	2.0	2.1	18.1	4500
Rexburg Irrigation	5,280	5,655	54,500	9.6	5	0.0	2.1	7.5	42,600
Subtotal	32,345	32,639	288,261						233,400
Total	125,150	113,283	1,153,201						818,500

* See Wytzes. Further mapping review needs to be made of the Consolidated Farmers system.
> Average of Consolidated Farmers and Island Ward (dual operation)

Table 52. Canal Records - 1977

Name	Recorded Acres	Calculated Acres*	Diversion Ac-ft	Ac-ft/Ac	% Return Flow	Return Flow Ac-ft/Ac	Consumptive Use Ac-ft/Ac	Groundwater Recharge Ac-ft/Ac	Total Recharge Ac-ft
Dewey	1,200		2,360	2.0	5	0.1	2.1	0.0	0
Last Chance	1,860	2,630	12,850	4.9	10	0.5	2.1	2.3	6000
Farmers Friend	3,025	2,250	8,650	3.8	14	0.5	2.1	1.2	2700
Twin Groves	2,500	2,420	17,830	7.4	10	0.7	2.1	4.5	11,000
St. Anthony Union	9,700		115,370	11.9	10	1.2	2.1	8.6	83,500
Salem Union	5,500	4,367	41,250	9.4	8	0.8	2.1	6.6	28,800
Egin	7,000	6,030	80,360	13.3	10	1.3	2.1	9.9	59,700
St. Anthony U. Feeder	2,300		29,210	12.7	10	1.3	2.1	9.3	21,500
Independent	6,000	6,525	28,000	4.3	3	0.1	2.1	2.1	13,500
Consolidated Farmers	6,000	2,432	47,270	>7.3	6	0.4	2.1	4.8	11,700
Subtotal	45,085	39,854	383,150						238,400
Falls River									
Yellowstone	2,100		1,468	0.7	0	0.0	2.1	0.0	0
Marysville	16,000		24,240	1.5	0	0.0	2.1	0.0	0
Farmers Own	5,800		11,590	2.0	5	0.1	2.1	0.0	0
Conant Creek	1,680		2,696	1.6	0	0.0	2.1	0.0	0
Boom Creek	2,180		890	0.4	0	0.0	2.1	0.0	0
Squirrel Creek	1,165		1,092	0.9	0	0.0	2.1	0.0	0
Orme			123		0		2.1		
Enterprise	5,890	1,340	20,100	15.0	10	1.5	2.1	11.4	15,300
Fall River	9,000	6,780	66,800	9.9	14	1.4	2.1	6.4	43,200
Chester	1,400	1,240	4,890	3.9	5	0.2	2.1	1.6	2000
McBee	125		61	0.5	5	0.0	2.1	0.0	0
Silkey	1,080		3,650	3.4	5	0.2	2.1	1.1	1200
Curr	1,300		9,840	7.6	10	0.8	2.1	4.7	6100
Subtotal	47,720	40,790	147,317						67,800
Lower Teton River									
Canyon Creek	2,200		1,590	0.7	0	0.0	2.1	0.0	0
Wilford	2,630	2,005	14,960	7.5	17	1.3	2.1	4.1	8200
Teton Irrigation	2,500	2,954	18,140	6.1	39	2.4	2.1	1.6	4900
Siddoway	240			0.0	5	0.0	2.1	0.0	0
Pioneer	300		282	0.9	5	0.0	2.1	0.0	0
Stewart	480		930	1.9	5	0.1	2.1	0.0	0
Pincock-Byington	260	243	1,154	4.7	0	0.0	2.1	2.6	600
Teton Island Feeder	10,400		55,690	5.4	11	0.6	2.1	2.7	27,700
North Salem	450		48	0.1	5	0.0	2.1	0.0	0
Roxana	880	665	2,610	3.9	5	0.2	2.1	1.6	1100
Island Ward	3,300	4,493	3,130	>7.3	6	0.4	2.1	4.8	21,600
Saurey-Sommers	275	289	3,090	10.7	10	1.1	2.1	7.5	2200
McCormick-Rowe	160		103	0.6	0	0.0	2.1	0.0	0
Pincock-Garner	480	370	958	2.6	0	0.0	2.1	0.5	200
Bigler Slough	240	180	80	0.4	0	0.0	2.1	0.0	0
Woodmansee-Johnson	1,320	1,295	1,610	1.2	10	0.1	2.1	0.0	0
City of Rexburg	950	250	2,450	9.8	9	0.9	2.1	6.8	1700
Rexburg Irrigation	5,280	5,655	39,310	6.9	5	0.0	2.1	4.8	27,400
Subtotal	32,345	32,639	146,135						95,600
Total	125,150	113,283	676,602						401,800

* See Wytzes. Further mapping review needs to be made of the Consolidated Farmers system.
\> Average of Consolidated Farmers and Island Ward (dual operation)

Figure 24:
Storage and Diversion Schematic - Henrys Fork Basin

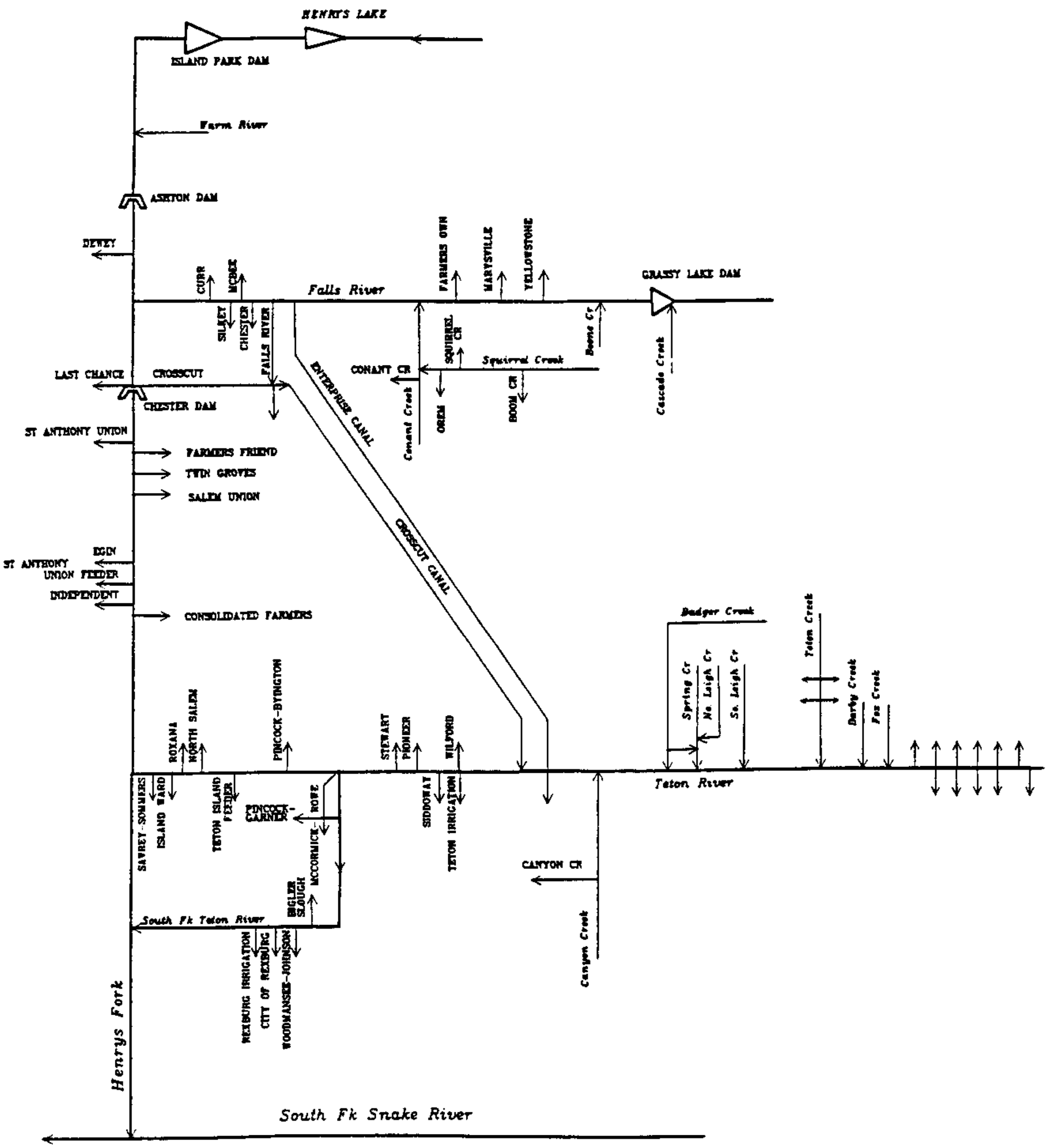


Figure 25:
Diversions - Henrys Fork Basin

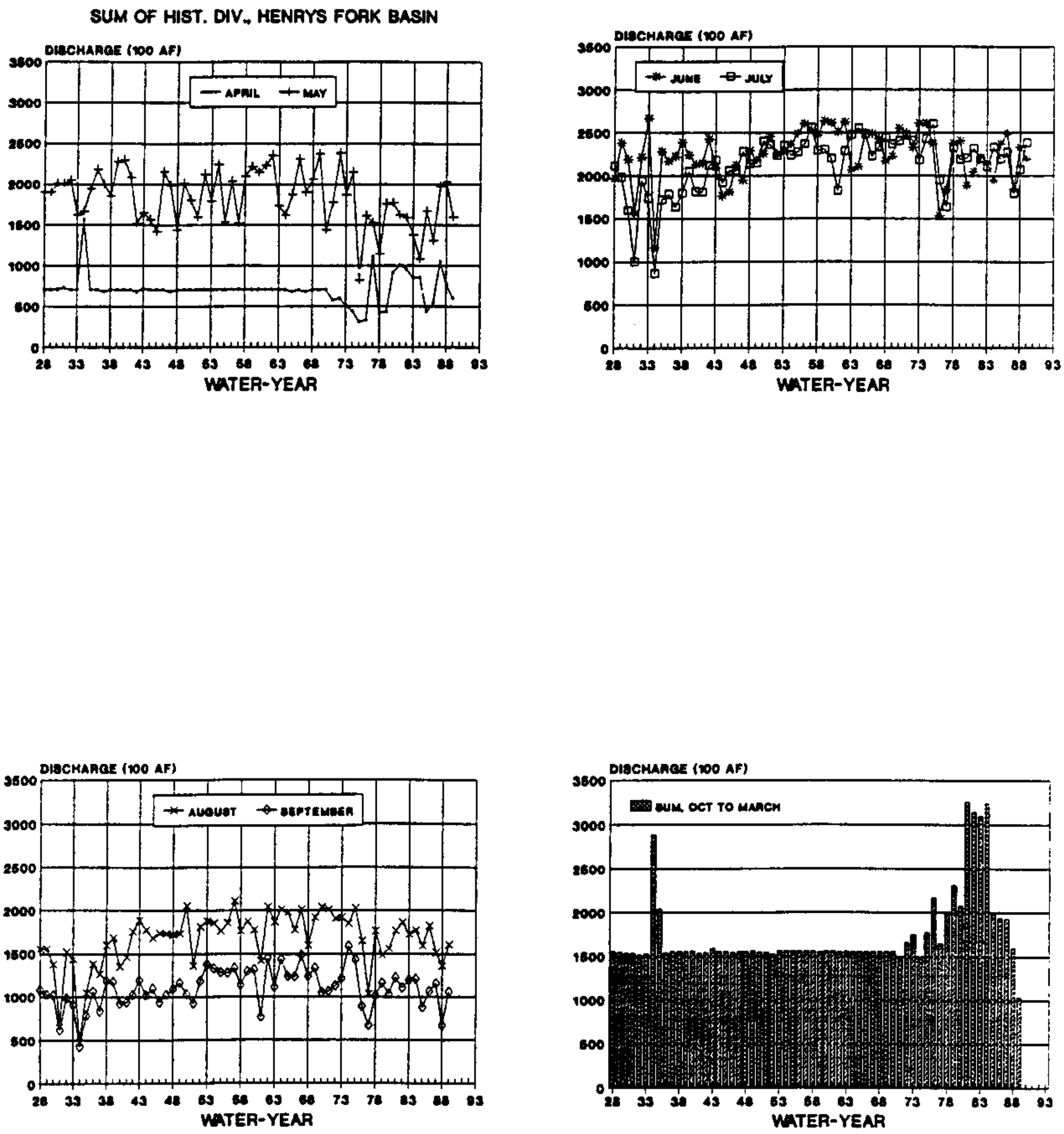


Figure 26. Egin Bench Irrigation Methods

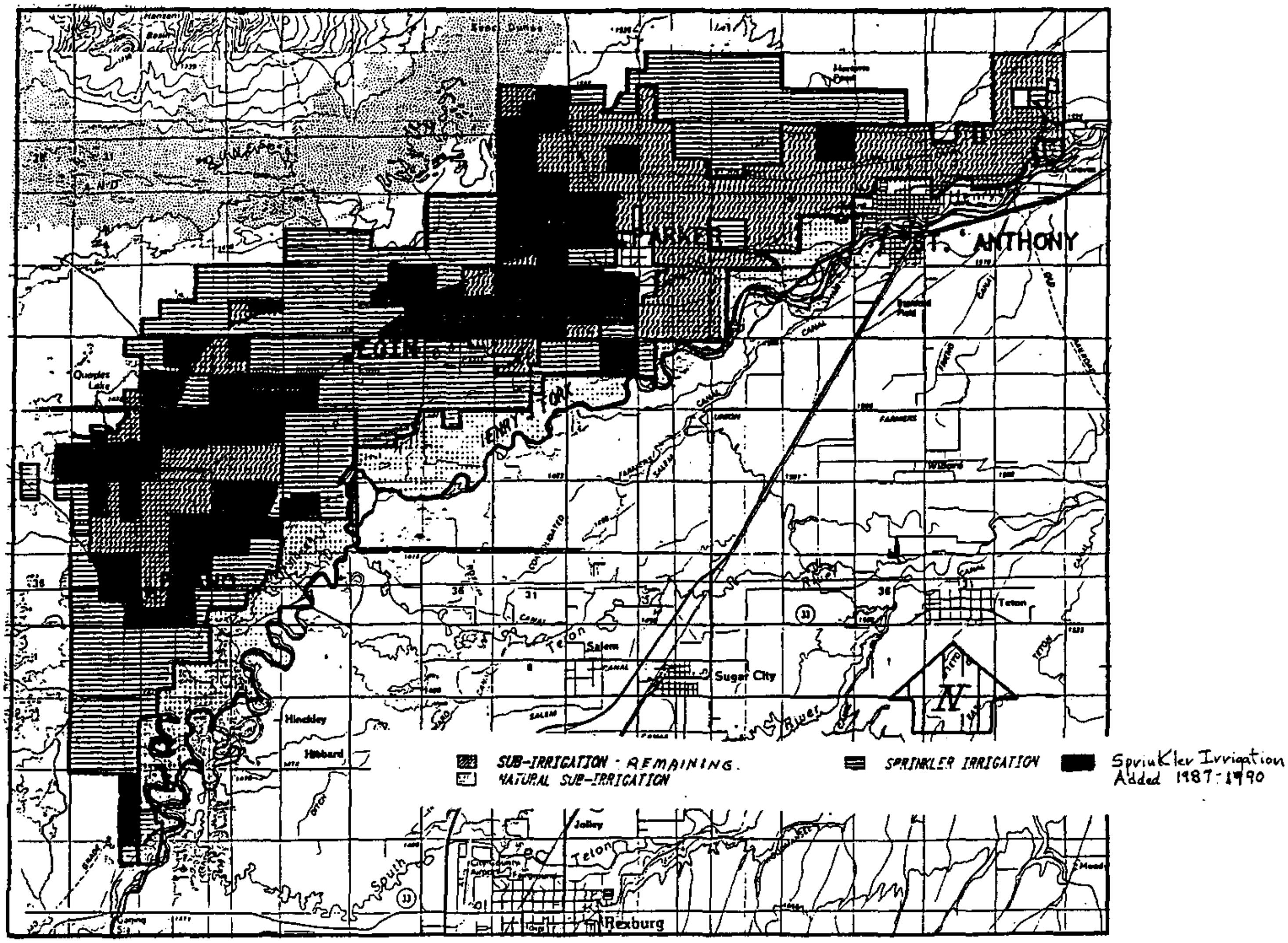


Table 53. Water Use Summary

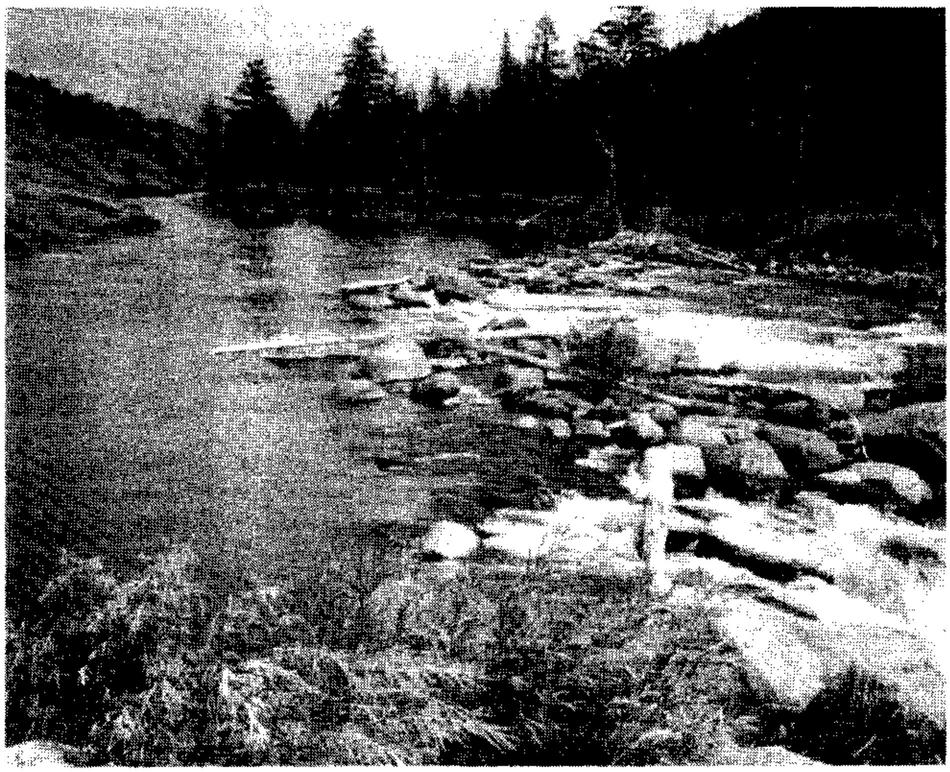
1986	Acres	Diversions/AC	Return Flow	Consumptive* Use	Groundwater Recharge
Falls River	40,800	5.0	0.7	2.1	2.7
Teton River	32,600	8.8	1.2	2.1	6.2
Henrys Fork	39,900	16.6	1.4	2.1	13.1
1977					
Falls River	40,800	4.0	0.4	1.9	2.0
Teton River	32,639	4.8	0.6	1.9	2.5
Henrys Fork	39,900	9.5	0.8	1.9	6.8

* Some areas used less, so the average will be less than indicated amount

In 1987 the Department of Water Resources did a study of irrigation on the Egin Bench; the mapping was recently updated. The 1987 study identified 27,600 acres under cultivation in the upper bench area. The acreage by irrigation method by year was:

	Sprinkler Irrigation	Natural Subirrigation	Subirrigation
1966	200	24,700	2,700
1987	9,600	15,300	2,700
1990	16,000	8,900	2,700

The recent rapid change in irrigation method is due to better potato yields and grade with sprinkler irrigation. At the current rate of change, it appears that nearly all subirrigated land other than natural subirrigated land will be changed to sprinkler irrigation within a few years.



Yellowstone Diversion on the Falls River.

If subirrigation were eliminated, the per acre use would drop to approximately 5.0 acre-feet. For a short water year, such as 1977, there would be 4.5 acre-feet per acre water savings. Somewhere on the order of 112,000 acre-feet (24,900 acres x 4.5) would have been available for other users.

In some cases, water diversions to field perimeter ditches continue year-round, and contribute to the large per-acre use of water. If not diverted to the field perimeter ditches natural flow would be available to the next junior water right holder. During the nonirrigation season and early spring runoff period, water not diverted would be stored (on-paper) in one of the following reservoirs listed in order of priority: Henrys Lake, American Falls, Island Park, or by exchange Palisades--if American Falls fills.

Ground Water

The valley portions of this study area generally yield relatively high amounts of groundwater. These are the areas that generally are presently irrigated. In the Teton Valley the depth to groundwater in many areas is 50 feet or less. Downriver from St. Anthony the regional water table depth decreases from about 100 feet to 50 feet between Egin and Sugar City, and approaches zero near the mouth of the Henrys Fork. Depth to groundwater beneath the adjacent bench-land areas is of course proportionally deeper. The perched water table in the valley down river from St. Anthony and in the Ashton area may approach the surface (see Figure 28).

Irrigation in the Ashton-Marysville area and downriver about six miles appears to have created perched water at less than 50 feet in many places. Basalts underlying the St. Anthony-Rexburg area and the area south of the Teton River are relatively porous and have good water yield potential.

South of the Falls River, in the Grainville-Squirrel-Lamont area, the bedrock appears to consist of rhyolite, a silicic volcanic material. These rocks contain large amounts of quartz (SiO_2 > 65%), and are much less porous than basalts. This same rock type nearly outcrops on the benches north and south of the Teton River in the Canyon Creek area. These areas, generally, have poor groundwater yields.

Further localized and detailed study is needed of potential groundwater sources on the south side of the Henrys Fork. Significant groundwater studies have been done of the irrigated valley area below St. Anthony, and of the Teton Valley bottomlands. Likewise, north of the Henrys Fork the depth to groundwater is generally known. In parts of the rangeland area of the basin pumping levels may be high by today's standard. The rangeland aquifer is generally a high-yielding basalt rock. In the sand dune area the subsurface geology is basalt.

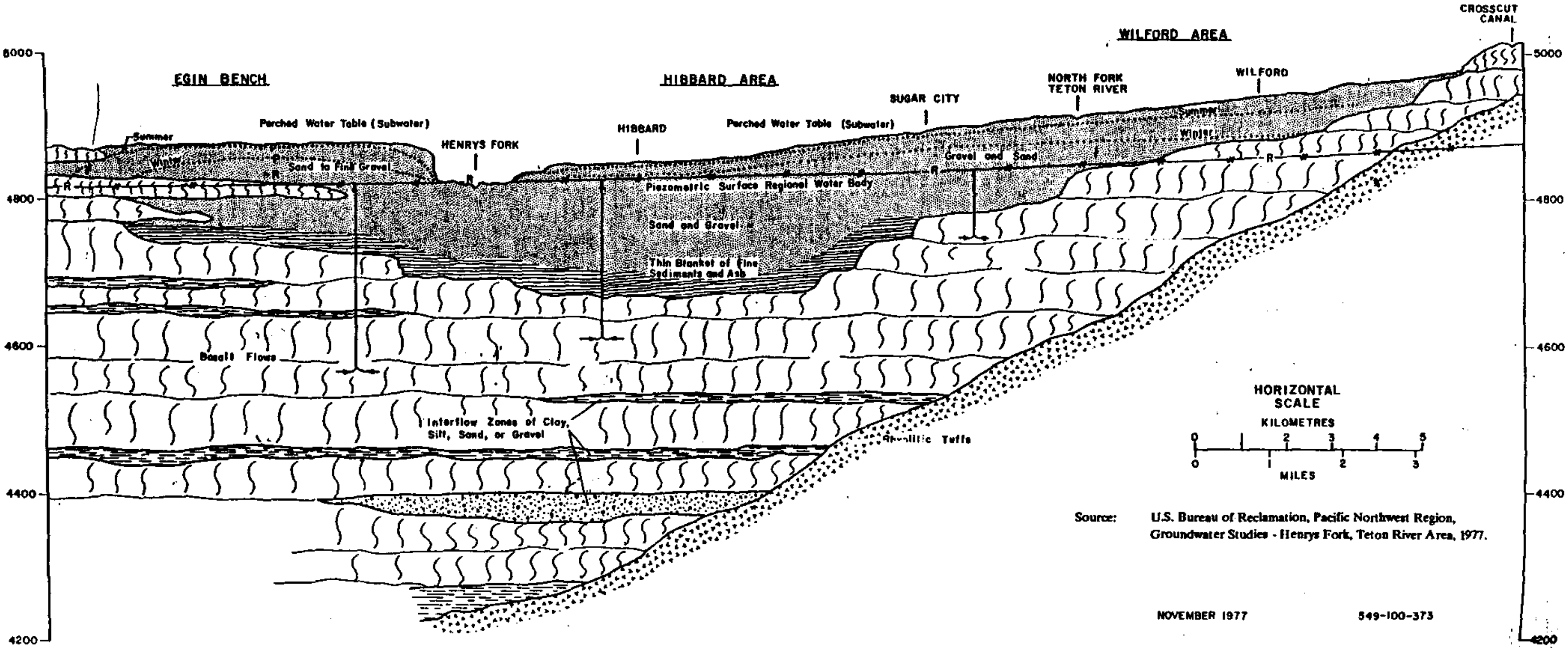
See Figures 29 and 30 for the depth to groundwater. (Note: Figure 30 generally shows deeper depths to the regional water table in the lower Henrys Fork bottom lands than the general area map for the first encounter with water. Regional water may be 100 feet deeper than the first water encountered.)

Minimum Stream Flows

A state designated minimum stream flow has been established for reaches of the Henrys Fork, the Warm River, Teton River, and Bitch Creek (see Table 54).

An application for a 140 cfs minimum instream flow on Falls River, from Highway 32 to the mouth, was withdrawn in 1985 after a local information meeting. In general, these stream flows are the minimum flow required to sustain the fishery. The summer flow established for the Henrys Fork

Figure 27:
Geological Section - Henrys Fork Valley



Source: U.S. Bureau of Reclamation, Pacific Northwest Region, Groundwater Studies - Henrys Fork, Teton River Area, 1977.

Figure 28:
Perched Water Tables - Lower Henrys Fork

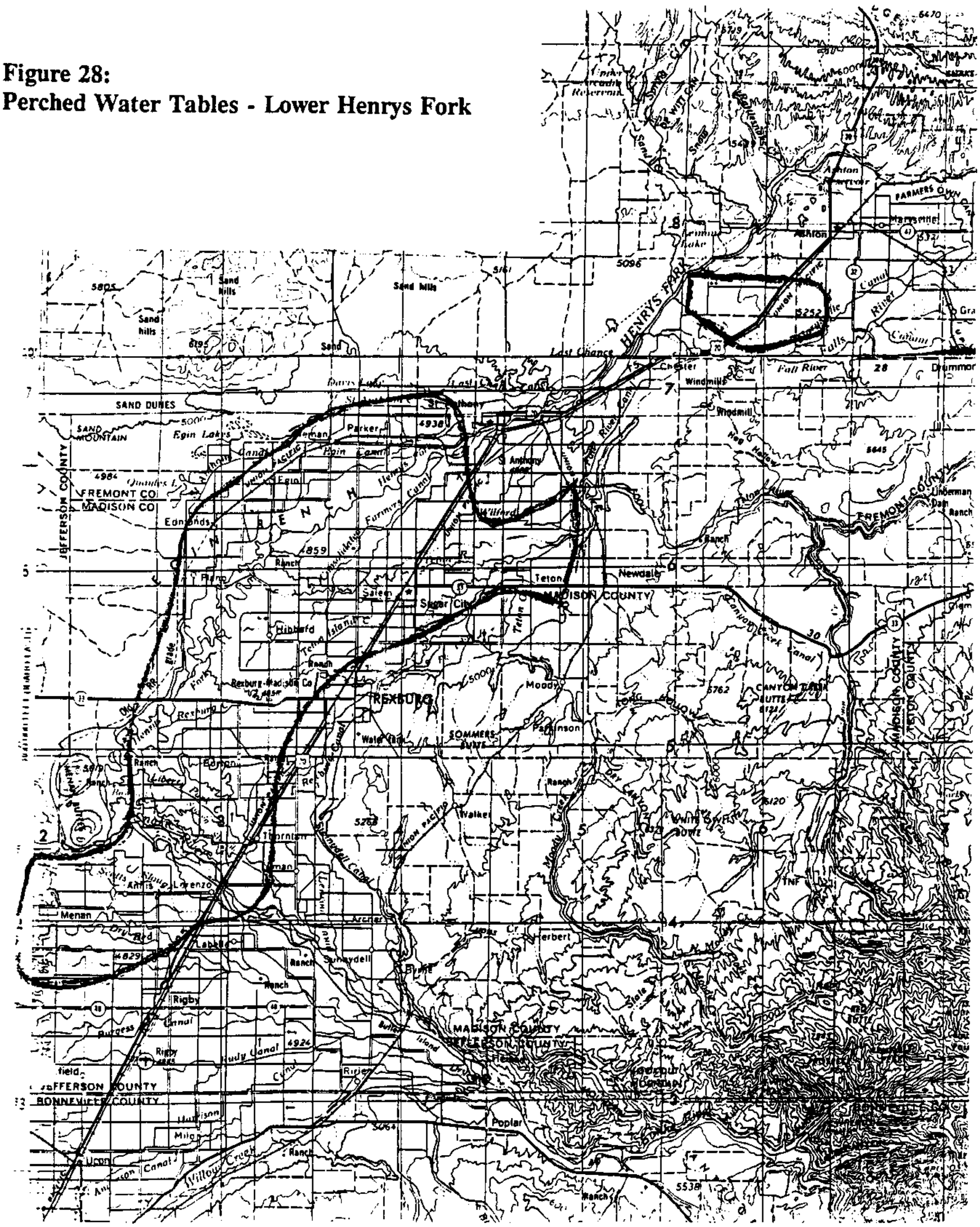
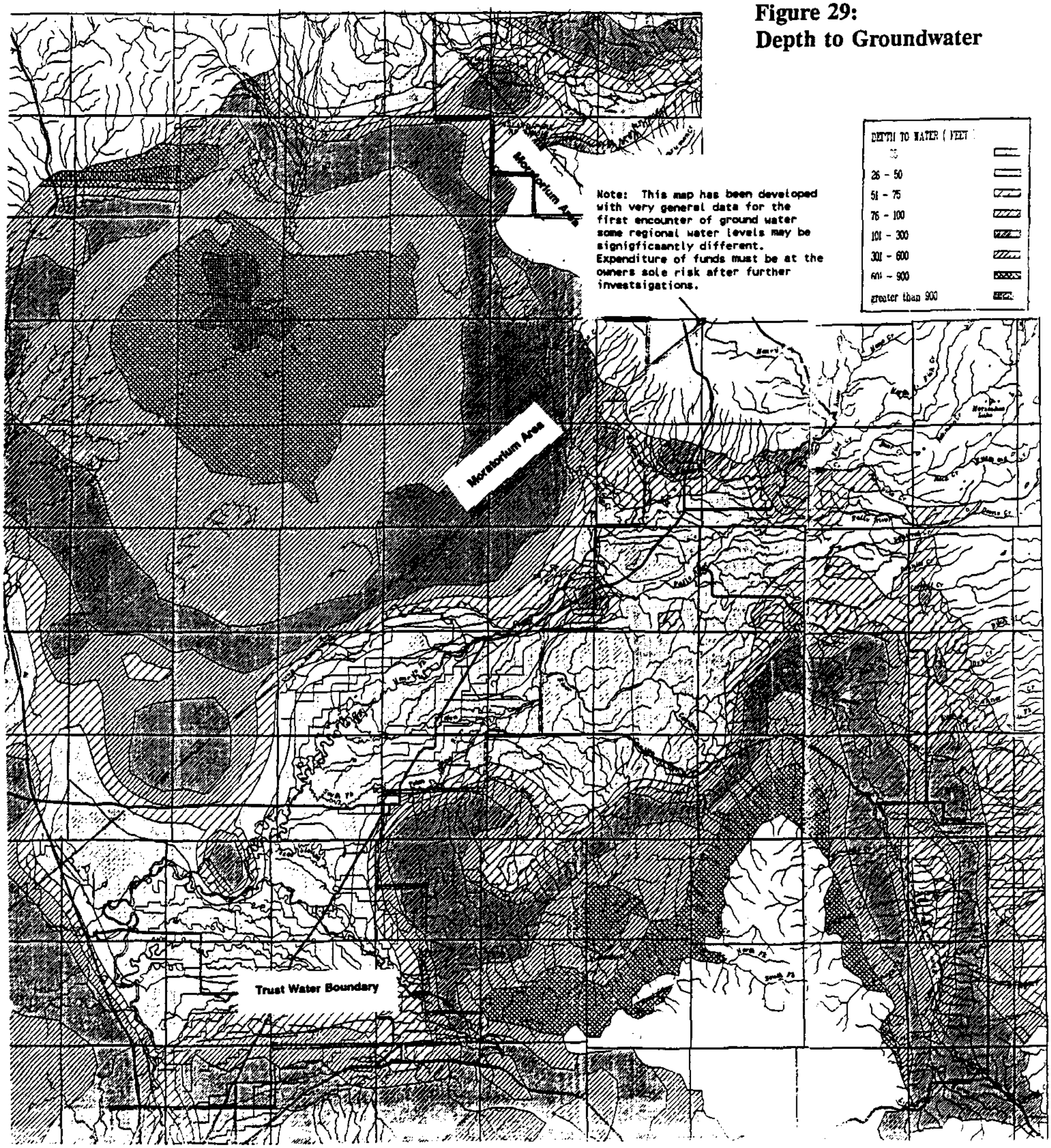


Figure 29: Depth to Groundwater



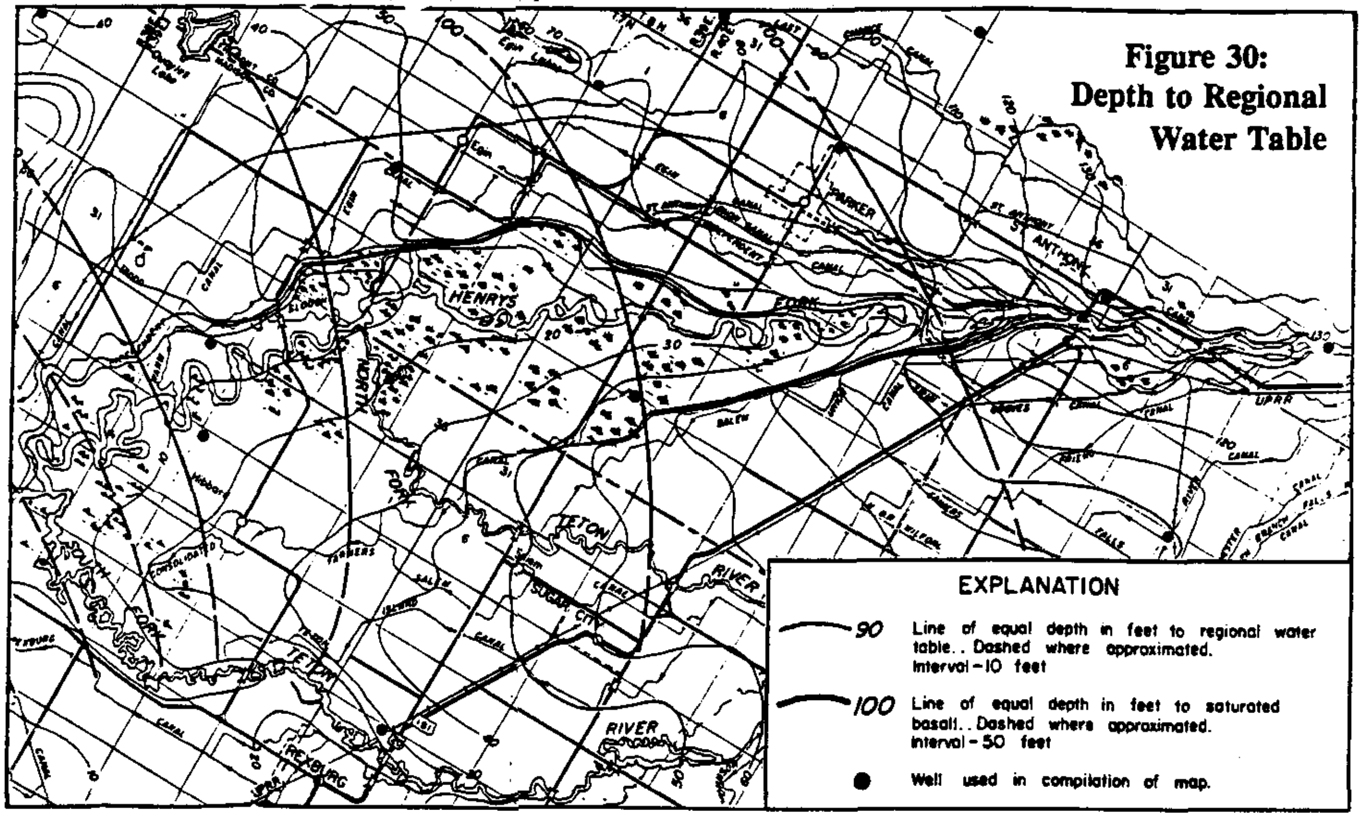


Figure 30: Depth to Regional Water Table

Source: Ham, Herbert, U.S. Bureau of Reclamation, Teton Basin Project, 1968.

is tied to the recent historical flow of this stream and is provided largely for aesthetic and recreational purposes, including flow over Upper and Lower Mesa Falls and through Harriman State Park.

Table 54. Minimum Stream Flows - Henrys Fork Basin

Stream	Priority Date	Amount	Dates	River Area
Henrys Fork	9-23-81	300 cfs 1000 cfs	10-1 to 3-31 4-1 to 9-30	One mile above Upper Mesa Falls to one mile below Lower Mesa Falls (2 miles)
Henrys Fork	9-23-81	300 cfs	1-1 to 12-31	The mouth of the Buffalo River (one mile below Island Park Dam) to one mile above Upper Mesa Falls (about 24 miles)
Warm River	11-20-85	141 cfs	1-1 to 12-31	Warm River Springs to mouth (about 8 miles)
Teton River	11-21-85	106 cfs	1-1 to 12-31	Highway 33 to confluence with Bitch Creek (about 9 miles)
Bitch Creek	11-21-85	28 cfs	1-1 to 12-31	Highway 32 to mouth (about 7.5 miles)

Potential Water Supplies

1. Surface Water Storage Sites

In the Henrys Fork Basin significant water storage occurs only on the upper main stem of the Henrys Fork. Any new storage developed in the Henrys Fork basin would have to be used in conjunction with other Water District 01 reservoirs. As the junior water right, new storage could not be filled until downstream reservoirs above Milner Dam were full. In dry years water for storage would have to be purchased or leased from other right holders. In most dry years there is rental pool water available. There may be an occasional year, such as 1977, when the open market would have to satisfy some of the rental water need.

Twenty some potential surface storage sites have been identified within the basin. None of these sites are being actively pursued at this time because of financial or environmental constraints. New storage for irrigation should be located in the upper reaches of the basin. Lower elevation level storage such as at Teton or Warm River would require significant pump lifts for use on high ground. Table 55 lists some potential reservoir sites in the basin. Off-stream sites (sites that would need water from an adjacent drainage) are generally listed first. All potential "Off-Stream" sites could be smaller and use only the water from their drainage basin. A few small storage sites (2,000 to 10,000 acre-feet) are known in the basin, but are not identified here. (See p. 213 and other Chapter 7 projects of the "Upper Snake River Basin Wyoming-Idaho-Utah-Nevada-Oregon, Vol. 1, Summary Report" published by the U.S. Department of Interior, Bureau of Reclamation.)

Moody Creek - Sec. 3, T. 5 N., R. 41 E. - This site, on a south-side tributary to the lower Teton River, would have a 300-foot high dam with a short 1,300-foot length. It could store 50,000 acre-feet in a narrow canyon at the 5,400 feet elevation level. About 6,000 acre-feet of storable water would be available from Moody Creek and about 9,000 acre-feet would be available from Canyon Creek through a gravity canal about 15 miles long. The majority of the water would need to be brought from the Teton River through a canal approximately 10 miles long coupled with a pumping plant to lift the water about 350 feet. The water, of course, could come from the Upper Teton River Basin with no net lift through a 25 mile canal. The adjacent drylands generally start at the 5,400 feet level so the water used would have to be pumped 200 to 400 feet above the reservoir.

Spring Creek - Sec. 11, T. 5 N., R. 42 E. - This site is on a tributary to Canyon Creek, a south-side tributary to the Teton River. A dam 165 feet high and 1,000 feet long would provide for storage for 30,000 acre-feet at the 6,150 feet elevation level. About 9,000 acre-feet of water would be available through a three mile canal from Canyon Creek. The remaining needed water would require a 150-foot lift pumping plant and a 20-mile canal from the Teton River. By extending the canal another 10 miles to Bitch Creek the pumping lift could be reduced to 100 feet. This reservoir could be used to irrigate some of the higher lands southeast of Rexburg. There is 775 feet of elevation drop between this site and Teton damsite over a distance of nine miles. Some hydropower potential, therefore exists, but would prevent the water use for bench-land irrigation.

Another location for water storage in this area would be the Canyon Creek site just below the junction of Canyon, Calamity, and Warm Creeks. The waters of Calamity and Warm Creeks could not be stored at the Spring Creek site but at the Canyon Creek site. The reservoir storage level would be at about the 6,000 feet level with a dam height under 150 feet.

Lane Lake - Sec. 13, T. 7 N., R. 42 E. - This potential off-stream storage site is located in a dry basin east of St. Anthony and just to the north of the Teton River. A 150-foot high and 2,500-foot long dam would store 70,000 acre-feet of water at the 5,570 feet level. An 15 mile canal from Conant Creek would provide about 30,000 acre-feet. An additional 15 miles of canal would be needed to divert water from the Falls River in the vicinity of the Marysville diversion dam. An alternate water source would be Bitch Creek with a 25 mile canal. This would allow water to be picked up near the forest boundary in order to stay above the lower Bitch Creek Canyon. The 6,050 feet elevation at Bitch Creek could allow about 450 feet of hydroelectric head to be developed along the canal.

Table 55. Potential Reservoir Sites

Potential for Further Study by Priority	Name	Reservoir Elevation in Feet	Water Level Rise	Dam Length	Reservoir Capacity Acre-Feet	Water Source	Canal Length
	OFF-STREAM						
	Bitch Cr.	5,970	475	1,400	140,000	Falls R. or Teton R.	35 miles 20-25 miles
1	Bitch Cr.	6,010	515	1,800	210,000	60,000-Bitch Cr. & Falls R. or Teton R.	35 miles & 20-25 miles
	Moody Cr.	5,400	300	1,300	50,000	6,000 - Moody Cr. 9,000 - Canyon Cr. 35,000 - Teton R.	15 miles 10 miles + 150 ft. lift
2	Spring Cr.	6,150	165	1,000	30,000	9,000 - Canyon Cr. 21,000 - Teton R. or 21,000 - Bitch Cr.	3 miles 20 miles + 150 ft. lift 30 miles + 100 ft. lift
1	Lane Lake	5,570	150	2,500	70,000	30,000 - Conant Cr. 40,000 - Falls R.	15 miles 30 miles
1	Lower Badger Cr.	5,900	410	1,400	70,000	Teton R.	10 miles
2	Upper Badger Cr.	5,970	130	2,600	50,000	Teton R.	10 miles
1	Conant Cr.	5,600	150	1,300	40,000	30,000 - Conant Cr. 10,000 - Falls R. or 10,000 - Bitch Cr.	15 miles 15 miles + 400 ft hydro
	Squirrel Cr.	6,400	280	3,300	130,000	Falls R.	10 miles + 2,400 ft. lift
	Squirrel Meadows	6,440	50 & 20	1,200 & 2,500	10,000	Boone Cr.	5 miles
	Boon Cr.	6,320	290	2,800	80,000	Falls R.	10 miles + 160 ft. lift
2	Robinson Cr.	5,800	300	2,000	70,000	20,000 - Robinson Cr. 50,000 - Falls R.	12 miles + 1 mile tunnel with J.Y. Ranch Reservoir
1	J.Y. Ranch	5,800 or 5,840	170 210	3,300	50,000 80,000	Falls R. Falls R.	12 miles 13 miles
	Howell Ranch	5,720	130	3,700	30,000	Falls R.	10 miles
	Park Lake	6,200	220	2,200	40,000	Falls R.	12 miles + 40 ft. lift
	Moose Cr.	6,640	140	1,000	60,000	Henrys Fk.	6 miles + 250 ft. lift
2	Ground-water Exchange	5,150				Falls R.	various lengths
	DIRECT STORAGE						
2	Ashton Enlargement	5,192	+38	1,000 + 4,000 dike	50,000/40,000	Henrys Fk.	
2	Teton	5,320	320	2,800	315,000/200,000	Teton R.	
	Warm River	5,478	265	1,600	140,000/75,000	Henrys Fk. & Warm R.	
	Tetonia or Driggs	6,010 6,010	140 42	1,200 6,500	590,000 50,000/35,000	Teton R.	
1	Newdale Diversion		10	900	to 2,000 cfs	Teton R.	
2	Marysville Headworks	5,740	140	3,000	56,000	Falls R.	

Lane Lake is one of four sites in the basin that the University of Idaho's Water and Energy Resources Research Institute (1981) believed had the most potential for development. Water from the project could be used for irrigation on adjacent dry-farmed land. This land could be served with a pump lift generally under 200 feet. This site also could develop about 400 feet of head through a three mile canal and penstock to the bottom of the Teton River Canyon, just upstream of the Teton damsite. However, hydroelectric use would preclude the use of that water to irrigate adjacent drylands.

Bitch Creek - Sec. 10, T. 7 N., R. 44 E. - Two miles up from the mouth of Bitch Creek, a 475-foot high dam with a 1,400 foot crest could store 142,000 acre-feet at the 5,970 feet elevation level. If the dam was raised 40 feet, to 6,010 feet, it could increase the storage capacity to nearly 210,000 acre-feet. Approximately 75,000 acre-feet is available for storage during a normal year in Bitch Creek. The remaining water would need to be diverted from the Teton River via a 20-25 mile canal originating in the Driggs area, extending over to and down Badger Creek. An alternative water source would be Falls River, near the Idaho border, and Conant Creek through a 35 mile canal. The Bitch Creek site is an alterative to the Teton Dam project. Water would be available for irrigation of adjacent Teton Bench lands and the Lamont-Drummond-Squirrel area, where groundwater appears to have limited availability.

Power generation would be possible at the site. For any power generation analysis, the diversion of spring freshet flows from the Falls River must be reviewed. For the higher reservoir the available hydropower head could range up to 515 feet. Figuring only Bitch Creek water, the estimated average annual generation is 5,000 KW. With the diversion of Teton River water to this site, generation could double. The use of water for power generation would, however, prevent the water's use for irrigation on higher land.

Lower Badger Creek - Sec. 21, T. 7 N., R. 44 E. - At the 5,900 feet elevation level, a 410-foot high, 1,400-foot long dam would store 70,000 acre-feet in this deep canyon site near the mouth of Badger Creek. A canal about 10 miles long would bring Teton River water to this site. A powerhouse at the site would allow for the capture of some hydroelectric benefits but, again, to the exclusion of irrigation of higher lands.

Upper Badger Creek - Sec. 26, T. 7 N., R. 44 E. - A 130-foot high, 2,600-foot long dam at the 5,970 feet elevation level could store about 50,000 acre-feet. Similar to the Lower Badger Creek site, this reservoir's water source would be the Teton River, via a 10 mile canal. A 1-3/4 mile tunnel to the Teton River would allow for the development of 440 feet of hydroelectric head. As in several other storage sites, hydroelectric development would prevent irrigation of higher elevation land with the portion of the storage used for power generation. Estimated average generation is 2,000 KW.

Conant Creek - Sec. 25, T. 8 N., R. 43 E. - A 150-foot high, 1,300-foot long dam could store 40,000 acre-feet at 5,600 feet elevation. The water available annually from Conant Creek is estimated to be 30,000 acre-feet. Provisions for dry years may reduce this to 20,000 acre-feet. Additional water could be diverted from Falls River into a 15 mile canal. An alternate water source would be Bitch Creek from a diversion at the 6,050 feet elevation level, again through a 15 mile canal. Approximately 400 feet of head could be developed in this canal system. An alternative to diversion from the Falls River, is a diversion from Boone Creek at 6,200 feet elevation, three miles upstream from the mouth. A four mile canal could provide a 250-foot head. Preliminary estimates suggest 30,000 acre-feet could be available from a Boone Creek/Squirrel Creek diversion. A dry year estimate would be 20,000 acre-feet.

Squirrel Creek - Sec. 1, T. 8 N., R. 45 E. - A 280-foot high, 3,300-foot long dam could store 130,000 acre-feet at 6,400 feet elevation. The water source would be Falls River through a 240-foot lift pumping plant and a 10 mile canal originating just below the Yellowstone National Park boundary, and 30,000 acre-feet, in most years, through a four mile canal from Boone Creek.

Squirrel Meadows - Sec. 9, T. 47 N., R. 118 W. (Wyoming survey origin) - A 50-foot high, 1,200-foot long dam could store 10,000 acre-feet in Wyoming at 6,400 feet elevation. Five dikes, about 20 feet high and 500 feet long, would also be needed at this site. The water source would be Boone Creek via a five mile canal.

Boone Creek - Sec. 35, T. 9 N., R. 45 E. - A 290-foot high, 2,800-foot long dam could store 80,000 acre-feet at 6,320 feet elevation. The water source would be Falls River through a 160-foot lift pumping plant and a 10 mile canal originating just below the Yellowstone National Park boundary. Approximately 30,000 acre-feet would be available in most years from the Boone Creek drainage. A generating plant could be located one and one-half miles downstream from the dam at the confluence of Boone Creek with the Falls River. This would develop 520 feet of head between elevations 6,320 and 5,800 with a full reservoir. Approximately 3,000 KW would be the average generation using only Boone Creek water. To use reservoir water for power generation would generally prevent its use for irrigation on higher land. Without the dam, about 400 feet of head could be developed with a three-mile conduit.

JY Ranch - Sec. 24, T. 9 N., R. 44 E. - A 170-foot high, 3,300-foot long dam on Rock Creek, a tributary to Robinson Creek, could store 50,000 acre-feet at 5,800 feet elevation. If the dam was raised 40 feet the storage capacity would be increased roughly an additional 30,000 acre-feet for a total of 80,000 acre-feet. The water source would be Falls River through a 12 mile canal starting just below Sheep Falls. Alternately, if water was taken three miles downstream at the Yellowstone Canal inlet on the Falls River, an 80-foot pump lift would be needed. Geologic features at the damsite may not be favorable and would need further analysis, as is the case for all sites reviewed in this report. Geologic studies one mile downstream, just below the mouth of Porcupine Creek, reported unfavorable findings (1961 Snake River Basin Summary Report of USBR/COE site 68, p. 7-214).

Howell Ranch - Sec. 24, T. 9 N., R. 44 E. - A 130-foot high, 3,700-foot long dam on Rock Creek could store 30,000 acre-feet at 5,720 feet elevation. The water source would be Falls River at the Yellowstone Dam diversion, two miles above the National Forest boundary. The inlet canal would be 10 miles long.

Robinson Creek - Sec. 3, T. 9 N., R. 44 E. - A 300-foot high, 2,000-foot long dam could store 70,000 acre-feet at 5,800 feet elevation. Approximately 20,000 acre-feet are available from Robinson Creek, and 5,000 acre-feet might be available via a three-mile canal from Fish Creek. Additional water could be made available through a canal system from the Falls River. The easiest canal route from the Falls River would be an over-flow tunnel one mile long from a reservoir at the JY Ranch site, so facilities at Robinson Creek should be constructed in conjunction with this project.

Park Lake - Sec. 10, T. 9 N., R. 45 E. - A 220-foot high, 2,200-foot long dam at 6,200 feet elevation could store about 40,000 acre-feet. The site is on Upper Rock Creek near the southwest corner of Yellowstone National Park. The water source would be Falls River just below the Yellowstone National Park boundary. A 12 mile canal would be needed plus a pumping plant to fill the top 40 feet of the reservoir.

Moose Creek - Sec. 13, T. 13 N., R. 44 E. - A 140-foot high, 1,000-foot long dam at 6,640 feet elevation could store 60,000 acre-feet. The water source would be Henrys Fork through a six-mile canal with a pump lift of 250 feet. A narrow constriction at the end of a large valley provides a good reservoir site for a low, short dam. However, the Henrys Fork is well regulated by Island Park Reservoir. Island Park Reservoir is below the point at which water would be taken from the Henrys Fork so the Moose Creek Reservoir site would have few water-storage benefits.

Ashton Dam Enlargement - Sec. 28, T. 9 N., R. 42 E. - This enlargement would be a 38-foot rise in the water surface for a total height of 94 feet at the dam. Although the proposed dam would be 1,000 feet long, a couple of dikes totaling an additional 4,000 feet would be needed. The reservoir storage could increase 40,000 acre-feet, and the reservoir surface area would change from 400 acres to 1,800 acres. With the increase in surface area, there would be an additional water loss to evaporation of approximately 4,000 acre-feet. The new water surface would be at 5,192 feet elevation with the dam crest at 5,200 feet. The benefits of this project are storage for flood control on the lower Henrys Fork, and power generation (90 percent of the benefits). The current 5,800 KW hydroelectric plant generating 33,000 MWH could be replaced with a 12,000 KW generating plant. This would generate a total of 70,000 KWH annually or an average of 8,000 KW. (See report, Upper Snake River Basin, Volume I, Summary Report, USBR/COE, 1961, p. 7-28.)

Teton - Sec. 30, T. 7 N., R. 42 E. - A 300-foot high dam on the lower Teton River could create the largest reservoir within the basin. The site is located about two miles upstream of the mouth of the canyon and about 15 miles northeast of Rexburg. Active storage could be 200,000 acre-feet with 315,000 acre-feet total-storage. The reservoir would extend 17 miles up to the mouth of Bitch Creek and a little over two miles up Canyon Creek. The reservoir site is a narrow but gently descending canyon incised through a rolling plateau used largely for dryland and sprinkler irrigated agriculture. A hydroelectric plant located at the dam would have 295 feet maximum head. The average generation could be about 14,000 KW (123,000 MWH). Because of water releases from the reservoir for seasonal uses, the probable average generation is reduced to 8,000 KW (73,000 MWH) from an installed capacity of 22,000 KW. The movement of a large amount of Falls River water into the Teton basin for storage at an off-stream site such at Bitch Creek could considerably improve the power benefits at the Teton site.

One primary benefit of the Teton Reservoir site is that Upper Teton River water users (about 7,000 acres in Teton County) could continue to divert the upper river flows later into the summer. The Lower Teton River users have an earlier priority for natural flow water rights which could be provided by Teton Reservoir storage water. Natural flows then, by exchange, could be used above Teton Reservoir after July 1. An alternative use of Teton Dam could be to provide the head for a valley-wide gravity irrigation system for the lower Henrys Fork including the Egin Bench. This could conserve water, but in turn, would prevent ground-water recharge.

Teton: Recent Reappraisal Summary - The U.S. Bureau of Reclamation has recently completed a reappraisal of the Teton Reservoir project. Re-analysis has been set up to allocate water yields as follows:

41,000 ac-ft for mitigation flows - resident fish
24,000 ac-ft to enhance trumpeter swans
<u>20,000</u> ac-ft for supplemental irrigation
85,000 ac-ft of total yield.

Water bank water or the use of supplemental ground-water wells were not added to increase total water yield as was done in the original project.

The allocation of construction cost in million dollars was:

Irrigation	52
Power	34
Flood Control	49
Swan Flows	28
Recreation	5
Total	168

Interest during construction would be an added cost. The irrigation portion of the project included 25 million dollars to provide distribution to the Enterprise, East Teton and Canyon Creek Canals. Since Teton Reservoir water would belong to the water bank in exchange for natural flows, the project could probably be constructed using only the smaller Canyon Creek Canal. Of the 168 million dollar construction cost, 137 million dollars is the current estimate for the dam, spillway, powerplant, river outlet works, mechanical items for structures, lands and rights, and clearing of lands.

Fish and wildlife mitigation for the original project included 17,000 acres to be acquired, or set aside, which has been done. In addition, a minimum pool of 100,000 acre-feet was to be provided for fishery use. Hatchery facilities were to be constructed to rear trout and kokanee for release into the reservoir and river below the dam. Thirteen existing diversions below the dam were to be screened and the original proposal was to provide 300 cfs of stream flow with 150 cfs during dry years. In the reappraisal the U.S. Fish and Wildlife Service requested a mitigation stream flow of 450 cfs below the dam.

Fifty-two million dollars allocated to irrigation with zero interest and a 50-year repayment schedule, would require an annual repayment of $1,040,000. For an average annual yield of 20,000 acre-feet, the annual cost per acre-foot would be $52.00. If the cost allocation for irrigation was cut in half by deleting distribution facilities, and the amount of water allocated to irrigation was doubled, the annual cost per acre-foot would be $13.00 plus $2.70 for operation and maintenance costs. On the lower Henrys Fork where exchange water from main-stem Snake River storage has been available at a cost of $2.95 per acre-foot, the $15.70 ($13.00 + $2.70) per acre-foot is not competitive. Project analysis and cost of construction make new storage water much more costly. The allocated cost originally authorized by Congress for the failed Teton Dam was $2.21 per acre-foot including operation and maintenance (about $1.50 for construction costs only).

Warm River - Sec. 14, T. 9 N., R. 43 E. - A dam on the Henrys Fork six miles northeast of Ashton, just below the mouth of the Warm River could raise the water about 220 feet and create a reservoir with an active capacity of 75,000 acre-feet (140,000 acre-feet total capacity). Water would be backed up the Henrys Forks seven miles to the top of Lower Mesa Falls. This site could be used for power generation. The average annual generation would be 22,000 KW (190,000 MWH) with a 30,000 KW powerplant. A dam that raised the water 150 feet instead of 220 feet would back water up to the base of Lower Mesa Falls but would have considerably less water storage potential and an average annual generation of about 15,000 KW (130,000 MWH).

Driggs/Tetonia - A 43 feet high, 6,500 feet long dam on the upper Teton River near Driggs, (Sec. 13, T. 5 N., R. 44 E.), could store 50,000 acre-feet of which 35,000 acre-feet would be usable. The water storage elevation would be 6010 feet. A 140-foot high, 1200 feet long dam at the lower

Tetonia site, (Sec. 3, T. 6. N., R. 44 E.), could store 590,000 acre-feet at 6010 feet elevation, although the reservoir would flood a considerable area. A powerhouse could be built at the dam with a head of 140 feet. Average generation would be 4,000 KW if storage water is used on lands below the outlet elevation of the reservoir. The Tetonia site might be used with a lower height dam of 66 feet for hydroelectric production. It would generate about 18,000 MWH annually or an average of 2,000 KW with a 4,000 KW generator. The upper water level would be at 5930 feet elevation. Geologic studies for a large reservoir at this site disclose potential reservoir leakage. Correction of this problem would impose significant cost (USBR, 1961).

Marysville Headworks - Sec. 35, T. 9 N., R. 44 E. - A 120-foot high dam on the Falls River, above the site of the Marysville Canal diversion, could store 38,000 acre-feet and use about three miles of the Falls River. The Yellowstone Canal diversion works would be one-half mile upstream. A 140-foot high dam would raise the elevation to 5740 feet, store 56,000 acre-feet, and back water up to the Yellowstone Dam. The elevation of this reservoir would allow its use as a gravity irrigation system for much of the lower dryland in the Drummond-Lamont area.

Buffalo River Hydro - Sec. 20, T. 13 N., R. 44 E. - This 17,000 acre-feet site is on the upper Buffalo River six miles above its mouth. A 1400-foot long dam could raise the water level 100 feet. A tunnel about 0.6 mile long in Sec. 35, T. 13 N., R. 44 E. would move Split Creek into the upper Buffalo Creek drainage. This reservoir generally would be used for power generation. Average annual generation may be near 2,000 KW although the installed capacity could be twice this amount. The springs that form the beginning of a large part of the Buffalo River would be inundated to a depth of 50-75 feet. There is some concern that water pressure would slow the spring flow and shift part of the outflow to a different location. This project is reviewed in Water Power Resources of Idaho Under the Ponds Lodge heading, p. 67.

2. Ground-water Use and Ground-water Exchange

The selective direct use of ground water in the lower Henrys Fork area from St. Anthony to the mouth of the basin would allow the diversion of the Henrys Fork onto land now served by the Falls River. A gravity diversion at Ashton Dam (elevation 5,150 feet), could move water into the Enterprise and Falls River Canals. In order to serve higher lands in the Ashton area, the Henrys Fork could be diverted near the settlement of Warm River at elevation 5250 through a pumping plant with a lift of 250 feet. The Falls River water, in turn, could be diverted in the vicinity of the Yellowstone Canal and could be used in the Drummond/Lamont areas.

3. Ground-water Storage

Further study needs to be given to the potential of groundwater recharge for local use. The area that appears to have the best groundwater recharge potential is the Marysville-Grainville-Squirrel-France-Lamont area west of the National Forest boundary. In this area, material directly below the soil profile is mapped as gravel and outwash from the east mountains. The bedrock material is unknown, although in many areas it appears to be rhyolite, a less porous rock than basalt. Thus, it appears recharged groundwater could largely stay in the area for later use. Further groundwater studies are needed.

This study also should cover the Chester-Drummond area south to the Teton River as well as the south side Teton River Plateau areas from Moody Creek to Canyon Creek and east to the Teton River. Much of this area appears only to have the less porous felsic rock below the soils but, again, a detailed study would be helpful to further define local differences and opportunities for ground-water recharge.

4. Weather Modification

Cloud seeding has been successful in increasing winter precipitation. The success rate appears to be significant in mountainous terrain much like the upper reaches of the Henrys Fork Basin. However, weather modification programs are generally not successful increasing precipitation during drought periods since storm clouds are not present for seeding. Cloud seeding in normal years can provide more water for carry-over into a drought cycle. An increase in precipitation of 10 to 15 percent during a drought period appears low, however, the increase in runoff could be higher if the soil profile was saturated or became saturated as a result of induced precipitation. Consequently, even in an impending drought situation, the seeming small amount of additional precipitation does make a difference.

The implementation of a weather modification program should be long-term. One consideration for cloud seeding is the usefulness of winter and early spring snow. In the winter or early spring additional runoff generated by cloud seeding would generally occur over frozen ground and could be stored in basin reservoirs. Late spring rains, much of the time, percolate into the groundwater system and are greatly delayed in returning to streamflow. This consideration accentuates the importance of starting cloud seeding early in the water year, probably in November.

5. Rental Pool

The rental pool, also known as the water supply bank, generally consists of assigned irrigation storage water space in Jackson Lake Reservoir, Palisades Reservoir and American Falls Reservoir. This storage water may be used by Henrys Fork basin irrigators through an exchange for natural flow which would normally pass downstream to earlier priority water-right holders. The exchange of water is limited to available stream flow not used in the area. Rental pool water is the most economical water for new uses, if it can be made physically available. The current price is $2.95 per acre-foot used, of which $0.75 goes to Water District #1, Snake River and Tributaries above Milner, for administering the rental pool.

6. Water Conservation

In the Henrys Fork basin, water conservation applies principally to irrigation, since irrigation is the primary off-stream use of water. The greatest on-farm water losses are from deep percolation or seepage below the root zone, especially in the sandy subsoil of river bottom areas. End-of-field runoff is a much smaller loss and, of course, can be immediately reused by a lower diverter.

With sprinkler systems crop yields may be significantly increased since over watering is reduced. Labor expenditures for irrigation may also be reduced or reallocated. A conjunctive use strategy to maximize water use in the basin would use surface water in "good" water years. Ground water could be used to supplement supplies during low water years. The continued reliance on surface water throughout much of the basin will ensure adequate recharge to the aquifer for local needs.

Water conservation has been a focal point in many different water-use programs. Recently, in the Drought Assistance Act of 1988, it was stated the Secretary of Interior is to "perform studies to identify opportunities to . . . conserve water supplies available to Federal reclamation projects." In the Reclamation Reform Act of 1982 (regarding a change of acreage limitation), a lesser discussed section of the act states:

> "(a) The Secretary (of Interior) shall . . . encourage the full consideration and incorporation of prudent and responsible water conservation measures in the operations of non-Federal recipients of irrigation water from Federal reclamation projects, were such measures are shown to be economically feasible . . . ."

"(b) Each district that has entered into a repayment contract or water service contract . . . shall develop a water conservation plan which contain definite goals, appropriate water conservation measures, and a time schedule for meeting the water conservation objectives."

"(c) The Secretary is authorized <u>and directed</u> to enter into memorandums of agreement with those Federal agencies having capability to assist in implementing water conservation measures to assure coordination of ongoing programs. Such memorandums should provide involvement of non-Federal entities such as States, Indian tribes, and water user organizations to assure full public participation in water conservation efforts" (underlining added).

In answer to subsection B of the above act and as an example of what can be done in water conservation measures, an excerpt follows from a letter of the Falls Irrigation District of American Falls, Idaho (Michaud Flats) to the U.S. Bureau of Reclamation.

As you will see below, the District (since 1980) has not used water in excess of 2.07 acre feet per irrigable acre:

AVERAGE WATER USE PER IRRIGABLE ACRE
in Acre-Feet

1980 - 1.73
1981 - 2.07
1982 - 1.76
1983 - 1.35
1984 - 1.59
<u>1985 - 1.82</u>

Average 1.72

One definite advantage we have over other organizations is being an almost total (we have one or two small acreages who still use flooding to irrigate pastures) sprinkler project. Our water, when put upon the land, stays there. We do not have to contend with part of the delivered water running off the end of the field, so this does entail less water needed to be applied to acquire the water crops need for proper growth.

There are two acre feet of water per acre allowed each wateruser for normal usage which is paid for in the O&M assessment. Any water used in addition to this amount is classed as excess water. The first acre foot of excess water is charged at the same rate as the first two in the allotment. The second acre foot of excess is charged at one and a half times the price of the first three acre-feet. These excess water charges encourage our waterusers to conserve as much as possible by improving their equipment and using it more efficiently.

We also have a very strict water measurement procedure when delivering water to our waterusers. All the District's delivery points are locked and operated only by District personnel. This enables the District to have a more controlled water delivery system and equality of charges to all waterusers.

We are using a computerized water recording system where the ditchriders put the delivery into a calculator and later feed it into the computer. Written records are also kept to confirm the computer printouts. The computer can compile and organize the records quickly so that, when calling, waterusers are provided a faster and more accurate status of their water accounts. This helps them use their water more wisely and efficiently and encourages conservation in their operations."

Recommended Action

1. Encourage water conservation and the use of water bank water in lieu of new impoundments as sources of additional water. Use both yearly leases and develop innovative long-term leases. Exchanges with natural flow rights will be the main method of implementation in the Henrys Fork basin.
2. Ground-water wells and more efficient irrigation systems are additional water sources that should be considered. The benefits of large water conservation actions must be carefully weighed against the ground-water recharge benefits associated with current practices.
3. Study the availability of the ground-water resource in the plateau areas east of St. Anthony and in the Canyon Creek area.
4. Study off-stream reservoir sites for Falls River and Teton River water. (Uses would be irrigation of Drummond-Lamont dryland farmed area and similar plateaus, plus power development, limited flood control, and recreation.)
5. Encourage the use of surface water during high and average flow years in order to promote regional ground water recharge; during low flow years a partial switch to ground water use is encouraged.
6. Amend new ground-water license/transfer procedures to allow irrigators that transfer from a surface water source to a ground-water source to keep the surface water priority date for a portion of the water transferred if certain conditions are met.
7. Specific aquifer recharge project areas may be helpful if set aside for use during high and average runoff seasons.
8. For any surface water development, if the environmental consequences are acceptable, encourage reservoir location in the upstream or upper plateau areas in order to allow for water use in these areas.
9. Continue to reserve the Teton Dam site for future use as a major water storage project. Release the reservation of the Warm River Dam Site.
10. Set up a weather modification study in the upper basin with a companion study to determine resulting increased surface runoff.
11. Water quality, water yield and water development opportunities should be a planning consideration for all regulatory and management agencies in the basin.
12. Seek legislative change which would provide incentives for water conservation. Saved water must somehow benefit the entity effecting the savings.

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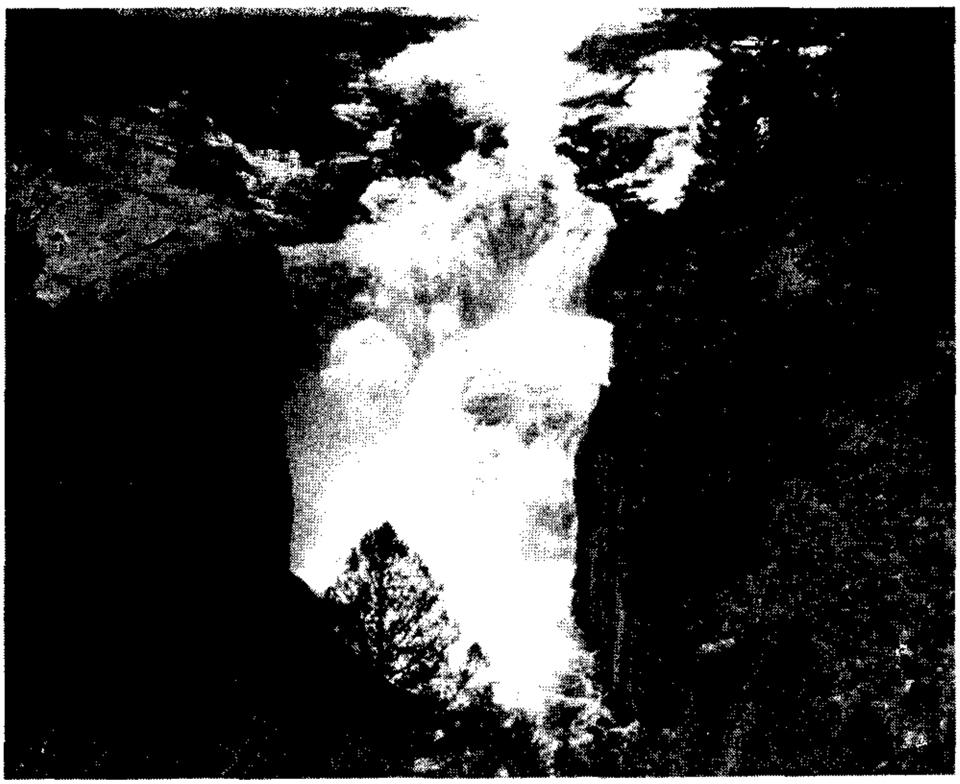
RESOURCE EVALUATION

Identified as part of the basin goals and objectives is the need to identify and care for historic and archaeologic sites, protect outstanding natural features, scenic values, and the quantity and quality of prime recreation waters, and maintain and enhance fish and wildlife populations and their habitat. Rivers that possess outstanding fish and wildlife, recreational, aesthetic, or geologic values can be designated as Idaho protected rivers. An assessment of the effects of protection on other identified resource uses is undertaken prior to designation. An initial attempt to assess these values in the Henrys Fork basin has been documented by the Pacific Northwest Rivers Study. Following is a matrix of stream segment assets based on the Pacific Northwest Rivers study, with resource data updated to reflect current information. The matrix was used to help identify and evaluate stream segments with "outstanding" natural and recreational resource values.

Aesthetic and Geologic Values

Aesthetic and geologic values are addressed in the first two columns of the matrix. Aesthetic features are noted vistas and canyon environments. Geologic features are: waterfalls, canyons, caves, glacial features, active meander complexes, hot, warm, or cold springs, or an exceptional display of bedrock structural features. Three criteria were used to evaluate these features: (1) scarcity, (2) quality, and (3) scientific value. Scarcity refers to the distribution of the feature both within the state



Lower Mesa Falls on the Henrys Fork

and worldwide. Quality refers to the relative physical condition of a natural feature in comparison to other known occurrences of the same feature. The scientific value of a feature or a given site refers to its usefulness and importance as an educational resource. Scarcity, quality, and scientific value determinations weighed the final scenic/natural features evaluation for a stream segment. Only "Outstanding" = 1, or "Substantial" = 2, ratings were recorded on this matrix. The features of note for each stream segment are listed in the second column.

Fishery Values

The following components were included in the resident fish resource assessments: habitat quality, species present and their current status, migration corridors, research sites, abundance of catchable sport fish, angler effort, quality of angling experience and potential fishery and habitat value. Resident fish include game fish and non-game fish.

High (=1), Intermediate (=2) and Low (=3) quality habitats were defined as those which provide optimum, satisfactory and poor environmental conditions, respectively, for the species present. Environmental factors considered in evaluating habitat quality included temperature, water quality parameters, instream flow, substrate composition, availability of instream cover, food abundance, and quality of riparian habitat.

Fish species of High (=1) concern are wild or native gamefish species of regional importance. In the Henry's Fork this would encompass cutthroat trout, rainbow trout, and mountain whitefish. Species of Intermediate (=2) concern are all gamefish species except as noted above; all native nongame species in natural, unimpounded environments; and exotic nongame fish that serve as a forage base for a species of high concern. Species of Low (=3) concern are all exotic nongame species not noted above, and native nongame fish populations in altered habitats.

Levels of fish abundance (High = 1, Intermediate = 2, and Low = 3) were correlated with catch per unit effort, actual population size based on field sampling data, or resource expert consensus estimates. Levels of angler use (High = 1, Intermediate = 2 and Low = 3) are expressed as fisherman-days per unit area, or are resource expert consensus estimates. For estimate purposes the following guidelines were used. High - supports a renowned fishery as evidenced by the number of anglers who come specifically to fish this particular stream segment, anglers from a national or statewide area. Intermediate - supports a fishery utilized by anglers from a 3-4 county area. Low - supports a fishery used by local anglers.

Wildlife Values

The criteria used to assess wildlife resources were habitat quality, species composition and abundance, recreational use or potential, and geographic importance. Noted use of habitat for nesting, winter range, calving, or migration is listed under the Critical Use column on the matrix. Final wildlife values recorded on the matrix were further modified by IDWR staff to reflect water-associated species or land-associated species as follows:

1 = Outstanding wildlife value
   primarily water-associated animals, e.g., muskrat, beaver, bald eagle, swans
2 = Outstanding wildlife value
   primarily land-associated animals, e.g., bear, deer, moose
3 = Substantial wildlife value

Wildlife values are logged as "Outstanding" or "Substantial" for most of the stream segments evaluated in the Henry's Fork basin. This contrasts, however, with other river basins within the state which show substantially lower wildlife values for their respective streams. The Henry's Fork basin is unique on a state and regional scale in wildlife abundance.

Recreational Values

In evaluating the recreational value of a stream segment it is impossible to rank all rivers on exactly the same criteria. The physiographic diversity of stream segments contributes to distinct settings and to the suitability for some activities over others. Consequently, the river segments were inventoried and ranked on a regional basis. Although some Idaho rivers boast users from throughout the nation and the world, the river segments with primarily regional and/or local use are no less important as recreation resources. Use figures were not seen as an appropriate measure of a river's recreation value. User counts do not exist for most of the rivers that do not require permits. The number of users does indicate the popularity of a river segment, but tells nothing of the quality of experience. The best source of recreational data was thought to be from the recreation planners and managers of the region.

Three major criteria, land-based recreation opportunities, water-based recreation opportunities and scenic factors, were used to evaluate recreational resources on each stream segment. Land-based recreation included activities that occurred within 1000 feet of the river or stream. Other factors such as the accessibility, type of experience desired, water level, and difficulty also played a role in the assessment of the recreational value. Each criteria was evaluated using an inventory and ranking matrix which documented the physical attributes and activity opportunity characteristics of each stream segment. Assessment values for the individual study reaches were determined by group consensus at meetings held throughout the state.

The Land and Water Opportunity Use columns in the matrix describe the recreation opportunities that occur along the river segment. Potential developed recreation sites located by the Targhee National Forest in the 1985 Management Plan are listed in the final recreation column. Recreation potential was considered but not included in the Parks and Recreation inventory and evaluation. The Targhee National Forest has mapped potential recreation sites as a part of its Forest Management Plan (1985). The following definitions describe the recreational value rating:

1 = "Outstanding" recreational resource

An outstanding recreational resource may be due to a unique combination of attributes or to one specific characteristic that creates exceptional recreational opportunities for one or more activities. Outstanding resources would be described by recreation experts and the public as "blue ribbon" resources--the epitome or classic of its type of setting and/or experience. Recreationists may be willing to travel substantial distances or endure difficult access to use these resources.

2 = "Substantial" recreational resource value

This class describes recreational resources that are highly valued but do not offer the special characteristics found in outstanding recreational resources. These may be somewhat scarce opportunities in a region due to the limited suitability for certain opportunities or based on the special physical attributes of the river segment. These opportunities and/or settings are of a higher quality than the resources typically found in the region. These are very important recreational settings in the region.

3 = "Moderate" recreational resource value

Moderate recreational resources are typically available in the region. They have considerable recreational value, but the physical setting or experience opportunity may be considered standard for what is available in the region.

Development Use Values

Several columns in the matrix identify other uses or concerns for specific river segments or streams. Hydropower sites are summarized from the Power Development section of the Henry's Fork basin plan. If the project is an active FERC filing, it is noted in the column to the right with an "A". Potential sites are noted with a "P". Potential irrigation water supply sites are summarized from the Water Supply section of the Henry's Fork basin plan. A priority classification for further study is noted in the column to the right. Stream segments adjacent to scheduled Targhee National Forest timber sales, and/or noted for flooding problems in the Henry's Fork basin plan, and/or designated as "Special Resource Waters", (see also Water Quality chapter), are marked with an "X" in the appropriate column of the matrix.

State Protection Eligibility Criteria

The final matrix column identifies that the segment meets particular eligibility criteria for defining outstanding aesthetic, geologic, fish & wildlife, and recreational values. Eligibility for state protected river designation is based solely on the relative significance of the reach as a public resource, e.g., to be eligible for protection a reach must contain at least one "Outstanding" fish and wildlife, recreational, aesthetic or geologic value. After eligibility is determined, an assessment of the effects of designation on other identified resource uses is undertaken.

In order to highlight outstanding stream segments in the Henrys Fork basin, screening criteria were applied to the matrix values. The following criteria were developed:

#1 Fish & Wildlife

Fishery Habitat & Abundance = 1; and
Species of Concern = 1 or stream segment is spawning habitat; and
Wildlife value = 2 or
Critical use by wildlife

#2 Fish & Wildlife and Recreation

Fishery Abundance & Angler Use = 1; and
Habitat & Species of Concern minimum = 2; and
Wildlife Value = 2; and
Recreation value minimum = 2

#3 Aesthetics, Geology, and Recreation

Recreation value = 1; or
Scenic/natural linear features value = 1

River Segment Values

Stream segments in the Henrys Fork basin that met criteria for outstanding fish and wildlife, recreational, aesthetic, and geologic resource values are described below.

Henrys Fork from Big Springs to Island Park Reservoir -
Outstanding fish habitat, high fish numbers, and spawning use; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities; scenic terrain and outstanding geologic features: - Big Springs, hot springs, and volcanics.

Henrys Fork from Island Park Dam to Harriman State Park -
Outstanding fish habitat high fish numbers, and spawning use; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork through Harriman State Park -
Outstanding fish habitat, high fish numbers, and spawning use; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities; scenic open vista and historic railroad ranch.

Henrys Fork from Harriman State Park to Riverside Campground -
Outstanding recreation value based on current land and water opportunities; outstanding scenic and geologic features: - view of Teton Range, canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use.

Henrys Fork from Riverside Campground to Hatchery Ford -
Outstanding recreation value based on current land and water opportunities; scenic canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Hatchery Ford to Upper Mesa Falls -
Outstanding recreation value based on current land and water opportunities; outstanding scenic and geologic features: - Sheep Falls, volcanics, canyon environment. Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use.

Henrys Fork from Upper Mesa Falls to Lower Mesa Falls -
Outstanding recreation value based on current land opportunities; planned recreational development at Mesa Falls; outstanding scenic/geologic features: - Upper and Lower Mesa Falls, canyon environment.

Henrys Fork from Lower Mesa Falls to Warm River -
Outstanding recreation value based on current land and water opportunities; outstanding scenic canyon environment. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Warm River to Ashton Reservoir -
Outstanding recreation value based on current land and water opportunities. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Henrys Fork from Ashton Dam to Chester Dam -
Outstanding fish habitat and high fish numbers; critical use by species of concern; outstanding wildlife habitat, and water-associated species present; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork from Chester Dam to St. Anthony -
Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; high angler use and outstanding recreation value based on current land and water opportunities.

Henrys Fork from St. Anthony to Teton River confluence -
Outstanding recreation value based on current land and water opportunities. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern.

Buffalo River -
Outstanding fish habitat, high fish numbers, and spawning use; high fish species value; critical use by species of concern; outstanding wildlife habitat, and water-associated species present; substantial recreation value based on current land and water opportunities.

Warm River from Split Creek to Warm River Spring -
Outstanding scenic canyon environment.

Warm River from Warm River Spring to mouth -
Outstanding fish habitat, high fish numbers, and spawning use; outstanding wildlife habitat and critical use by species of concern; outstanding scenic and geologic features: - canyon environment, hot springs; campground, trails, and scenic route provide recreation opportunities.

Falls River from Wyoming Border to Yellowstone Diversion -
Outstanding fish habitat, high fish numbers; high fish species value; outstanding wildlife habitat, water-associated species present; substantial angler use and outstanding recreation value based on current land and water opportunities.

Falls River from Yellowstone Diversion to Conant Creek -
Outstanding recreational value based on current land and water opportunities. Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern; substantial angler use.

Falls River from Conant Creek to mouth -
Outstanding fishery habitat and abundance; high fish species value; outstanding wildlife habitat, water-associated species present; high angler use and substantial recreation value based on current land and water opportunities.

Teton River from Spring Creek to Bitch Creek -
Outstanding fishery habitat and abundance, and high fish species value; outstanding wildlife habitat, water-associated species present, and critical use by species of concern.

Duck Creek -
Outstanding fish habitat,high fish numbers, and spawning use; critical use by species of concern; high fish species value; outstanding wildlife habitat.

Timber Creek -
Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Targhee Creek -
Outstanding scenic/natural features in proposed Research Natural Area. Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Howard Creek -
Outstanding fishery habitat and spawning area; high fish abundance and high fish species value; outstanding wildlife habitat and critical use by species of concern.

Robinson Creek -
Outstanding scenic canyon with hot springs. Outstanding fishery habitat and spawning area; high fish abundance; outstanding wildlife habitat; harlequin duck habitat.

Bitch Creek -
Outstanding fish habitat,high fish numbers, and spawning use; high fish species value; big game winter range.

	Aesthetic, Natural or Geologic		Fish & Wildlife						Recreation					Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Lake Outlet			1	2	2	3	1	Eagle-W, N TSwan-W SCrane-N Wetlands	F&W		F	FB, C	Crooked Cr; 2mi N of Conf	1	H								
Henrys Fork-Big Springs to Island Park Reservoir	1	Volcanics Big Springs Hot Springs	1 Sp	2	1	1	1	Eagle-W, N TSwan-W Wetlands Osprey	F&W	1	CG,Tr,P,Dr ORV,Res,F	S,T,PB,FB,C Outfitters	North Fk Summer Hm Area	2	A&H	Coffee Pot	P	Moose Cr				X	1 2 3
Henrys Fork-Island Park Dam to Harriman State Park		Canyon	1 Sp	1	1	1	1	Eagle-W, N TSwan-W Osprey	F&W	1	CG,Tr,P,Dr ORV,Res,F	S,T,FB,C,F Outfitters	Hwy 20 1mi S of Last Chance	2	A&H	Island Park Last Chance	A P					X	1 2 3
Henrys Fork-Harriman State Park	1	Vista	1 Sp	1	1	1	1	Eagle-W, N TSwan-W, N SCrane-N Elk-C Wetlands Osprey	F&W	1	CG,Tr,P,Dr	S,T,PB,FB,C F-Outfitters		1	A&H							X	1 2 3
Henrys Fork-Harriman SP to Riverside Campground	1	Teton View Canyon	1 Sp	1	1	1	1	Eagle-W, N TSwan-W, N Osprey	F&W	1	CG,Tr,P,Dr ORV	FB,C,F Outfitters	Osborne Br; near Riverside Campground		A	Lookout Butte	P					X	1 2 3
Henrys Fork-Riverside CG to Hatchery Ford		Canyon	1 Sp	1	1	2	1	Eagle-W, N TSwan-W Osprey	F&W	1	CG,Tr,P	FB,C,F Outfitters	Lookout Butte; Hatchery Fd		A	Lookout Butte	P					X	1 3

Natural Features:

pNNL - Proposed National Natural Landmark
pRNA - Proposed Research Natural Area

___ Underlined data indicates rating or information update supplied by regional Idaho Fish and Game personnel, 1991.

Fish and Wildlife:

D - Deer
Mo - Moose
SCrane - Sandhill Crane
TSwan - Tundra or Trumpeter Swan

C - Calving
M - Migration
N - Nesting
Sp - Spawning
W - Wintering
WR- Winter Range

Recreation:

C - Canoe
CG - Campground
Cp - Camping
Dr - Pleasure Driving
F - Fishing
H - Hunting
ORV - Off-Road Vehicles
P - Picnicking
Res- Resort
S - Swimming
T - Tubing
Tr - Trail
PB - Power Boating
FB - Float Boating:
Kayak
Dory
Raft

NPPC - Northwest Power Planning Council Designations

F&W - Fish and Wildlife
F - Resident Fish
W - Wildlife

	Aesthetic, Natural or Geologic		Fish & Wildlife							Recreation				Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Fork-Hatchery Ford to Upper Mesa Falls	1	Waterfalls Canyon	1	1	1	2	1	Eagle-W, N TSwan-W Elk-M, WR Osprey	F&W	1	Tr	FB,F Outfitters	Sheep Falls		A	Lookout Butte Sheep Falls Hatchery Ford	P P P					X	1 3
Henrys Fork-Upper Mesa Falls to Lower Mesa Falls	1	Waterfalls Volcanics pNNL	1	1	2	3	1	Osprey	F&W	1	CG,Tr		Mesa Falls		A	Mesa Falls Hatchery Ford	P P					X	3
Henrys Fork-Lower Mesa Falls to Warm River	1	Canyon	1 Sp	1	1	2	1	Eagle-W, N TSwan-W Osprey	F&W	1	Tr,P,Dr	FB,C,F Outfitters			A	Hatchery Ford	P	Warm River				X	1 3
Henrys Fork-Warm River to Ashton Reservoir			1 Sp	1	1	2	1	Eagle-W, N TSwan-W Elk-M, WR Osprey	F&W	1	Cp,Tr,P	S,T,FB,C,F Outfitters		3	A	Warm River Hatchery Ford	P P	Warm River				X	1 2 3
Henrys Fork-Ashton Dam to Chester Dam			1	1	1	1	1	Eagle-W, N Osprey	F&W	1	Cp,F,H	S,T,PB,FB,F Outfitters		3		Ashton Cross Cut St. Anthony Lwr Ashton	A P A P	Ashton	2		X	X	1 2 3
Henrys Fork-Chester Dam to St. Anthony			1	1	1	1	1	Eagle-W, N Osprey		1											X	X	1 2 3
Henrys Fork-St. Anthony to Confluence with N Fk Teton		Sand Dunes	1	1	1	3	1	Eagle-W, N D-M, WR	F&W	1	Cp,F,H	S,T,PB,FB,F Outfitters		3	A&H						X	X	1 3

Natural Features:

pNNL - Proposed National Natural Landmark
pRNA - Proposed Research Natural Area

___ Underlined data indicates rating or information update supplied by regional Idaho Fish and Game personnel, 1991.

Fish and Wildlife:

D - Deer
Mo - Moose
SCrane - Sandhill Crane
TSwan - Tundra or Trumpeter Swan

C - Calving
M - Migration
N - Nesting
Sp - Spawning
W - Wintering
WR - Winter Range

Recreation:

C - Canoe
CG - Campground
Cp - Camping
Dr - Pleasure Driving
F - Fishing
H - Hunting
ORV - Off-Road Vehicles
P - Picnicking
Res - Resort
S - Swimming
T - Tubing
Tr - Trail
PB - Power Boating
FB - Float Boating:
Kayak
Dory
Raft

NPPC - Northwest Power Planning Council Designations

F&W - Fish and Wildlife
F - Resident Fish
W - Wildlife

	Aesthetic, Natural or Geologic		Fish & Wildlife						Recreation					Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Henrys Fork-N Fk Teton Confluence to Mouth	1	Eolian Features Menan Buttes pNNL	3	1	3	3	1	Eagle-W, N Elk/D/Mo-WR													X	X	
Buffalo River-from springs (SW ¼ Sec 21) to mouth			1 Sp	1	1	1	1	Eagle-W, N TSwan-W, N	F&W	2	Cp,Res,F	S,T,FB,C,F		3	A&H	Ponds Ldg Buffalo River	A P			X		X	1 2
Warm River-Partridge Creek to Warm River Spring	1	Hot Springs Canyon	1 Sp	1	2	2	2	Elk/Mo-C, WR	F&W	2	CG,Tr,P,Dr ORV,F	S,T,FB	Partridge Cr, Flat Canyon	2	A&H	Partridge Buffalo R	P P			X		X	3
Warm River-Warm River Spring to HF Confluence	1	Hot Springs Canyon	1 Sp	1	1	2	2	Eagle-W, N TSwan-W Elk/D/Mo-WR	F&W		CG,Tr,P,Dr ORV,F	S,T,FB	Warm Springs Twisted Draw Overlook	2	A&H	Warm R Butte	P	Warm R				X	1 3
Falls River-Wyoming border to Yellowstone Diversion			1 Sp	1	1	3	1	Elk-M, C Harlequin Ducks Osprey	F&W	1	Tr,F,H	FB	Boone Cr Cll Dog Cr Cll Sheep Falls			Sheep Falls	P	Bitch Cr Park Lake Squirrel Cr Boone Cr JY Ranch	1 1			X	1 3
Falls River-Yellowstone Diversion to Conant Creek			1	1	1	2	1	Eagle-W Elk/D/Mo-WR Osprey	F&W	1	Tr,F,H	FB				Falls River Yellowstone Marysville Dp	A A P	Howell Rch Lane Lake Conant Cr Marysville	 1 1 1			X	1 3
Falls River-Conant Creek to Enterprise Canal Diversion			1	1	1	1	1	Eagle-W Elk/D/Mo-WR Osprey	F&W	2	Cp,Tr,ORV F,H	S,T,FB,C		3	A&H	Enterprise Cnl	P					X	1 2

Natural Features:

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NPPC - Northwest Power Planning Council Designations

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Segment	Aesthetic, Natural or Geologic: Scenic/NF Value	Scenic/Natural Features	Fish & Wildlife: Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation: Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural or Historic: Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Teton River-Trail Creek to Spring Creek			2	1	2	1	3	Eagle-W TSwan-W SCrane-N Elk/D/Mo-WR Wetlands	F&W			Outfitters			A	Tetonia/ Driggs	P	Bitch Cr UpprBdgr LowrBdgr Te/Driggs	1 2 1 2			X	
Teton River-Spring Creek to Bitch Creek			1	1	1	3	1	Eagle-W TSwan-W Elk/D/Mo-WR	F&W	2	Cp,F,H	FB Outfitters			A	Felt Uppr Teton	A A	Tetonia	2			X	1
Teton River-Bitch Creek to Canyon Creek			3	1	2	2	1	Eagle-W D/Mo-WR		2	Cp,F,H	FB Outfitters										X	
Teton River-Canyon Creek to North-South Branches			3	1	2	1	1	Eagle-W D/Mo-WR	F&W	3	Cp,F	FB Outfitters			A	Briggs Enterprise Crl Teton	A P P	Teton Newdale Div	2 1			X	
North Branch Teton River to Henrys Fork Confluence			3	1	2	2	1	Eagle-W													X		
South Branch Teton River to Henrys Fork Confluence			3	1	2	2	1	Eagle-W													X		
Sand Creek	1	Hot Springs	2	2	1	3	1	SCrane-N Elk/D/Mo-C Elk/D/Mo-WR							A								
Sheridan Creek			3	2	3	3	2	Eagle-W, N TSwan-W, N SCrane-N						2	A&H								

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	Aesthetic, Natural or Geologic		Fish & Wildlife						Recreation					Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Icehouse Creek			1	2	3	3	2	Eagle-W TSwan-W, N Elk-C, M	W				nr Bunkhouse Creek CII	2	A&H								
Sheep Creek							2	Mo-WR	W														
Blue Creek			3				2	Mo-WR	W					2						X			
Hotel Creek			1	2			2	Eagle-W TSwan-W Mo-WR	W											X			
Yale Creek							2	Elk-C Mo-WR	W					2									
Duck Creek			1 Sp	1	1	3	2	Eagle-W, N TSwan-W	F&W				near South Fk CII										1
Timber Creek			1 Sp	1	1	3	2	Eagle-W, N Elk-M, C	F&W														1
Targhee Creek	1	pRNA	1 Sp	1	1	3	2	Eagle-W, N Elk/D/Mo-WR	F&W				T16,R43,Sec25										1 3
Howard Creek			1 Sp	1	1	3	2	Eagle-W, N Elk/D/Mo-WR	F&W											X			1
Moose Creek			1 Sp	2	1	2	2	Eagle-W, N Elk/D/Mo-WR	W	3			1mi SE Rd 292		A			Moose Cr					
Partridge Creek	1	Hot Springs	2	2	2	3	1								A					X			

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	Aesthetic, Natural or Geologic		Fish & Wildlife						Recreation					Cultural or Historic									
	Scenic/NF Value	Scenic/Natural Features	Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural Features Value	A-Archeologic Sites H-Historic Sites	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Fish Creek	1	Hot Springs	1	2	1	3	2						2mi NE Moose Cr Butte	3	A	Fish Cr	P	Robinson Cr	2	X			
Snow Creek	1	Hot Springs	1	<u>1</u>	2	3	2								A	Fish Cr	P			X			
Rock Creek			1	2	1	3	1						Shaefer Cr CG; 1mi SW of Yellowstone NP	3	A	Park Lake Fish Cr	P P	Park Lake JY Ranch Howell Rch	1				
Porcupine Creek			2	2	2	3	2			3	Cp,F		Rising Cr CG	2	A&H	Fish Cr	P						
Robinson Creek-Wyoming border to mouth	1	Hot Springs Canyon	1 Sp	2	1	3	2	Harlequin Ducks	F&W	2	Cp,Tr,ORV,F		Horseshoe Lk			Fish Cr	P	Robinson Cr	2	X			1 3
Boone Creek-Wyoming border to mouth			1	2	2	3	1		W				Falls R CG			Boone Cr	P	Boone Cr Conant Cr Squirrel Cr Sqrl Mdow	1				
Squirrel Creek-Wyoming border to mouth			1	2	2	3	1		F&W					3				Squirrel Cr					
Conant Creek-Wyoming border to mouth			2	2	2	3	1	Elk/D/Mo-WR	W					3				Lane Lake Conant Cr Bitch Cr	1 1 1				
Bitch Creek-Wyoming border to mouth		Canyon	1 Sp	1	1	3	3	Elk/D/Mo-WR Harlequin Ducks	F	2	F	FB,F			A	Judkins	P	Bitch Cr Lane Lake Conant Cr Spring Cr	1 1 1 2				1

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River Segment	Aesthetic, Natural or Geologic: Scenic/NF Value	Scenic/Natural Features	Fish & Wildlife: Fishery Habitat	Species of Concern	Abundance	Angler Use	Wildlife Value	Critical Use	NPPC Protected Area	Recreation: Recreation Value	Land Opportunity/Use	Water Opportunity/Use	Potential Developed Recreation Site	Cultural or Historic: Cultural Features Value	A-Archeologic Site H-Historic Site	Hydropower Site	A - Active FERC File P - Potential Site	Potential Irrigation Water Supply	Priority for Further Study	Adjacent Timber Sales	Flooding Along Segment	Designated "Special Resource Water"	Eligible River by Criteria Group #
Badger Creek-Wyoming border to mouth			2	1	2	3	3	Elk/D/Mo-WR SCrane-N	F&W	4	Cp,Tr,P,F	S,T				Uppr Bdgr	P	UpprBdgr LowrBdgr	2 1				
Spring Creek			2	1		3	3	Elk/D/Mo-WR TSwan-W SCrane-N	F&W														
South Leigh Creek-Wyoming border to mouth		·	3	1		3	3	Elk/D/Mo-WR TSwan-W SCrane-N	F														
Teton Creek-Wyoming border to mouth			2	1	2	2	3	Elk/D/Mo-WR TSwan-W SCrane-N	F														
Darby Creek-Wyoming border to mouth			2	1			3	Elk/D/Mo-WR TSwan-W SCrane-N															
Trail Creek-Wyoming border to mouth			2	1			3	Elk/D/Mo-WR TSwan-W SCrane-N	F	3	CG,Tr,P Dr,F				A	Victor	P						
Mahogany Creek				1		3	3	Elk/D/Mo-WR SCrane-N	F				1.5 mi SW of Bates										
Horseshoe Creek			2 Sp	1		3	3	Elk/D/Mo-WR SCrane-N	F				Ski Area at HW	2	A								
Packsaddle Creek			2 Sp	1		3	3	Elk/D/Mo-WR SCrane-N	F				N Fork HW; S Fork HW	2	A								

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Canyon Creek-Headwaters to Calamity Creek			2	1	2	3	2	Elk/D/Mo-WR SCrane-N	F				3mi S of Calamity Cr; Hilton Cr Cfl	3	A&H			Spring Cr Canyon Cr Moody Cr	2				
Canyon Creek-Calamity Creek to Mouth	2	pNNL, Pincock Hot Springs	3	1	3	3	2	Elk/D/Mo-WR SCrane-N Eagle-W	F							Canyon Cr	P	Canyon Cr Teton	2 2				
Spring Creek			2	1			3	Elk/D/Mo-WR	F									Spring Cr	2				
Calamity Creek			2	1			3	Elk/D/Mo-WR	F											X			
Moody Creek			1 Sp	1	2	3	3	Elk/D/Mo-WR SCrane-N	F				Sheep Cr HW					Moody Cr		X			

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DESIGNATIONS AND RECOMMENDATIONS

The role of the Idaho Water Resource Board is to establish water policy for the state, including the development of comprehensive water plans for geographic areas within the state. A key element of Idaho water policy and planning is state sovereignty. It is the policy of Idaho that the state has sovereignty over decisions affecting the development and use of its water resources. The state opposes any attempt by any other entity to usurp the state's role in these areas. Consistent with the goals and objectives of the Idaho Water Resource Board, and through the water planning process mandated by the Idaho Legislature, the following designations and recommendations are made to protect and manage the water resources of the Henrys Fork of the Snake River.

State River Designations

The river reaches designated as state protected rivers have outstanding fish and wildlife, recreation, aesthetic or geologic values. These reaches are identified on maps in the appendix showing potential hydropower and reservoir sites. Having considered these values and balanced them with other river uses, the Water Resource Board has determined that the value of preserving the reach for these particular uses outweighs use of the waterway for other uses (Idaho Code 42-1734A). Existing uses will continue, and in many cases some other new uses will be allowed. This judgement is influenced to a large degree by current values. Where the designation of a state protected river precludes a project or development, the Board will consider requests from individuals to amend a component of the comprehensive state water plan on a case-by-case basis. The Board will amend the plan whenever the balance of competing uses changes. The determination shall be based on their evaluation of the impact of such change on the protection and preservation of the state's waterways, its economic impact on the state as a whole, whether it effects existing water rights, whether it is necessary to provide adequate and safe water for human consumption, and whether it is necessary to protect life. Where the Water Resource Board has not prohibited activities, this plan does not exempt persons from meeting normal regulatory requirements such as stream channel alteration permits, Department of Lands easements, water right permits, etc.

The comprehensive water planning legislation protects approved applications for the appropriation of water and other property rights from restrictions developed as part of the planning process. A water user may maintain or replace a water diversion structure, and may remove obstructions from the stream channel that interfere with the delivery or use of water.

There are many other river lengths that have some outstanding values, however, other uses or potential uses are significant. These streams or stream segments are not afforded protected river status at this time. A significant degree of protection exists for these other river areas because of well established federal and state agency regulatory programs. By choosing not to designate other state protected rivers at this time, the state does not endorse or support any specific development plans on any undesignated river reach.

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

- Within Lionhead Roadless area.
- Grizzly bear and peregrine falcon habitat.

- Important spawning habitat for cutthroat and brook trout.

Targhee Creek, including West and East Forks, from sources to the Targhee National Forest boundary (Forest Route 057 bridge) is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- Outstanding fishery values; national and international recognition, very high use rate per mile and a trophy fishery.
- Outstanding recreational values.
- Outstanding aesthetic values - the river is the focal point of large summer recreational use.
- Contains the first National Water Trail - from the abandoned railroad trestle crossing below Big Springs to U.S. Highway 20 bridge at Macks Inn.
- Major area of floating use from Big Springs to Upper Coffee Pot Rapids - the majority of the floaters are from out-of-state.
- Has one identified small potential hydroelectric project at Coffee Pot Rapids. A 45- foot drop within one-half a mile which could produce an average of 1,000 KW.
- No identified irrigation potential.

The Henrys Fork from Big Springs to Island Park Reservoir (McCrae Bridge) is designated a state recreational river. Also designated a state recreational river is the last two miles of Henrys Lake Outlet (also known as the Henrys Fork) starting at the beginning of the Forest Service land between Sections 29 and 30 near the Forest Boundary and ending at the mouth in Section 32, all in T. 14 N., R. 44 E. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

The good water quality in this river section is very important to its continued recreational use. The large amount of ground-water inflow below the springs combined with the gravel materials underlying many recreational homesite areas creates a situation requiring close monitoring of water quality in this river section.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at Big Springs of past and present forest management practice in the ground-water basin above the spring which includes the Thirsty Creek drainage.

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

- Outstanding fishery values from Island Park Reservoir to U.S. Highway 20 crossing - has national and international recognition with very high use rates per mile and a trophy fishery.
- Outstanding recreational values and use from Island Park to Riverside Campground.
- Outstanding aesthetic values - the middle reach from the Box Canyon settlement to the Pine Haven subdivision is in an outstanding pastoral setting while the reaches at the upstream and downstream ends generally would be considered as having outstanding limited canyon environments.
- A major area of floating use from Island Park Reservoir to Riverside Campground.
- Has a limited hydroelectric potential partially in a short area in the upstream area near Island Park Reservoir.
- No identified irrigation potential.
- Year-round minimum stream flow of 300 cfs from mouth of Buffalo River to end of reach.

The Henrys Fork from the downstream right-of-way line of the U.S. Bureau of Reclamation Island Park Dam to the section line between Sections 24 and 25, T. 11 N., R. 42 E., located approximately one-fourth mile below Riverside Campground, is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct fishery enhancement facilities and public access facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

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

- Smaller sized water bodies: Golden Lake is 50 acres and Silver Lake is 150 acres.
- Lakes are somewhat shallow. Golden Lake is approximately ten feet deep, Silver lake is approximately three feet deep and is eutrophic with high summer water temperatures.
- Lakes are located generally within the special use Harriman State Park property, a pastoral setting beauty spot of the basin.
- Lakes are managed so no development can take place around them, lake level is not drawn down.
- Trumpeter swans nest on the shorelines. A significant portion of the local breeding population nest in this area.
- The lakes are an outstanding aesthetic natural resource.

Golden Lake, Silver Lake and Thurman Creek from Golden Lake to its confluence with the Henrys Fork, all mostly within Harriman State Park, are designated state recreational rivers (waterways). Waterways can include lakes. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction of hydropower projects;
- construction of water diversions works;
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, impoundments, fish and wildlife enhancement facilities and public stream access facilities and for public agencies to construct public access facilities, and fish and wildlife enhancement facilities.

Close coordination with the Idaho Department of Parks and Recreation will be necessary to ensure that their management of the lakes and creek complements this designation.

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

- Outstanding fishery numbers and habitat, however, angler use is considerably reduced from upstream angler use.
- The recreational value is largely for kayaking use and is very good to outstanding. Actual recreational use is reduced from upstream recreation use, however, recreation use appears to be increasing.
- The aesthetic values relate to a mountain evergreen-covered canyon area without access except at the end points of this river area. Most viewers rate the canyon aesthetic values as outstanding.
- There is hydroelectric potential in this river reach.
- Year-round minimum stream flow of 300 cfs through the reach.

The Henrys Fork from the section line between Section 24 and 25, T. 11 N., R. 42 E., located approximately one-fourth mile below Riverside Campground to a point 100 feet upstream of the

Forest Service boat ramp at Hatchery Ford is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- This one-twelfth mile reach is extremely scenic because of its canyon environment.
- A concrete boat ramp is used as a take-out point for floaters from up river. Kayakers access the river here for whitewater runs to Sheep Falls or Upper Mesa Falls.
- The boat ramp access detracts from the naturalness of the setting.
- Improved recreational access will be needed in the future for this area.
- The Fremont County Commissioners filed for a Federal Energy Regulatory Commission permit to study the hydroelectric potential of the site as a diversion point for a pumped storage project that would use Ashton Reservoir as the release point. On November 22, 1991 the Federal Energy Regulatory Commission denied the request based on the federal prohibition against hydropower construction on this reach of the Henrys Fork.
- Year-round minimum stream flow of 300 cfs through the reach.

The Henrys Fork from a point 100 feet upstream of the Forest Service boat ramp to a point approximately 300 feet downstream of the ramp, is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

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

- This reach from Hatchery Ford to Upper Mesa Falls has outstanding aesthetic values as a river canyon environment. Sheep Falls has a 35-foot drop. Upper Mesa Falls is a spectacular single drop of 160 feet (compared to the Niagara Falls drop of 182 feet; the respective water flow is 1,000 cfs versus 200,000 cfs). One mile downstream, Lower Mesa Falls has a constricted cascade of 65 feet. These falls have statewide significance.
- The geologic aspects of the reach below Upper Mesa Falls are outstanding.
- The Upper Mesa Falls visitors area receives heavy use. The river area below Lower Mesa Falls is used by a small number of floaters who have a high regard for the faster water in this reach. In the area from Lower Mesa Falls past the Forest Boundary to the Highway 20 bridge, there is commercial river guiding activity and significant noncommercial recreation use. Angler use is much lower than upriver areas, perhaps because of limited access.

- Outstanding fish numbers and habitat exist in this river reach. Above Upper Mesa Falls angler use is restricted because of limited access.
- Year-round minimum stream flow of 300 cfs to one mile above Upper Mesa Falls, one mile above Upper Mesa Falls to one mile below Lower Mesa Falls: 300 cfs 10/1-3/31, 1000 cfs 4/1-9/30.

The Henrys Fork from a point 300 feet downstream of the Hatchery Ford boat ramp to the southern boundary of the Targhee National Forest near the mouth of Warm River is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- The geologic aspects of the canyon change slightly near the forest boundary because of a decreased gradient in the river.
- The visual impact of the river also changes slightly near the forest boundary since the south-facing slopes of the canyon become nonforested. The aesthetic values for the reach are very high. The canyon ends two miles upstream from the highway crossing.
- The reach is heavily fished.
- The recreation classification is high because of the boating and fishing activity.
- Some hydroelectric potential exists.

The Henrys Fork from the southern boundary of the Targhee National Forest near Warm River to the U.S. Highway 20 bridge near the upstream limit of Ashton Reservoir is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new water diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to installations which have the main riverbed structure located below the water level and blended with the riverbed or to pumping installations which do not create an obstruction in the river, and are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation, special attention is drawn to the boat docks along the river's banks. All docks built or significantly altered after July 1, 1971 must have a stream channel alteration permit from the Department of Water Resources. Current design standards may be applied to docks built after 1971.

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

- The fishery in this reach is classified as good to outstanding, and is heavily used.
- The identified Lower Ashton hydroelectric site is located in this reach.

The Henrys Fork from the south property line of the Utah Power and Light Co. Ashton Dam property to the confluence with the Falls River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alteration is prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new water diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. In addition, new private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

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

- The fishery use is very good to outstanding. The proposed addition of a fish ladder over the Ponds Lodge hydroelectric impoundment should further improve the fishery.
- Elk Creek below Elk Creek Reservoir and the seven-mile stretch of the Buffalo River above the U.S. Highway 20 bridge generally are classified as having outstanding aesthetic qualities. The Buffalo River Springs at the upper end of this designated area are particularly scenic.
- Recreational use of this river area is substantial.
- Sandhill cranes frequent the area.
- The identified Buffalo River project at the upper end of this river area has hydroelectric potential.

The Buffalo River from the springs (in the SW 1/4 of Sec. 21, T. 13 N., R.44 E.) to its confluence with the Henrys Fork and Elk Creek from below the right-of-way line of Elk Creek Dam to its confluence with the Buffalo River are designated state recreational rivers. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed.

The construction of hydropower projects is prohibited except for the rebuilding of the Ponds Lodge hydropower facility.

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; and for public agencies to construct public access facilities including bridges and fishery enhancement facilities; and for new diversion works including those associated with the rebuilding and upgrading of the Ponds Lodge hydroelectric project providing the conditions of the stream channel permit process are met.

Construction or expansion of dams or impoundments are prohibited unless associated with the rebuilding and upgrading, including a raise in the water level, of the Ponds Lodge project.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

As part of the state designation of this river reach, attention is directed to the fact there are occasional fences across the river reach. Provisions need to be made so boaters can navigate down the river area without restriction. State law prohibits restricting navigation. Assistance to landowners in providing alternate livestock control measures would be helpful.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at the Buffalo River Springs of past and present forest management in the ground-water basin above the springs.

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

- This stream is quite small during the nonrunoff season.
- This reach is the upper end of a river reach that qualifies as a state natural river.
- The bridge detracts from the naturalness of the setting.
- Use of the fishery is low.

The Warm River from its confluence with Partridge Creek downstream to a point 100 feet upstream of the Forest Route 153 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(6) the following activities are prohibited:

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

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

- The recreational use of this reach is low.
- Use of the fishery is low.

- The bridge detracts from the naturalness of the setting.

The Warm River from a point 100 feet upstream of the Forest Route 153 bridge (in the NW 1/4 of Sec. 20, T. 44 E., R. 11 N., B.M.) to a point 100 feet downstream of the bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain, improve, or replace the bridge.

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

- The recreational use of the reach is low, although access is provided at both ends.
- The stream is quite small except during the runoff season.
- The hydroelectric potential is low because of the limited water flow.
- The aesthetic value is quite high.

The Warm River from a point 100 feet downstream of the Forest Route 153 bridge to a point 100 feet upstream of the Forest Route 154 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- The bridge is located at the Warm River Fish Hatchery site. The hatchery is not operational, but the buildings and bridge detract from the naturalness of the setting.
- This is the access point to view Warm River Springs, an outstanding aesthetic value.
- The hatchery buildings have value as an historic site.

The Warm River from a point 100 feet upstream of the Forest Route 154 bridge (in the SW 1/4 of Sec. 10, T. 44 E., R. 44 E., B.M.) to a point 100 feet downstream of the bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain, improve, or replace the bridge.

Pursuant to the designation of this reach as a state protected river, the Forest Service is urged to consider the effects upon the flow and quality at Warm River Springs of past and present forest management practices in the ground-water basin above the Warm River Springs.

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

- Year-round minimum stream flow of 141 cfs from Warm River Springs to mouth.
- The aesthetic values are tied to the canyon, and are high to outstanding. The cascades are particularly scenic.
- The hydroelectric potential is low, although some offstream development might be possible.
- Fishery values are high, although use is low. The reach is used as a spawning area.

The Warm River from a point 100 feet downstream of the Forest Route 154 bridge to a point 100 feet upstream of the bridge near the upstream edge of Warm River Campground (in the SW 1/4 of Sec. 7, T. 9. N., R. 44 E., B. M.) is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- Scenic canyon environment.
- Important spawning habitat for rainbow and brown trout.
- Grizzly bear habitat.

Robinson Creek from the Yellowstone National Park boundary to a point 100 feet upstream of the Forest Route 241 bridge is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- Important spawning habitat for rainbow and brown trout.
- Bridge crossing at both ends of reach.

Robinson Creek from a point 100 feet upstream of Forest Route 241 bridge to its confluence with Warm River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to repair or replace existing bridges.

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

- Important trout spawning habitat.
- Grizzly bear habitat.
- Several potential dam sites may be technically feasible.

Rock Creek from the Yellowstone National Park boundary to its confluence with Robinson Creek is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to repair or replace existing bridges.

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

- The recreational value of this river reach is outstanding, although the actual use is quite low largely because of limited access.
- The aesthetic value of this river reach is outstanding because of its pristine condition.
- Sheep Falls is a scenic drop of about 30 feet, and is an outstanding visual resource.
- The hydroelectric potential of this river reach is significant.

The Falls River from the Idaho border to a point 100 feet upstream of the upstream right-of-way boundary of the Yellowstone Diversion Dam, is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

- construction or expansion of dams or impoundments;
- construction of hydropower projects;
- construction of water diversion works;
- dredge or placer mining;
- alterations of the streambed;

• mineral or sand and gravel extraction within the streambed.

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

- The reach has considerable potential for recreation use.

The Falls River from a point 100 feet upstream of the upstream right-of-way boundary of Yellowstone Diversion Dam to the Kirkham Bridge, located in Sections 2 and 3 along the northern boundary of T. 8 N., R. 43 E., is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

The construction of water diversion works is prohibited except for those associated with off-stream storage projects. The Water Resource Board can not support any project at this time since feasibility studies are not available for consideration. The existing water-right process provides opportunity for the public and the Water Resource Board to be involved in the approval of any potential project.

Stream channel alterations are prohibited except those necessary to maintain, improve, or relocate existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new off-stream storage projects; and for public agencies to construct public access facilities and fishery enhancement facilities.

The Falls River (FERC #9885) hydropower project will use the existing Marysville Canal diversion. This project has received a FERC license, and as such is considered a vested right by the Warer Resource Board. The prohibitions associated with this state protected river designation, therefore, do not apply to this project.

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

- Outstanding fish habitat.
- Outstanding wildlife values.
- Potential site for a high dam and reservoir.

Boone Creek from the Idaho border to its conflence with Falls River is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- Moose winter range.
- Trout spawning habitat when water is available.

Conant Creek from the Idaho border to the Targhee National Forest boundary is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- Moose winter range.
- Trout spawning habitat when water is available.

Conant Creek from the Idaho border to the Targhee National Forest boundary is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticable from the river; are providied with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

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

- The fishery values of the reach and its tributaries are outstanding.
- The reach and its tributaries contains outstanding wildlife habitat with water-dependent species present; used by Idaho species of concern.
- The scenic values of the area are extremely high.

The Teton River from its confluence with Trail Creek to the Highway 33 bridge is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations shall be prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, impoundments, fish and wildlife enhancement facilities and public stream access facilities, and for public agencies to construct public access facilities and fish and wildlife enhancement facilities.

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

- The reach is an identified whitewater run.
- There is a year-round minimum stream flow from the bridge to the confluence with Bitch Creek of 106 cfs.
- Most of the reach is in a canyon setting.
- There is an existing hydropower project with an impoundment approximately three-quarters of a mile long at the end of the reach, and the potential exists for additional projects.
- There are a number of pump diversions in the lower end of the reach.

The Teton River from the Highway 33 bridge to Felt Dam is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

- construction or expansion of dams or impoundments.
- dredge or placer mining;
- mineral or sand and gravel extraction within the streambed;

The construction of hydropower projects is prohibited except for the Upper Teton Project (FERC #10613), located in Sec. 3, T. 6 N., R. 44 E. The Water Resource Board has reviewed this proposed project and feels that the minimum streamflow that exists will provide sufficient protection to the river in the project area.

The construction of water diversion works is prohibited except for those associated with off-stream storage projects. The Water Resource Board can not support any project at this time since feasibility studies are not available for consideration. The existing water-right process provides opportunity for the public and the Water Resource Board to be involved in the approval of any potential project.

Stream channel alterations are prohibited except those necessary to maintain and improve existing utilities, roadways, diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new off-stream storage projects; and for public agencies to construct public access facilities and fishery enhancement facilities.

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

- Habitat for Idaho species of concern.
- Trout spawning habitat.

Teton Creek from the springs near Highway 33 to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticable from the river; are providied with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

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

- Habitat for Idaho species of concern.
- Trout spawning habitat.

Fox Creek from the springs for approximately 2.5 miles to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

Stream channel alterations are prohibited except those necessary to maintain diversion works, fishery enhancement facilities and managed stream access facilities; for the maintenance of private property; for new diversion works; and for public agencies to construct public access facilities and fishery enhancement facilities. New private stream access facilities may be allowed with Idaho Water Resource Board approval.

New diversion works shall be limited to pump installations which do not create an obstruction in the river; are visually blended with the surroundings so as to be less noticeable from the river; are provided with fish screens if appropriate; are to supply water for livestock, domestic, commercial or municipal uses; are sized to supply water at a rate not to exceed 0.5 cubic feet per second; and which receive the aesthetic and fish screen design approval of the Idaho Department of Water Resources.

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

- Habitat for Idaho species of concern.

- Trout spawning habitat.

Badger Creek from the springs in the canyon for approximately 3 miles to its confluence with the Teton River is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

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

- The fishery values for this stream reach are outstanding, although the use levels are low.
- Other recreation use also is low, probably because access is limited.
- The canyon has high aesthetic value with conifers on both slopes.
- There is some hydroelectric potential along this stretch.

Bitch Creek from the Idaho border to the railroad trestle in the NW 1/4 of Sec.9, T. 7 N., R. 45 E. is designated a state natural river. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

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

- The fishery is outstanding.
- High aesthetic values, with a narrow valley in this reach.
- The railroad trestle and highway bridge detract from the natural setting.

Bitch Creek from the railroad trestle in the NW 1/4 of Sec. 9, T. 7 N., R.45 E. to the Highway 32 bridge, located in the NW 1/4 of Sec. 17, T. 7 N., R. 45 E., is designated a state recreational river. Pursuant to Idaho Code 42-1734A(6), the following activities are prohibited:

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

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

- This reach has an outstanding fishery, although use is low because of limited access.

- There is a year-round minimum stream flow of 28 cfs.
- There is some hydropower potential on the reach.
- The reach is an identified whitewater run.

Bitch Creek from the Highway 32 bridge to its confluence with the Teton River is designated a state natural river. If Teton Dam is rebuilt to its original height this designation shall terminate at the backwaters of the reservoir. Pursuant to Idaho Code 42-1734A(5), the following activities are prohibited:

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

Recommendations

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

16. The state should reexamine the role of artificial recharge within the basin. Earlier studies in the Egin Bench area can provide direction to the study effort.
17. The following waterways have recreational values that deserve special recognition and stringent application of existing regulatory authorities whenever new stream-altering activities are proposed:

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

APPENDIX

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931-1965

IDAHO

Idaho Falls Airport

1931-1965

MAXIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -10	-10 TO -6	-5 TO -1	0 TO 4	5 TO 9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 TO 104	105 TO 109	110 TO 114	ABOVE 114
MAR 1							2	3	10	23	23	20	9	7	2												
MAR 8							•	2	9	11	25	25	16	5	3	2	1	1									
MAR 15								2	2	11	16	22	16	13	9	7	3	•									
MAR 22								1	2	6	11	20	21	13	12	9	6										
MAR 29										3	9	11	19	22	19	9	•	2									
APR 5											3	13	13	22	20	14	7	7	1								
APR 12											2	4	12	9	15	21	19	11	7	1							
APR 19											2	3	15	9	14	17	18	11	7	3	1						
APR 26											1	4	8	14	15	18	19	11	9	1	•						
MAY 3											•	2	3	12	16	16	15	16	14	5	2						
MAY 10											•	•	5	5	10	17	18	17	11	13	3	•					
MAY 17													1	8	14	11	16	23	11	10	5						
MAY 24													•	2	9	10	17	18	21	16	6	•					
MAY 31												•	2	4	9	11	16	22	18	15	3	1					
JUN 7													1	1	7	11	15	17	17	19	10	4					
JUN 14												•	•	1	3	6	9	16	27	20	12	5	1				
JUN 21														•	2	5	9	11	22	22	18	12	1				
JUN 28															1	2	5	11	16	24	25	15	1				
JUL 5																1	2	4	7	26	35	23	3				
JUL 12																	1	2	6	20	35	26	10	•			
JUL 19																	•	1	5	18	32	33	11	•			
JUL 26																	1	2	8	20	37	28	4				
AUG 2																•	•	2	8	25	39	19	6	•			
AUG 9																	2	3	7	25	34	25	4				
AUG 16															•	•	2	7	9	22	35	25	1				
AUG 23															1	2	6	9	16	31	28	7	•				
AUG 30														•	•	2	8	15	23	27	17	7	1				
SEP 6														1	1	5	10	16	16	29	15	3	•				
SEP 13											1		1	3	5	14	9	16	19	21	9	2					
SEP 20													2	5	9	12	14	18	18	17	5						
SEP 27												•	2	6	9	12	14	22	25	8	2	•					
OCT 4												2	7	7	10	13	11	24	21	5							
OCT 11											•	•	6	10	13	16	24	20	10	1							
OCT 18									•	1	2	•	9	12	13	20	22	12	2								
OCT 25										•	4	11	15	14	18	16	13	8	1								
NOV 1								•	4	5	11	14	19	15	14	9	7	1									
NOV 8								2	2	11	11	17	16	19	10	9	4										
NOV 15					•	•	1	4	7	14	18	15	14	11	9	2	•	•									
NOV 22							•	2	11	15	22	16	15	9	7	2											
NOV 29							•	4	11	23	20	20	15	6		1											
DEC 6					2	3	3	10	15	22	24	11	5	2	2	•											
DEC 13			•		•	3	5	11	14	24	23	12	5	1	1												
DEC 20					•	2	6	9	17	27	17	14	5	3	•												
DEC 27					1	2	5	16	21	22	23	8	2	•													
JAN 3			1	2	4	7	10	14	21	15	15	9	2	•													
JAN 10		1		1	2	2	9	13	21	22	20	7	2														
JAN 17	•		1	2	2	4	9	16	21	20	14	8	1	•													
JAN 24				1	2	6	10	14	16	22	20	7	2	•													
JAN 31				•	2	3	5	13	13	17	28	9	6	2	2	•											
FEB 7		•	•	1	1	2	5	10	16	19	24	11	7	2	2												
FEB 14				•	•	2	5	10	15	17	27	15	5	3	•												
FEB 21					•	3	2	5	9	18	27	19	10	7	•												
FEB 28						2	5	5	9	14	26	21	14	5													

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

BEGINNING DATE	MEAN MAXIMUM	STANDARD DEVIATION	HIGHEST OF RECORD
MAR 1	37.2	8.3	59
MAR 8	40.4	9.0	72
MAR 15	45.0	9.9	70
MAR 22	47.6	9.9	69
MAR 29	51.0	9.0	72
APR 5	54.8	9.1	79
APR 12	60.6	9.9	81
APR 19	60.6	10.7	85
APR 26	61.1	10.0	85
MAY 3	65.0	10.1	87
MAY 10	67.7	10.4	93
MAY 17	69.4	9.7	89
MAY 24	71.6	9.0	91
MAY 31	70.6	10.0	93
JUN 7	73.6	9.8	93
JUN 14	76.3	9.0	97
JUN 21	78.5	9.1	95
JUN 28	81.3	6.0	96
JUL 5	85.3	6.3	97
JUL 12	87.3	5.5	104
JUL 19	87.9	5.5	101
JUL 26	86.5	5.7	98
AUG 2	85.8	5.7	100
AUG 9	85.8	5.9	99
AUG 16	84.8	6.4	97
AUG 23	80.8	7.2	95
AUG 30	79.1	7.7	99
SEP 6	77.7	8.2	95
SEP 13	73.0	10.3	91
SEP 20	70.3	9.4	87
SEP 27	69.2	9.1	90
OCT 4	66.4	10.2	82
OCT 11	64.1	8.8	83
OCT 18	59.5	10.0	78
OCT 25	55.7	9.8	79
NOV 1	48.7	10.6	72
NOV 8	46.6	10.3	67
NOV 15	41.0	10.7	70
NOV 22	40.2	9.6	64
NOV 29	37.7	8.0	63
DEC 6	32.7	9.9	60
DEC 13	32.2	9.3	59
DEC 20	32.5	8.9	55
DEC 27	30.1	8.1	54
JAN 3	27.0	10.6	51
JAN 10	26.6	9.3	48
JAN 17	27.1	10.3	51
JAN 24	29.3	9.7	53
JAN 31	32.1	10.4	60
FEB 7	32.4	10.4	58
FEB 14	33.3	9.2	55
FEB 21	36.2	9.2	59
FEB 28	36.3	9.4	51

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MINIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -40	-40 TO -36	-35 TO -31	-30 TO -26	-25 TO -21	-20 TO -16	-15 TO -11	-10 TO -6	-5 TO -1	0 TO 4	5 TO 9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	ABOVE 84
MAR 1						•	1	•	3	5	11	14	19	17	19	9	2										
MAR 8								1	2	6	7	8	13	24	24	13	1	•									
MAR 15									1	2	7	5	9	22	33	17	3	•									
MAR 22									•	1	5	4	9	21	28	26	3	3									
MAR 29										•	•	3	5	18	30	27	13	3									
APR 5													3	14	34	34	12	3	1								
APR 12													2	8	25	32	24	8	2								
APR 19													1	7	20	28	26	15	3	•							
APR 26														2	16	28	29	22	2	•							
MAY 3														1	9	24	30	24	10	1	•						
MAY 10														1	8	18	29	27	14	3							
MAY 17															2	15	27	31	21	2	1	•					
MAY 24															1	9	20	29	28	13	•						
MAY 31															1	7	16	30	34	10	1						
JUN 7																3	13	33	31	18	1						
JUN 14																•	9	28	36	23	3	•	•				
JUN 21																•	7	20	35	27	10	2					
JUN 28																1	4	18	34	31	11	2					
JUL 5																	1	10	26	42	16	5	•	•			
JUL 12																	•	5	23	42	23	7					
JUL 19																	1	5	19	46	21	9	•				
JUL 26																	1	3	14	49	20	12	2				
AUG 2																•	•	10	26	32	24	6	1				
AUG 9																	•	10	31	34	16	7	•				
AUG 16																•	3	12	38	34	10	3	•				
AUG 23																1	6	24	30	30	8	1					
AUG 30																5	13	31	25	20	7	1					
SEP 6															1	6	19	33	28	10	4	•					
SEP 13														1	3	11	22	37	20	5	1						
SEP 20														1	7	15	35	27	13	2	•						
SEP 27														3	11	24	34	18	7	4							
OCT 4														4	9	33	34	16	5	1							
OCT 11													1	6	12	30	36	14	1		1						
OCT 18													2	14	29	34	15	5	1								
OCT 25												•	6	18	30	31	9	5	1								
NOV 1										2	3	4	15	22	26	21	7	•	•								
NOV 8										2	3	8	14	27	22	16	7	•	•								
NOV 15							•	1	2	2	6	9	16	21	25	11	7	•									
NOV 22								1	1	3	7	16	11	22	23	13	3	•									
NOV 29									3	5	7	18	18	20	20	10	1										
DEC 6						2	1	1	3	10	11	14	16	16	17	8	1										
DEC 13					•	1	2	2	7	9	10	18	18	12	12	6	2										
DEC 20							1	2	6	10	9	16	16	13	16	10	2	•									
DEC 27				•		1	1	3	6	15	16	16	15	15	7	5											
JAN 3				1	1	1	5	6	8	12	11	10	16	15	9	3	1										
JAN 10			•	•	1	1	3	6	5	13	16	13	17	11	10	4											
JAN 17			•	1	1	2	2	8	7	16	16	14	16	6	6	5	1										
JAN 24					1	1	5	4	9	11	17	14	11	11	10	4	1										
JAN 31				•	1	1	3	4	5	11	14	14	12	14	14	5	1	•									
FEB 7		•	•	•	1		2	4	5	12	11	13	14	11	16	10	2										
FEB 14				•	•	2	3	5	7	8	11	9	10	15	18	11											
FEB 21						1	2	3	5	7	8	8	14	23	20	8	2										
FEB 28					2	2		7		5	9	16	9	21	21	7	5										

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

BEGINNING DATE	MEAN MINIMUM	STANDARD DEVIATION	LOWEST OF RECORD
MAR 1	17.8	10.0	-16
MAR 8	20.3	9.5	-10
MAR 15	23.0	8.2	-3
MAR 22	25.2	7.8	-1
MAR 29	28.1	6.7	1
APR 5	29.4	5.5	15
APR 12	32.1	5.8	17
APR 19	33.5	6.2	19
APR 26	34.9	5.7	22
MAY 3	37.1	6.1	24
MAY 10	38.3	6.3	23
MAY 17	40.2	5.9	25
MAY 24	42.8	5.8	26
MAY 31	43.2	5.6	27
JUN 7	44.5	5.2	31
JUN 14	46.1	5.1	34
JUN 21	47.8	5.6	34
JUN 28	48.1	5.4	33
JUL 5	51.0	5.2	38
JUL 12	52.0	4.9	39
JUL 19	52.5	5.0	37
JUL 26	53.2	5.1	38
AUG 2	51.4	5.4	34
AUG 9	50.8	5.4	35
AUG 16	49.4	5.0	34
AUG 23	47.4	5.4	32
AUG 30	45.4	6.4	30
SEP 6	43.4	5.8	26
SEP 13	40.5	6.2	21
SEP 20	38.4	5.8	22
SEP 27	36.5	6.3	22
OCT 4	35.1	5.6	20
OCT 11	34.2	5.8	18
OCT 18	30.1	5.8	15
OCT 25	28.6	6.0	13
NOV 1	24.8	7.7	2
NOV 8	23.4	8.0	0
NOV 15	21.4	9.8	-15
NOV 22	20.4	9.2	-9
NOV 29	18.0	8.8	-5
DEC 6	15.6	11.5	-20
DEC 13	13.7	11.8	-21
DEC 20	15.9	11.4	-11
DEC 27	12.2	10.8	-26
JAN 3	9.6	13.9	-30
JAN 10	10.6	12.4	-33
JAN 17	8.2	13.6	-35
JAN 24	9.4	13.0	-25
JAN 31	12.8	12.8	-29
FEB 7	13.9	13.4	-37
FEB 14	13.7	13.9	-28
FEB 21	16.8	12.0	-18
FEB 28	16.3	13.8	-22

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931-1965

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1931-1965

MAXIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -10	-10 TO -6	-5 TO -1	+0 TO +4	+5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	85 TO 89	90 TO 94	95 TO 99	100 TO 104	105 TO 109	110 TO 114	ABOVE 114
MAR 1							2	5	11	26	34	17	5	1													
MAR 8							1	1	8	15	34	25	12	1	2	1											
MAR 15							•	2	2	11	28	30	17	5	3	•	•										
MAR 22								1	3	9	21	31	20	9	4	1	•										
MAR 29								1	1	5	15	30	25	15	7	1	1										
APR 5									•	•	8	20	28	21	9	7	3	3	•								
APR 12											2	7	15	19	17	21	11	6	2								
APR 19										1	2	4	11	15	17	27	14	6	5								
APR 26											2	7	9	14	14	18	18	11	4	2	1						
MAY 3										•	1	2	5	8	13	16	20	18	13	3	1						
MAY 10												1	3	6	11	17	23	19	15	7	1						
MAY 17												1	2	7	8	14	23	25	11	7	2						
MAY 24														4	8	13	20	22	14	15	3	•					
MAY 31												•	1	5	7	12	20	24	16	13	3						
JUN 7													1	1	5	15	14	22	18	17	6	1					
JUN 14														1	5	5	10	27	25	19	8	1					
JUN 21															1	5	11	19	27	17	15	4	1				
JUN 28																5	5	16	24	29	17	5					
JUL 5																•	4	7	18	34	31	6					
JUL 12																•	•	3	17	30	34	14	1	•			
JUL 19																	1	2	9	34	38	9	5	1			
JUL 26																•	1	4	14	33	33	12	2	•			
AUG 2																	2	5	13	39	33	8	2				
AUG 9																•	1	6	20	30	29	11	2				
AUG 16																2	3	7	17	34	31	7					
AUG 23															1	4	7	12	24	32	15	5					
AUG 30															1	3	11	17	27	27	9	4	•				
SEP 6														•	1	3	16	20	25	25	9						
SEP 13											•		1		6	13	16	25	22	11	6						
SEP 20												•	2	4	7	14	22	24	15	11	1	•					
SEP 27													2	3	10	14	17	27	20	8	1						
OCT 4												2	3	9	12	13	17	26	16	3							
OCT 11												1	7	8	9	22	25	17	9	1							
OCT 18										1	2	8	8	13	16	22	24	6	•								
OCT 25									•	2	6	11	16	16	16	19	13	4	1								
NOV 1								1	3	8	11	18	21	16	11	9	2										
NOV 8							•	1	6	8	14	22	16	19	7	5	1										
NOV 15					•	•	•	2	11	18	28	16	7	9	5	3											
NOV 22							1	6	10	24	21	14	8	9	6	1											
NOV 29						•	1	5	11	23	32	15	9	2	3												
DEC 6					2	5	2	13	17	26	21	11	3	1	1												
DEC 13			•	•	1	1	4	12	14	26	22	13	2	2	1												
DEC 20					•	2	5	11	16	27	24	10	3	1													
DEC 27					1	1	7	13	28	28	20	3	•														
JAN 3			1	1	1	6	9	15	24	20	16	7															
JAN 10			1	•	1	3	7	16	22	27	15	7	•														
JAN 17		•		1	3	4	7	16	22	25	16	5	•														
JAN 24				•	1	5	10	12	18	24	21	9	•														
JAN 31				•	2	2	6	8	16	26	24	11	3	1	1	•											
FEB 7		1	1		•	1	4	12	16	23	28	10	2	1	2	1											
FEB 14					•	2	4	12	15	21	22	17	5	2	1												
FEB 21					•	•	2	5	14	20	29	24	5	•													
FEB 28						2	5	2	11	21	23	30	7														

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

BEGINNING DATE	MEAN MAXIMUM	STANDARD DEVIATION	HIGHEST OF RECORD
MAR 1	35.1	6.3	54
MAR 8	38.1	6.9	63
MAR 15	40.4	7.1	65
MAR 22	42.2	7.2	65
MAR 29	44.7	7.1	67
APR 5	49.2	8.4	78
APR 12	56.3	8.9	77
APR 19	55.5	9.1	78
APR 26	59.7	10.2	88
MAY 3	64.4	10.2	86
MAY 10	66.5	9.2	87
MAY 17	67.7	8.8	88
MAY 24	70.4	8.9	90
MAY 31	69.8	8.7	88
JUN 7	72.1	8.6	92
JUN 14	74.6	7.7	92
JUN 21	76.9	8.0	98
JUN 28	78.7	7.0	92
JUL 5	82.0	5.7	94
JUL 12	84.0	5.6	100
JUL 19	84.8	5.2	100
JUL 26	83.8	5.6	100
AUG 2	83.0	5.2	96
AUG 9	82.9	5.7	98
AUG 16	81.7	6.1	94
AUG 23	78.5	7.1	94
AUG 30	77.0	7.4	95
SEP 6	75.6	7.0	89
SEP 13	71.6	8.4	89
SEP 20	68.9	8.7	92
SEP 27	68.5	8.3	86
OCT 4	65.9	9.3	83
OCT 11	61.8	8.5	81
OCT 18	57.8	9.3	76
OCT 25	53.9	10.0	75
NOV 1	46.2	9.6	67
NOV 8	44.0	9.7	69
NOV 15	38.9	9.6	64
NOV 22	37.9	9.3	62
NOV 29	36.2	7.5	58
DEC 6	31.2	9.0	58
DEC 13	31.8	8.8	57
DEC 20	31.4	8.0	54
DEC 27	29.1	6.7	45
JAN 3	27.2	9.1	44
JAN 10	28.2	8.3	47
JAN 17	27.3	8.7	47
JAN 24	29.0	8.6	45
JAN 31	31.8	9.0	61
FEB 7	31.9	9.5	61
FEB 14	32.9	8.5	58
FEB 21	34.9	7.1	50
FEB 28	34.8	7.8	48

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MINIMUM - PERCENTAGE FREQUENCIES

BEGINNING DATE	BELOW -40	-40 TO -36	-35 TO -31	-30 TO -26	-25 TO -21	-20 TO -16	-15 TO -11	-10 TO -6	-5 TO -1	+0 TO +4	+5 TO +9	10 TO 14	15 TO 19	20 TO 24	25 TO 29	30 TO 34	35 TO 39	40 TO 44	45 TO 49	50 TO 54	55 TO 59	60 TO 64	65 TO 69	70 TO 74	75 TO 79	80 TO 84	ABOVE 84
MAR 1						2	1	3	7	9	12	23	18	12	12	1											
MAR 8							2	5	7	9	10	14	18	14	15	8	1										
MAR 15							1	2	6	5	9	11	22	22	16	7											
MAR 22								1	4	8	5	13	13	21	24	11	1										
MAR 29								1	•	1	6	10	15	20	24	20	3										
APR 5									•	•	2	5	14	24	30	19	4	2	1								
APR 12												2	6	14	31	32	11	4	1								
APR 19												1	3	8	29	35	14	9	1								
APR 26												•	1	7	16	44	23	8	•								
MAY 3														3	16	29	31	18	2								
MAY 10														3	7	27	40	18	5	•							
MAY 17													•	3	5	28	39	20	5								
MAY 24															4	21	27	36	11	1							
MAY 31														•	2	17	29	38	11	2							
JUN 7															2	10	23	40	20	3	1						
JUN 14															•	6	25	33	26	7	3						
JUN 21															1	7	17	37	25	11	2						
JUN 28															•	7	22	38	21	8	3	•					
JUL 5															•	2	10	36	34	14	3	1					
JUL 12																2	9	23	42	20	5						
JUL 19																1	7	26	40	20	4	3					
JUL 26																•	7	27	35	27	4	•					
AUG 2																3	8	41	31	12	5						
AUG 9																1	12	32	37	15	2	•					
AUG 16															1	4	18	40	26	11	•						
AUG 23															1	6	28	41	18	6	•						
AUG 30															3	14	29	36	16	4							
SEP 6														1	5	17	30	31	14	2							
SEP 13													•	3	11	27	32	18	7	1							
SEP 20													•	4	14	33	29	17	3								
SEP 27													2	6	20	33	28	11	•								
OCT 4												•	•	9	18	42	22	7									
OCT 11													2	6	20	43	19	8	1	•							
OCT 18											•	5	5	18	32	34	7	1	•								
OCT 25												4	12	18	36	25	4	2	•								
NOV 1								•	3	2	3	7	13	25	22	21	3										
NOV 8									4	2	6	10	16	21	24	17											
NOV 15							•	1	4	5	9	10	12	26	16	16											
NOV 22							•	3	3	7	14	13	13	19	13	13	2										
NOV 29							1	2	6	9	13	20	12	18	13	6											
DEC 6						1	3	4	7	11	10	17	16	15	10	6	•										
DEC 13				•	1	1	3	4	6	10	13	16	15	16	11	5	•										
DEC 20						1	4	3	6	11	8	20	18	12	11	6	1	•									
DEC 27						1	3	7	12	11	14	15	14	14	7	3											
JAN 3			•	1	2	2	5	9	7	10	16	14	16	11	5	2											
JAN 10				1	1	3	4	4	10	13	14	16	14	12	5	3	•										
JAN 17			•	1	2	5	4	6	13	12	16	15	9	8	5	4	•										
JAN 24					3	4	5	5	11	9	12	17	12	13	5	4											
JAN 31				1	1	2	3	4	9	13	11	13	18	12	9	5											
FEB 7		1		1	1	1	3	5	8	15	10	12	10	11	14	7											
FEB 14			•	•	1	1	3	8	7	10	10	15	16	12	10	5											
FEB 21					•	•	2	4	9	9	11	15	18	19	8	4											
FEB 28					2		2	5	14	11	5	18	18	16	5	5											

MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

BEGINNING DATE	MEAN MINIMUM	STANDARD DEVIATION	LOWEST OF RECORD
MAR 1	12.0	10.4	-20
MAR 8	14.3	11.5	-14
MAR 15	16.4	10.0	-14
MAR 22	18.8	10.0	-8
MAR 29	22.6	8.4	-7
APR 5	25.0	7.3	-3
APR 12	28.8	6.1	11
APR 19	30.9	6.0	13
APR 26	32.3	5.2	12
MAY 3	34.4	5.4	23
MAY 10	35.8	5.2	20
MAY 17	35.8	5.2	18
MAY 24	38.6	5.3	26
MAY 31	39.3	5.2	24
JUN 7	40.7	5.1	27
JUN 14	42.4	5.6	29
JUN 21	42.7	5.4	24
JUN 28	42.5	5.6	29
JUL 5	44.8	5.0	29
JUL 12	46.1	5.1	30
JUL 19	46.7	5.3	31
JUL 26	46.7	4.9	34
AUG 2	44.8	5.0	32
AUG 9	44.8	5.0	31
AUG 16	43.0	5.0	28
AUG 23	41.3	4.9	26
AUG 30	39.7	5.5	25
SEP 6	38.8	5.6	22
SEP 13	35.7	6.1	19
SEP 20	34.4	5.4	18
SEP 27	32.7	5.6	18
OCT 4	32.1	5.3	11
OCT 11	31.7	5.4	16
OCT 18	27.7	6.0	8
OCT 25	26.2	6.1	11
NOV 1	22.7	8.8	-6
NOV 8	20.5	9.1	-5
NOV 15	18.6	10.3	-15
NOV 22	17.0	11.2	-13
NOV 29	14.8	10.1	-12
DEC 6	12.3	11.8	-20
DEC 13	11.0	12.0	-30
DEC 20	12.7	11.9	-17
DEC 27	9.5	11.5	-19
JAN 3	7.3	12.9	-34
JAN 10	8.4	12.7	-28
JAN 17	5.9	13.6	-35
JAN 24	7.3	13.7	-25
JAN 31	10.2	13.0	-28
FEB 7	10.7	14.2	-37
FEB 14	10.3	13.1	-35
FEB 21	12.0	11.4	-25
FEB 28	10.3	12.3	-23

MAXIMUM AND MINIMUM TEMPERATURES: Percentage Frequency Distribution of Daily Values by Weeks, 1931–1965

IDAH

Island Park Dam

1937–1965

MAXIMUM – PERCENTAGE FREQUENCIES / MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MAXIMUM TEMPERATURES

Beginning date	Below -10	-10 to -6	-5 to -1	+0 to +4	+5 to +9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	85 to 89	90 to 94	95 to 99	100 to 104	105 to 109	110 to 114	Above 114	Mean maximum	Standard deviation	Highest of record
MAR 1						1	3	10	17	31	19	14	4	2														32.9	7.4	54
MAR 8							1	7	14	32	21	18	5	2														34.4	6.8	52
MAR 15					1	1	1	4	12	17	22	20	12	11	1													37.6	8.8	57
MAR 22						1	1	3	3	18	18	25	16	8	8													40.8	8.7	59
MAR 29								1	2	6	16	30	23	16	6	1												43.7	7.0	60
APR 5									1	3	15	30	28	13	5	4												45.1	6.8	64
APR 12										1	8	14	26	23	17	11	1											50.0	7.5	65
APR 19										1	8	13	22	23	17	11	4	2										51.0	8.1	73
APR 26										2	6	18	16	17	15	17	7	3										52.1	9.3	73
MAY 3										1	2	9	13	16	16	19	19	6	1									56.7	9.2	77
MAY 10											1	6	10	12	16	22	16	10	7	1								60.0	9.7	80
MAY 17											1	6	8	9	18	16	18	15	8	2								61.6	9.5	82
MAY 24												1	5	8	12	18	25	19	11	1								64.5	8.5	80
MAY 31												3	6	7	10	21	18	18	14	3								64.4	9.5	82
JUN 7												1	2	6	16	15	20	19	17	4	1							66.6	8.9	87
JUN 14												1	3	5	5	11	23	31	13	9	1							68.7	8.7	89
JUN 21													1	4	7	12	19	21	22	12	2							70.5	8.4	88
JUN 28														3	5	5	13	22	33	20	1							73.4	7.5	87
JUL 5															3	1	4	16	32	36	8							77.7	6.1	88
JUL 12															1		5	14	30	33	10	1						79.3	5.7	90
JUL 19																1	2	9	25	42	18	3						80.7	5.2	94
JUL 26															1	2	4	8	26	37	22	1						79.8	5.7	90
AUG 2																3	3	11	27	36	18	3	1					79.7	5.9	96
AUG 9															1		4	15	28	35	15	2						79.2	5.8	93
AUG 16															1	3	5	12	25	40	15	1						78.9	6.1	90
AUG 23													1	1	3	6	9	20	34	21	3	1						74.3	7.6	90
AUG 30													1	1	3	9	16	21	22	19	7	2						73.7	8.3	91
SEP 6													1	3	5	9	14	26	22	16	4							71.8	8.4	87
SEP 13										1	1	2	3	8	9	11	20	15	20	11	1							67.5	10.4	85
SEP 20											1	4	3	8	10	14	19	20	16	5								65.2	10.4	84
SEP 27											1	4	6	11	12	17	19	22	9	2								63.2	10.0	81
OCT 4											5	8	7	10	10	16	19	21	6									60.3	11.0	78
OCT 11											3	9	12	12	16	21	13	12	2									57.7	9.8	78
OCT 18									3	2	6	8	12	14	15	26	11	2										54.0	10.3	72
OCT 25									1	10	12	12	13	17	13	17	4	2										49.4	10.8	70
NOV 1								2	5	14	21	19	13	10	10	6	1											43.0	9.8	66
NOV 8							1	5	9	19	19	13	16	13	7	1												39.8	9.8	61
NOV 15				1			3	5	20	26	21	8	9	6	1		1											34.5	9.5	69
NOV 22						1	4	7	18	22	27	12	7	3	2	1												34.3	8.8	63
NOV 29							4	8	19	32	21	13	2	1	1													32.7	6.7	56
DEC 6				1	2	2	10	16	25	19	17	5	3	1														28.4	8.5	52
DEC 13			1			4	9	14	21	30	16	3	2															28.6	7.9	47
DEC 20					1	4	10	12	28	30	13	3	1															28.2	7.1	46
DEC 27				1	1	5	9	28	25	24	9																	25.9	6.8	39
JAN 3				3	5	7	13	24	20	17	11	2																24.1	9.0	40
JAN 10	1		1	1	2	6	11	21	27	19	7	5	1															25.3	8.9	46
JAN 17			1	2	2	5	14	19	24	21	10	3																25.3	8.5	43
JAN 24			1		3	7	10	14	28	26	9	4	1															26.4	8.6	48
JAN 31				2	2	6	5	13	17	32	16	7	2		1													28.9	8.9	55
FEB 7						3	6	16	23	27	17	5	2	1														29.5	7.7	51
FEB 14				1	2	3	3	13	19	26	19	10	4	1														30.8	8.6	52
FEB 21				1	1	2	5	12	15	25	20	14	4	3														31.9	8.6	53
FEB 28						6		17	11	28	19	19																31.3	7.8	44

1937–1965

MINIMUM – PERCENTAGE FREQUENCIES / MEANS, STANDARD DEVIATIONS AND EXTREMES OF DAILY MINIMUM TEMPERATURES

Beginning date	Below -40	-40 to -36	-35 to -31	-30 to -26	-25 to -21	-20 to -16	-15 to -11	-10 to -6	-5 to -1	+0 to +4	+5 to +9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 to 44	45 to 49	50 to 54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	Above 84	Mean minimum	Standard deviation	Lowest of record
MAR 1		1	1	3	3	5	9	11	10	9	9	11	14	8	5	1												2.5	15.6	-36
MAR 8			2	1	3	5	3	11	6	8	10	14	13	9	11	3												6.5	15.6	-35
MAR 15			1	5	3	4	3	8	9	6	10	15	11	14	8	3												6.5	15.4	-31
MAR 22				1	1	3	4	4	9	9	10	14	15	20	7	3												10.2	13.4	-29
MAR 29						1	1	3	4	7	11	15	16	17	17	7												15.6	10.8	-17
APR 5							1	1	1	5	7	19	20	18	18	10	1											18.4	8.8	-11
APR 12									1	1	5	14	19	27	23	11												20.9	7.1	-1
APR 19										1	2	6	13	29	28	20	3											24.1	6.5	3
APR 26										1	1	5	7	22	38	21	3	2										25.9	6.5	3
MAY 3												1	5	19	38	27	9	2	1									28.0	5.6	14
MAY 10													2	14	30	31	20	3	1									30.1	5.3	18
MAY 17													1	7	25	40	20	5	2									31.8	5.2	19
MAY 24														6	14	28	29	20	4									34.7	6.0	20
MAY 31														2	11	30	33	21	3	1								35.5	5.1	23
JUN 7														1	7	25	39	24	3	1								36.6	4.9	24
JUN 14														1	6	19	33	29	11	3								38.3	5.9	21
JUN 21														1	5	21	29	32	10	3	1							38.5	5.6	23
JUN 28															4	20	29	33	10	4								38.7	5.8	25
JUL 5															2	8	22	38	27	7	1							42.2	5.1	28
JUL 12															2	4	20	37	24	12	1	1	1					43.0	5.8	25
JUL 19															1	4	19	32	31	9	4							43.4	5.7	27
JUL 26																4	11	46	29	8	2							43.5	4.8	31
AUG 2															1	7	25	36	22	8	2							42.0	5.5	29
AUG 9															1	9	22	36	22	9	2							42.1	5.7	28
AUG 16															1	21	23	29	16	9	1							40.2	6.1	27
AUG 23														1	6	19	31	28	10	3	1							38.5	6.2	24
AUG 30														1	10	17	28	22	11	2								38.9	6.3	23
SEP 6														4	13	28	30	19	3	3								35.2	6.2	20
SEP 13												1	2	8	20	37	19	12	2									32.3	6.1	13
SEP 20													3	13	22	40	12	7	2									30.9	5.9	17
SEP 27											1	1	3	23	33	24	11	5										28.3	6.1	9
OCT 4											1	2	2	18	43	21	10	3	1									28.0	6.0	7
OCT 11											1	4	7	13	36	28	10	3										27.6	6.2	9
OCT 18												2	13	30	39	14	4	1										25.0	5.2	10
OCT 25										2	2	4	14	31	29	11	3											22.7	8.8	3
NOV 1							1	2	9	2	9	13	15	23	20	12	1											18.6	10.1	-11
NOV 8						1	3	1	5	6	6	12	22	23	20	3	1	1										16.7	10.6	-19
NOV 15			1		1	2	3	4	4	7	11	17	17	18	10	7	1											13.4	12.4	-34
NOV 22				1	2		4	5	8	10	6	10	15	21	12	6												12.3	13.2	-26
NOV 29						2	4	8	10	12	12	15	14	12	10	2												9.8	12.0	-20
DEC 6		1		1	2	3	8	8	8	8	15	12	12	15	6	2												6.8	14.2	-38
DEC 13	1	1	2	1	2	3	5	6	8	12	15	14	9	13	7	3												6.8	15.2	-51
DEC 20			2	3	3	4	5	4	7	12	7	15	8	18	7	2	1											4.2	16.0	-32
DEC 27			2	3	4	6	5	11	9	11	10	13	17	7	4	1												2.7	15.1	-34
JAN 3	1	1	3	3	8	7	8	7	9	9	8	13	13	6	5	1												0.3	16.8	-45
JAN 10	2	1	2	3	4	6	8	10	5	11	8	12	11	10	6	3												2.2	17.5	-44
JAN 17	2	2	2	4	4	7	10	8	10	9	7	9	15	8	5	1												-0.1	17.6	-60
JAN 24		3	2	2	4	6	10	8	8	10	9	8	12	14	3	1												1.3	17.2	-40
JAN 31	2	1	1	3	4	4	4	6	11	12	10	11	13	9	8	2												4.0	16.9	-46
FEB 7	1	1	1	2	4	6	5	8	8	4	12	11	12	14	8	3												5.5	16.7	-45
FEB 14	1	1	2	3	3	9	7	6	8	6	10	13	10	10	9	1												2.7	17.3	-47
FEB 21	1		2	3	3	6	6	11	9	9	15	10	10	9	5	4												3.1	16.0	-44
FEB 28		3		6	11	3	8	11	11	17	6	8		14		3												-2.7	16.5	-37

PRECIPITATION: Weekly Totals -- Average, Median and Greatest, 1931-1965

Ashton 1S

WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.33	0.22	1.28
MAR 8	0.33	0.32	1.17
MAR 15	0.29	0.16	1.94
MAR 22	0.28	0.20	1.18
MAR 29	0.32	0.22	1.37
APR 5	0.27	0.14	1.04
APR 12	0.12	0.03	0.82
APR 19	0.28	0.14	1.86
APR 26	0.40	0.36	1.70
MAY 3	0.29	0.06	1.41
MAY 10	0.34	0.21	2.04
MAY 17	0.40	0.19	2.31
MAY 24	0.36	0.19	2.41
MAY 31	0.44	0.34	2.68
JUN 7	0.42	0.35	1.95
JUN 14	0.34	0.16	1.78
JUN 21	0.38	0.18	2.25
JUN 28	0.24	0.08	2.39
JUL 5	0.17	0.02	1.03
JUL 12	0.21	0.	2.58
JUL 19	0.14	0.	0.85
JUL 26	0.17	0.05	1.22
AUG 2	0.22	0.04	2.35
AUG 9	0.24	0.06	1.49
AUG 16	0.21	0.	1.79
AUG 23	0.23	0.07	1.65
AUG 30	0.12	0.	0.98
SEP 6	0.22	0.07	1.51
SEP 13	0.32	0.14	1.84
SEP 20	0.30	0.15	1.56
SEP 27	0.22	0.	1.45
OCT 4	0.25	0.03	2.38
OCT 11	0.31	0.10	2.05
OCT 18	0.38	0.08	1.89
OCT 25	0.28	0.07	2.28
NOV 1	0.40	0.28	1.34
NOV 8	0.41	0.24	1.80
NOV 15	0.46	0.32	2.00
NOV 22	0.32	0.16	1.50
NOV 29	0.42	0.28	1.46
DEC 6	0.37	0.23	1.31
DEC 13	0.33	0.18	0.98
DEC 20	0.49	0.41	1.53
DEC 27	0.52	0.38	1.54
JAN 3	0.37	0.27	1.05
JAN 10	0.43	0.40	1.36
JAN 17	0.38	0.36	1.35
JAN 24	0.47	0.35	1.72
JAN 31	0.60	0.43	2.23
FEB 7	0.55	0.41	2.93
FEB 14	0.37	0.27	1.49
FEB 21	0.35	0.26	1.22

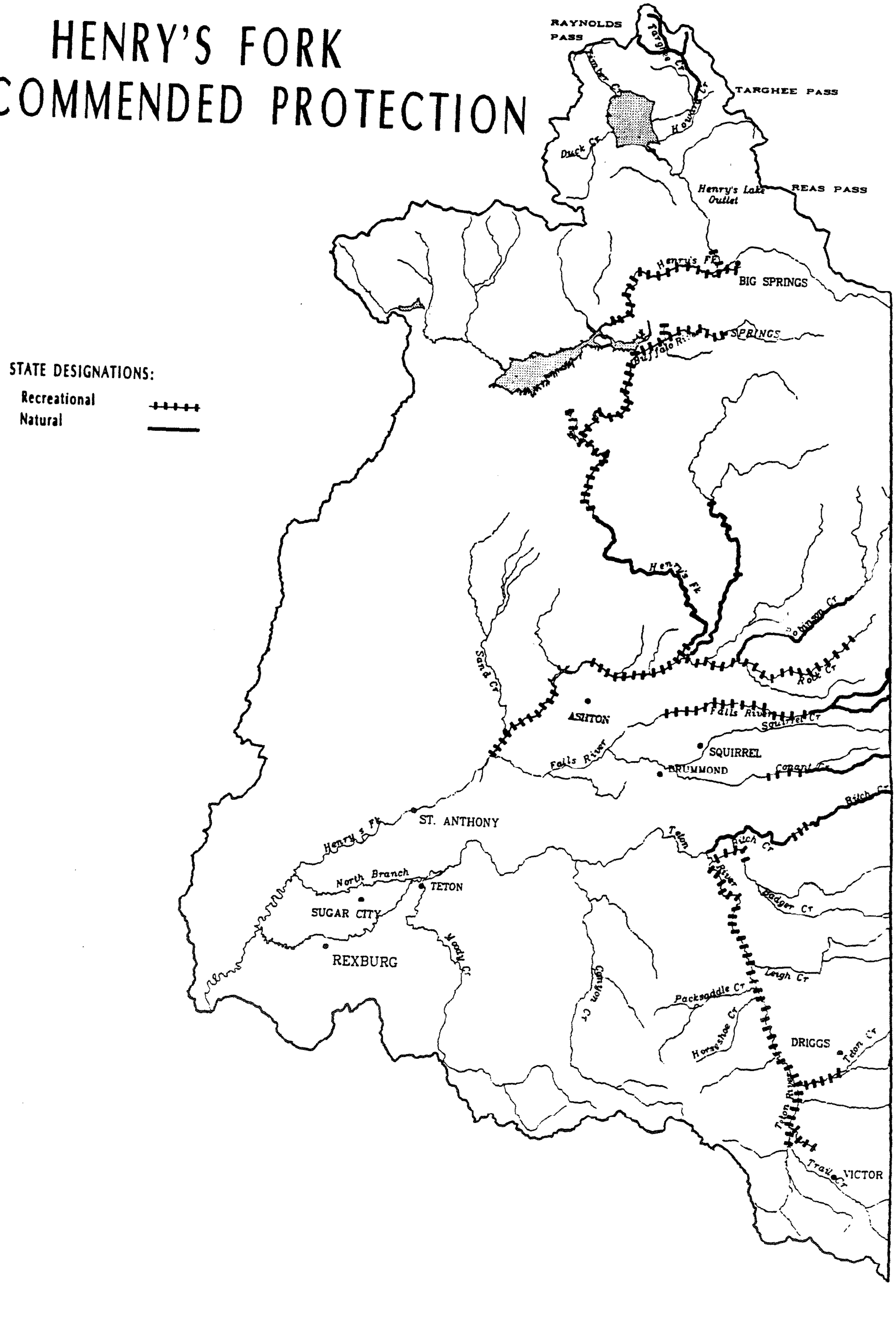
Idaho Falls Airport

WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.15	0.07	0.60
MAR 8	0.12	0.04	0.62
MAR 15	0.16	0.07	0.88
MAR 22	0.15	0.04	0.89
MAR 29	0.12	0.05	0.52
APR 5	0.18	0.07	0.97
APR 12	0.11	0.	0.88
APR 19	0.16	0.07	0.75
APR 26	0.26	0.17	1.06
MAY 3	0.12	0.07	0.55
MAY 10	0.23	0.13	1.21
MAY 17	0.27	0.09	1.77
MAY 24	0.24	0.07	1.08
MAY 31	0.46	0.30	1.77
JUN 7	0.35	0.26	1.58
JUN 14	0.23	0.07	1.54
JUN 21	0.25	0.03	1.61
JUN 28	0.12	0.	1.09
JUL 5	0.06	0.	0.46
JUL 12	0.09	0.	1.05
JUL 19	0.09	0.	0.72
JUL 26	0.11	0.	0.72
AUG 2	0.12	0.	1.39
AUG 9	0.12	0.01	1.08
AUG 16	0.10	0.01	0.53
AUG 23	0.08	0.01	0.67
AUG 30	0.09	0.	1.04
SEP 6	0.15	0.	0.90
SEP 13	0.22	0.02	1.20
SEP 20	0.19	0.05	1.01
SEP 27	0.12	0.	1.16
OCT 4	0.11	0.	1.05
OCT 11	0.14	0.04	0.91
OCT 18	0.12	0.02	0.86
OCT 25	0.16	0.05	1.24
NOV 1	0.16	0.08	0.61
NOV 8	0.19	0.07	0.72
NOV 15	0.20	0.09	1.27
NOV 22	0.10	0.03	0.60
NOV 29	0.15	0.08	0.90
DEC 6	0.14	0.10	0.45
DEC 13	0.10	0.05	0.47
DEC 20	0.24	0.16	1.28
DEC 27	0.21	0.10	1.00
JAN 3	0.16	0.09	1.09
JAN 10	0.24	0.13	1.32
JAN 17	0.21	0.12	1.16
JAN 24	0.17	0.05	1.10
JAN 31	0.26	0.12	0.94
FEB 7	0.25	0.12	1.82
FEB 14	0.12	0.05	0.45
FEB 21	0.15	0.06	0.65

Island Park Dam

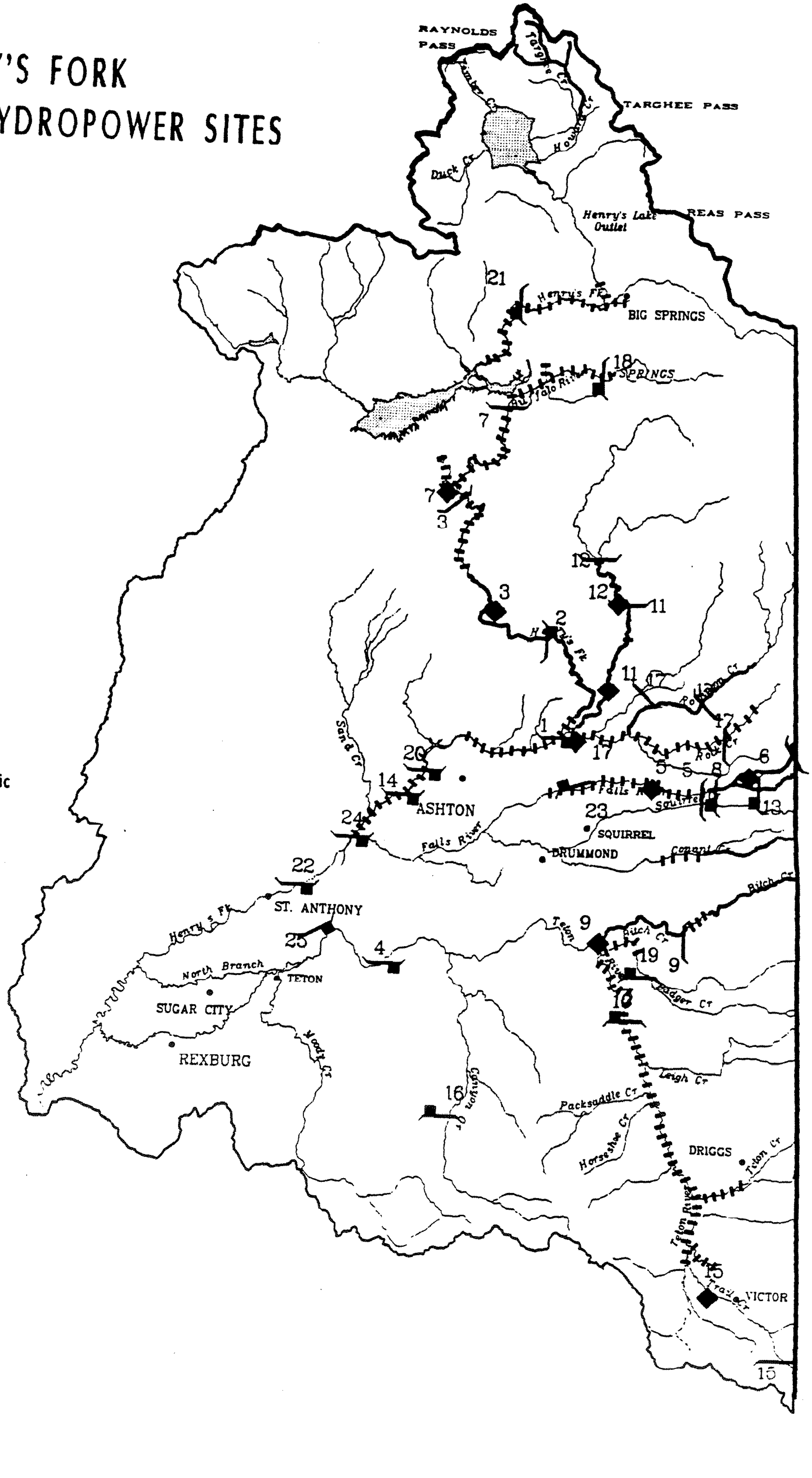
WEEK BEGINS	AVERAGE	MEDIAN	GREATEST
MAR 1	0.56	0.42	2.05
MAR 8	0.81	0.66	2.30
MAR 15	0.53	0.44	1.89
MAR 22	0.43	0.34	1.52
MAR 29	0.37	0.14	1.54
APR 5	0.45	0.29	1.85
APR 12	0.26	0.10	1.02
APR 19	0.49	0.31	2.39
APR 26	0.62	0.54	1.84
MAY 3	0.44	0.23	1.79
MAY 10	0.51	0.34	1.70
MAY 17	0.70	0.61	3.00
MAY 24	0.52	0.22	1.96
MAY 31	0.88	0.77	3.33
JUN 7	0.81	0.45	3.09
JUN 14	0.51	0.30	2.15
JUN 21	0.57	0.31	2.91
JUN 28	0.32	0.23	1.73
JUL 5	0.15	0.10	0.73
JUL 12	0.17	0.	1.67
JUL 19	0.24	0.12	1.36
JUL 26	0.34	0.14	1.78
AUG 2	0.33	0.18	2.05
AUG 9	0.28	0.12	1.78
AUG 16	0.38	0.18	2.81
AUG 23	0.28	0.10	1.72
AUG 30	0.22	0.04	0.91
SEP 6	0.34	0.23	1.40
SEP 13	0.42	0.27	1.78
SEP 20	0.38	0.20	3.27
SEP 27	0.33	0.13	1.60
OCT 4	0.34	0.18	1.24
OCT 11	0.47	0.36	2.45
OCT 18	0.44	0.13	2.61
OCT 25	0.56	0.25	2.90
NOV 1	0.57	0.45	2.65
NOV 8	0.69	0.61	3.11
NOV 15	0.71	0.59	2.55
NOV 22	0.66	0.50	2.54
NOV 29	0.61	0.45	1.90
DEC 6	0.66	0.50	2.34
DEC 13	0.72	0.48	2.20
DEC 20	0.82	0.56	3.11
DEC 27	0.84	0.68	2.57
JAN 3	0.71	0.59	2.78
JAN 10	0.71	0.53	3.05
JAN 17	0.90	0.43	5.14
JAN 24	0.82	0.45	2.94
JAN 31	0.97	0.76	2.80
FEB 7	1.04	0.74	3.78
FEB 14	0.93	0.40	1.49
FEB 21	0.77	0.63	2.55

HENRY'S FORK RECOMMENDED PROTECTION



HENRY'S FORK
POTENTIAL HYDROPOWER SITES

NUMBER	NAME
1	Warm River
2	Mesa Falls
3	Lookout Butte
4	Teton
5	Anderson
6	Sheep Falls
7	Last Chance
8	Squirrel
9	Judkins
10	Tetonia
11	Warm River Butte
12	Partridge
13	Boone Creek
14	Lower Ashton
15	Victor
16	Canyon Creek
17	Fish Creek
18	Buffalo River
19	Upper Badger
20	Ashton Enlargement
21	Coffee Pot Rapids
22	St. Anthony Canal
23	Marysville Drop
24	Cross-cut Diversion
25	Enterprise Hydroelectric



STATE DESIGNATIONS:

Recreational

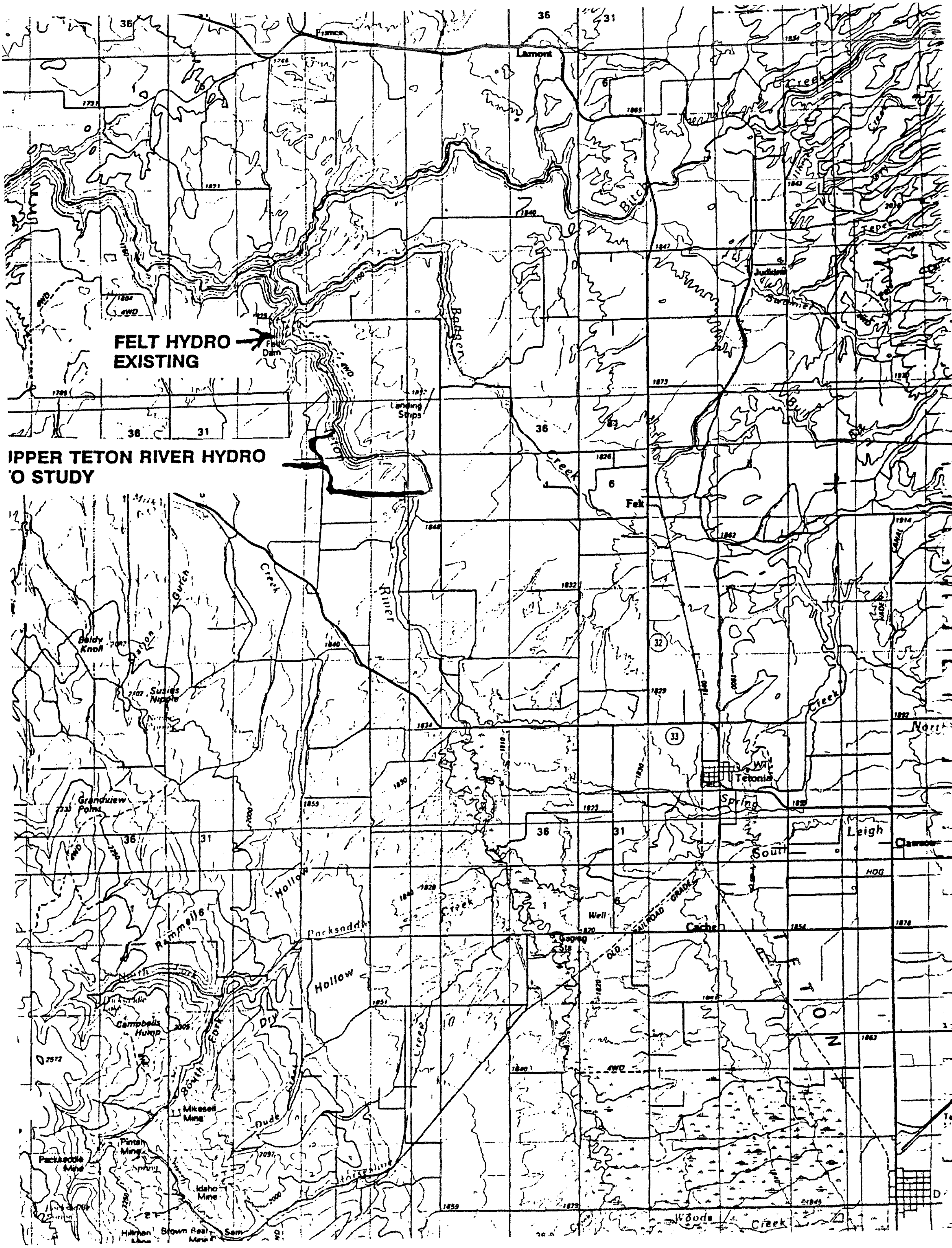
Natural

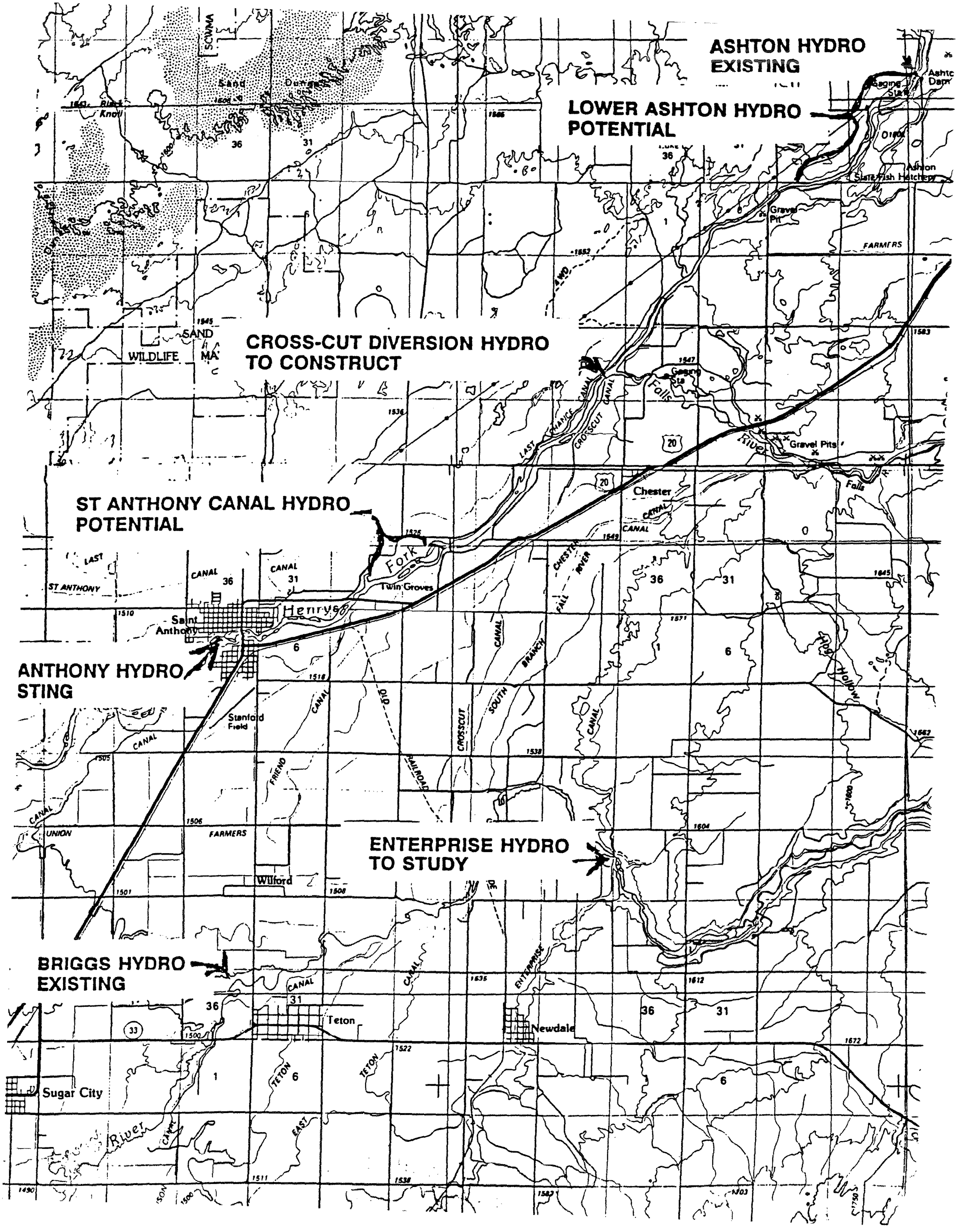
POTENTIAL HYDROPOWER SITES:

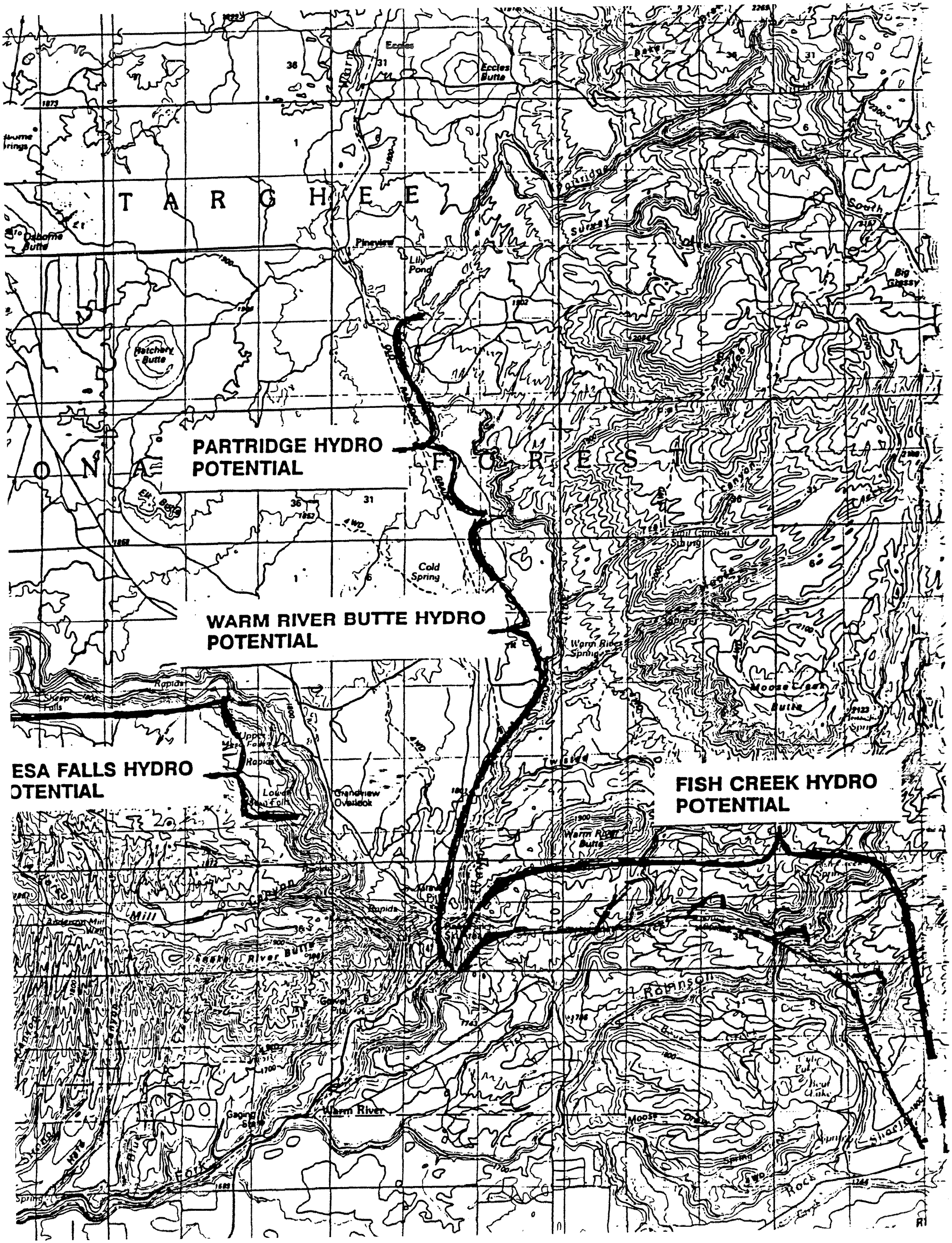
Diversion Dam

Powerplant

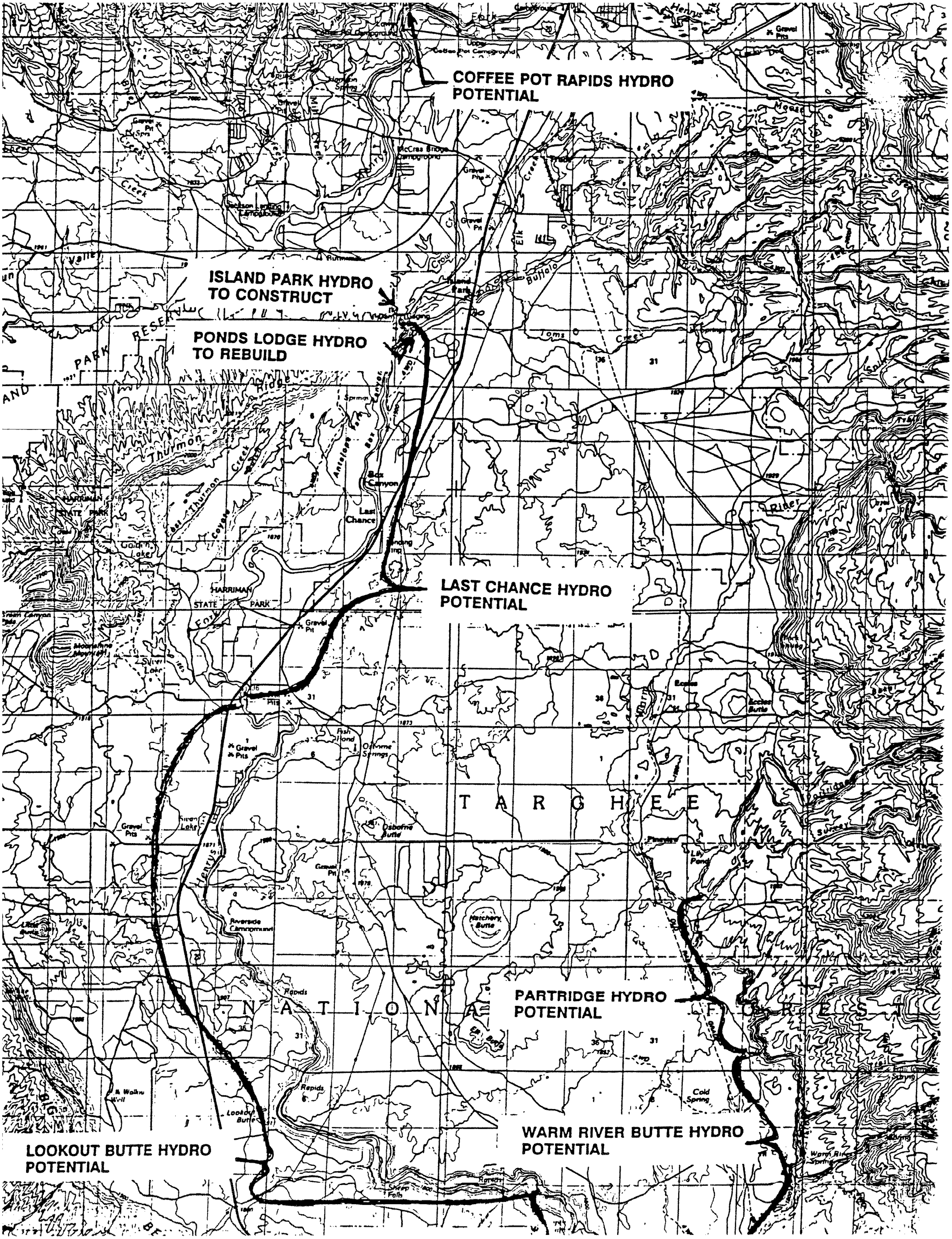
Reservoir or Diversion Dam and Powerplant

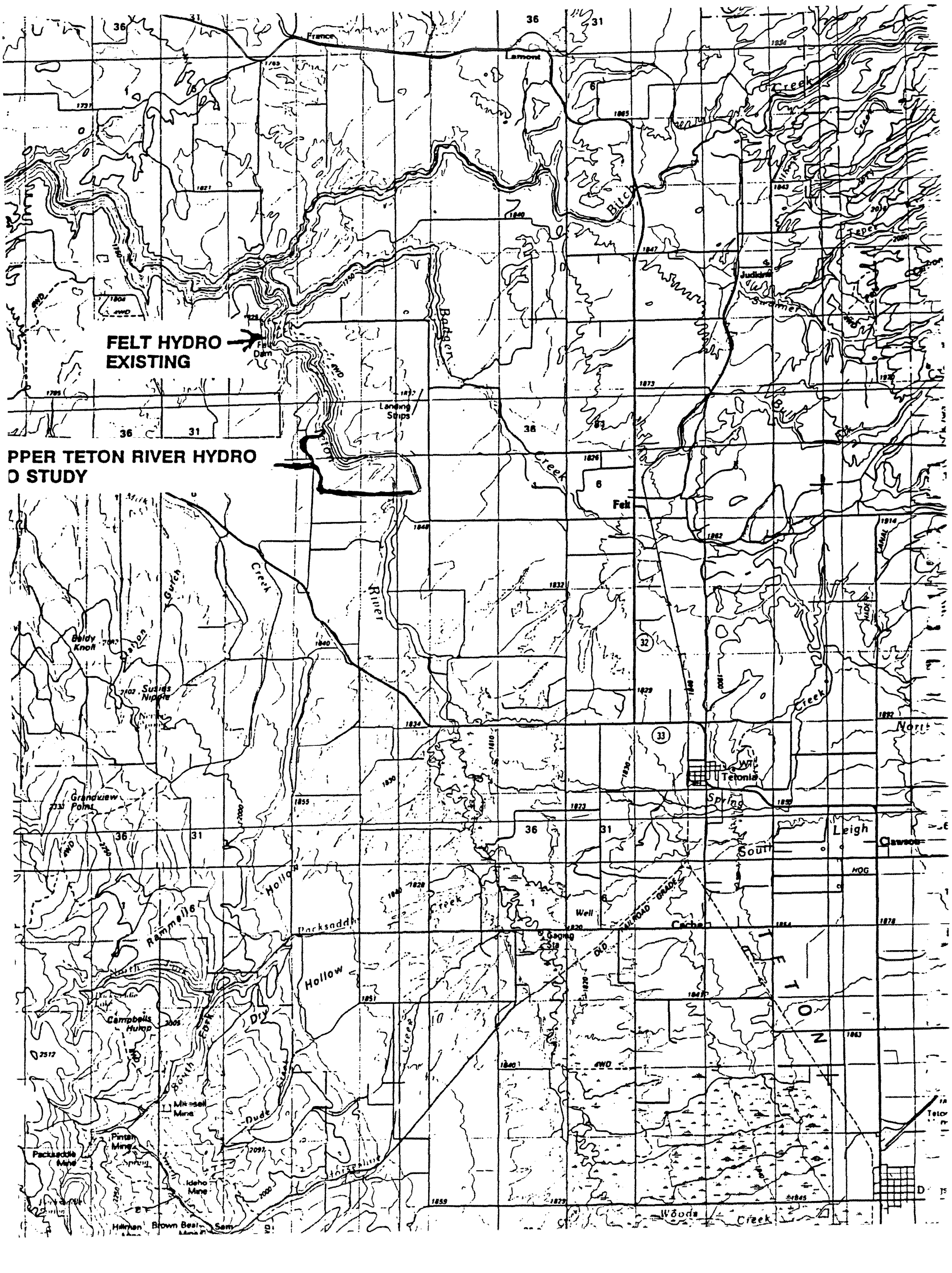

FELT HYDRO EXISTING
Felt Dam
PPER TETON RIVER HYDRO
O STUDY
France
Lamont
Bitch
Judkins
Badger
Landing Strips
Felt
Teton
River
Creek
Tetonia
Spring
Leigh
Clawson
South
HOG
Cache
OLD RAILROAD GRADE
Gaging Sta
Well
Baldy Knoll
Susies Nipple
Grandview Point
Rammell
Hollow
Packsaddle
Campbells Hump
South Fork
Dry
Mikesell Mine
Pinto Mine
Packsaddle Mine
Idaho Mine
Dude
Woods
T E T O N
4WD

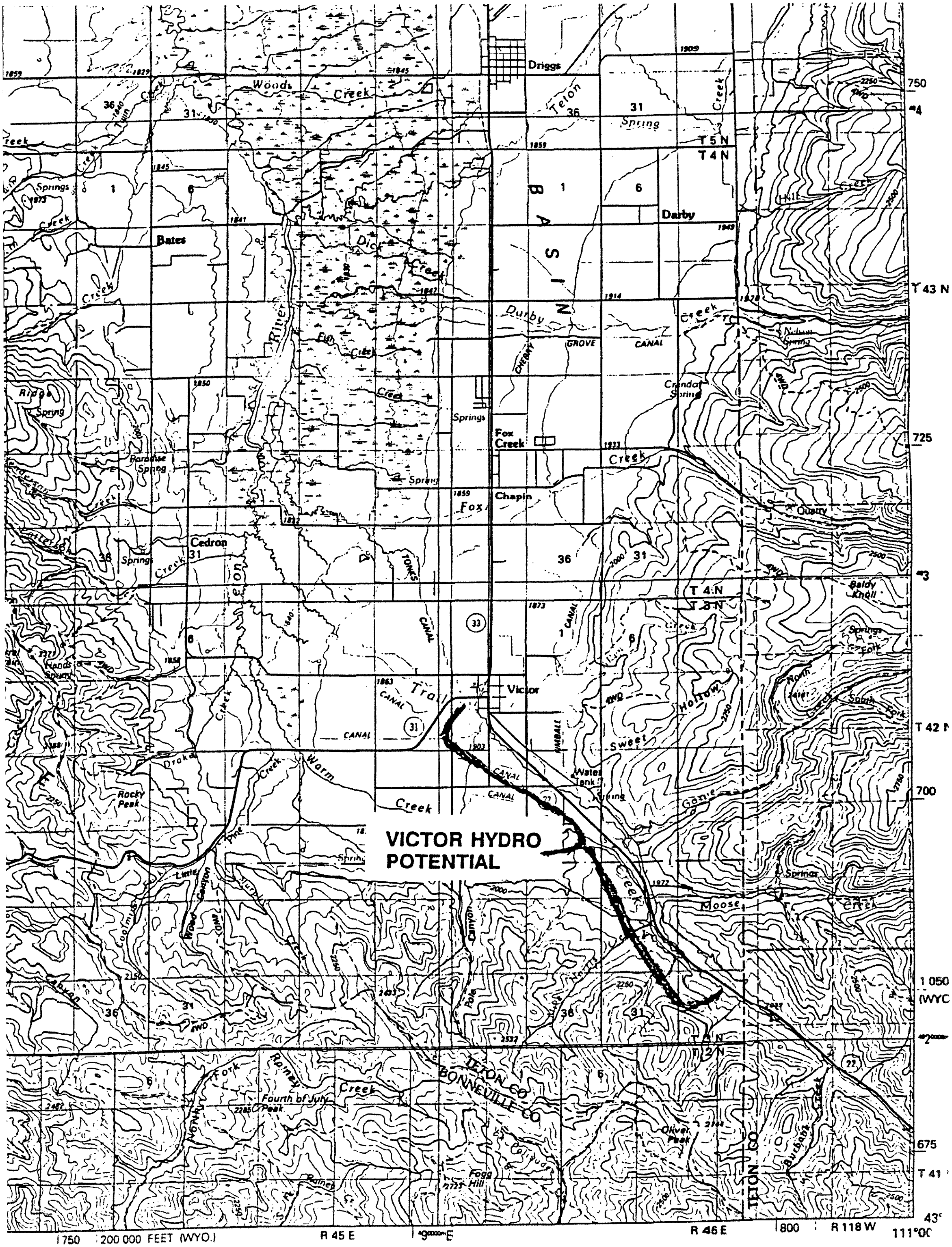

ASHTON HYDRO
EXISTING
LOWER ASHTON HYDRO
POTENTIAL
CROSS-CUT DIVERSION HYDRO
TO CONSTRUCT
ST ANTHONY CANAL HYDRO
POTENTIAL
ANTHONY HYDRO
STING
ENTERPRISE HYDRO
TO STUDY
BRIGGS HYDRO
EXISTING
Sand Dunes
Black Knoll
SAND
WILDLIFE
Gaging Sta
Ashton State Fish Hatchery
Gravel Pit
FARMERS
LAST CHANCE CANAL
CROSSCUT CANAL
Falls River
Gravel Pits
Chester
Twin Groves
Henrys Fork
Saint Anthony
ST ANTHONY
Stanford Field
FRIEND
OLD RAILROAD
CROSSCUT
SOUTH BRANCH
CHESTER
FALL RIVER
UNION
FARMERS
Wilford
ENTERPRISE
Teton
Newdale
Sugar City
River
TETON
EAST
CANAL



T A R G H E E
N A T I O N A L F O R E S T
PARTRIDGE HYDRO POTENTIAL
WARM RIVER BUTTE HYDRO POTENTIAL
ESA FALLS HYDRO POTENTIAL
FISH CREEK HYDRO POTENTIAL
Eccles Butte
Pineview
Lily Pond
Hatchery Butte
Cold Spring
Warm River Spring
Grandview Overlook
Warm River Butte
Moose Creek Butte
Warm River
Robinson
Gaging Station

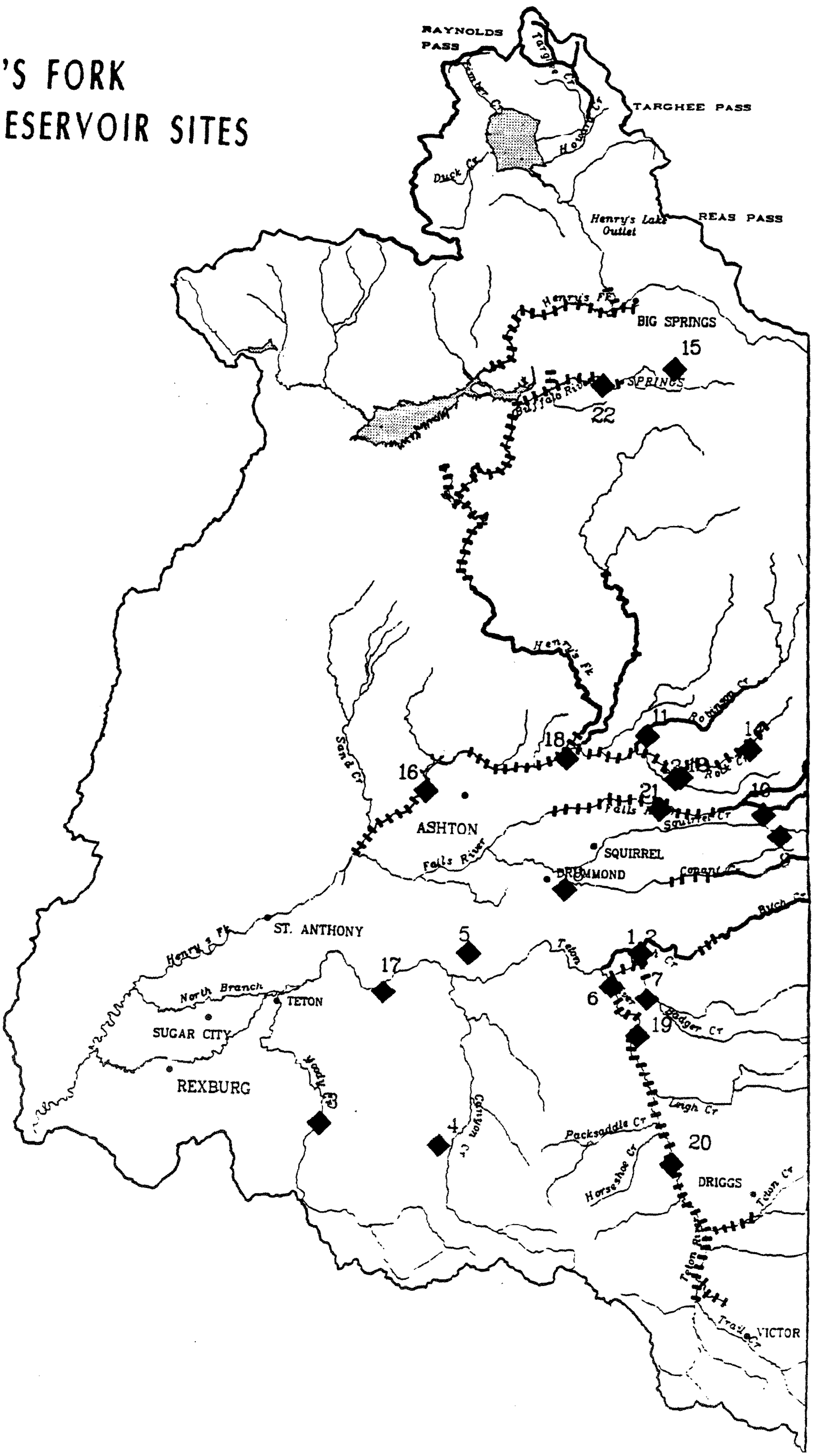

COFFEE POT RAPIDS HYDRO POTENTIAL
ISLAND PARK HYDRO TO CONSTRUCT
PONDS LODGE HYDRO TO REBUILD
LAST CHANCE HYDRO POTENTIAL
PARTRIDGE HYDRO POTENTIAL
WARM RIVER BUTTE HYDRO POTENTIAL
LOOKOUT BUTTE HYDRO POTENTIAL
TARGHEE
NATIONAL FOREST
HARRIMAN STATE PARK
Thurmon Ridge
Box Canyon
Last Chance
Hatchery Butte
Osborne Butte
Riverside Campground
Lookout Butte
Cold Spring
Toms Creek
Buffalo


FELT HYDRO EXISTING
PPER TETON RIVER HYDRO
D STUDY
France
Lamont
Felt
Tetonia
Judkins
Leigh
Clawson
Cache
Baldy Knoll
Susies Nipple
Grandview Point
Campbells Hump
Landing Strips
Badger Creek
Bitch Creek
Swanner
Spring
South
Hollow
Packsaddle
Rammell
Dry
Dude
Mikesell Mine
Pintail Mine
Idaho Mine
Packsaddle Mine
Horseshoe
Woods Creek
OLD RAILROAD GRADE
TETON
Well
Gaging Sta


VICTOR HYDRO
POTENTIAL
Driggs
Victor
Darby
Bates
Cedron
Fox Creek
Chapin
Woods Creek
Teton Creek
Spring Creek
Dick Creek
Fish Creek
Darby Creek
Fox Creek
Trail Creek
Warm Creek
Moose Creek
Sweet Hollow
Game Creek
CHERRY GROVE CANAL
TONKS CANAL
Rocky Peak
Fourth of July Peak
Oliver Peak
Fogg Hill
Baldy Knoll
Quarry
Rainey Creek
Pole Canyon
TETON CO
BONNEVILLE CO
TETON CO
T 5 N
T 4 N
T 3 N
T 2 N
T 43 N
T 42 N
R 45 E
R 46 E
R 118 W
200 000 FEET (WYO.)
111°00'

HENRY'S FORK
POTENTIAL RESERVOIR SITES

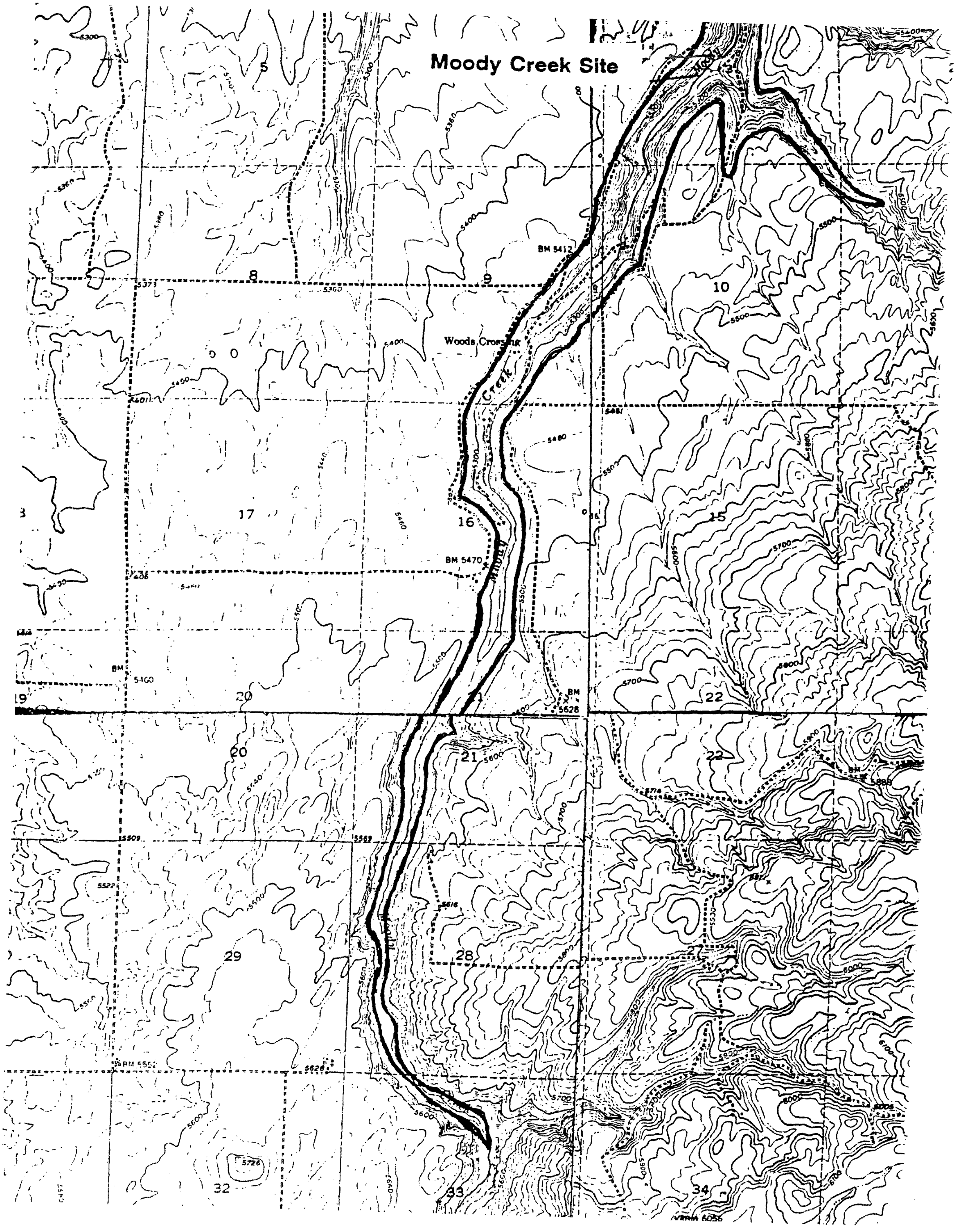
NUMBER	NAME
1	Bitch Creek
2	Bitch Creek
3	Moody Creek
4	Spring Creek
5	Lane Lake
6	Lower Badger Creek
7	Upper Badger Creek
8	Conant Creek
9	Squirrel Creek
10	Boone Creek
11	Robinson Creek
12	J.Y. Ranch
13	Howell Ranch
14	Park Lake
15	Moose Creek
16	Ashton Enlargement
17	Teton
18	Warm River
19	Tetonia
20	Driggs
21	Marysville Headworks
22	Buffalo River
23	Squirrel Meadows
•	(in Wyo.- not on map)

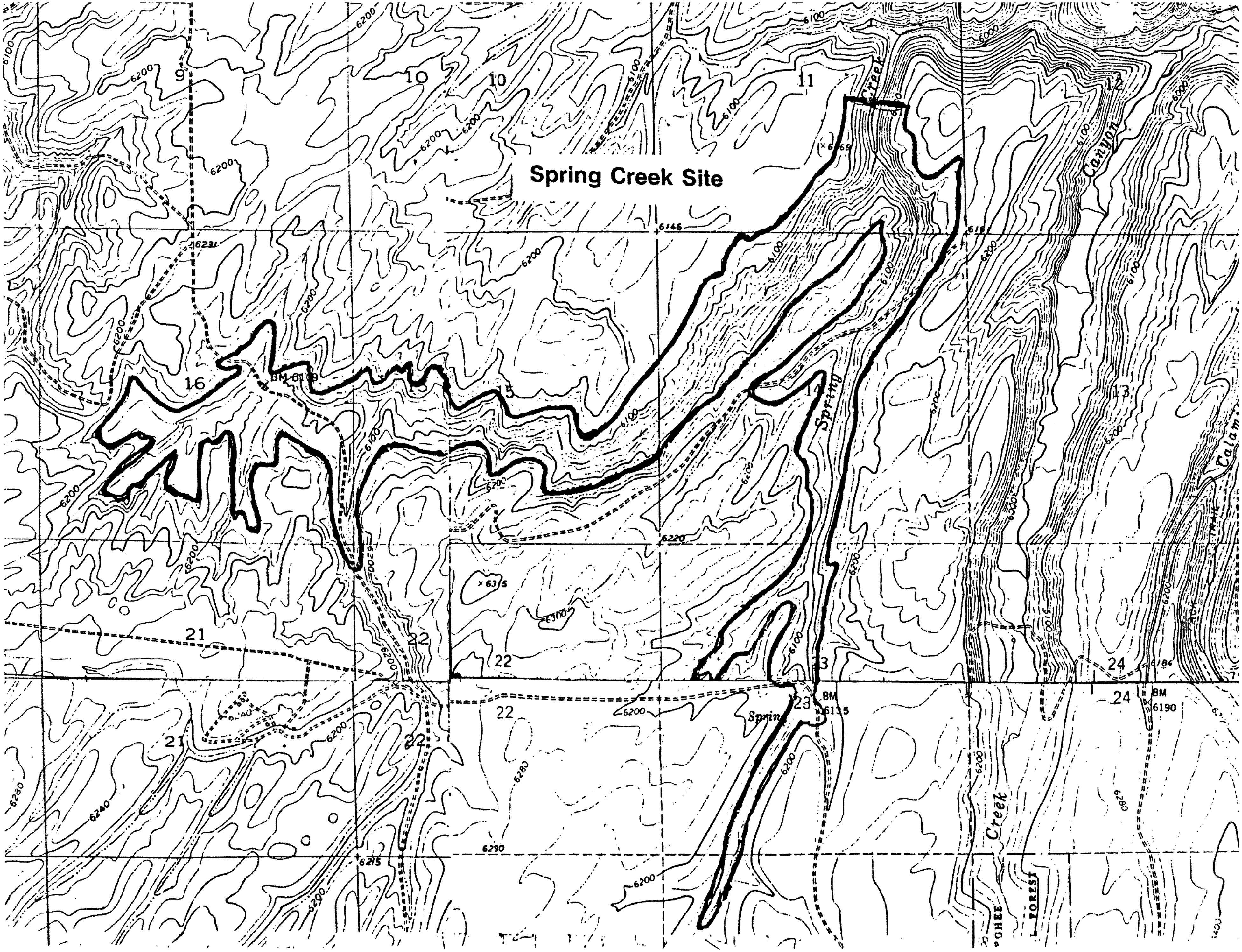


STATE DESIGNATIONS:

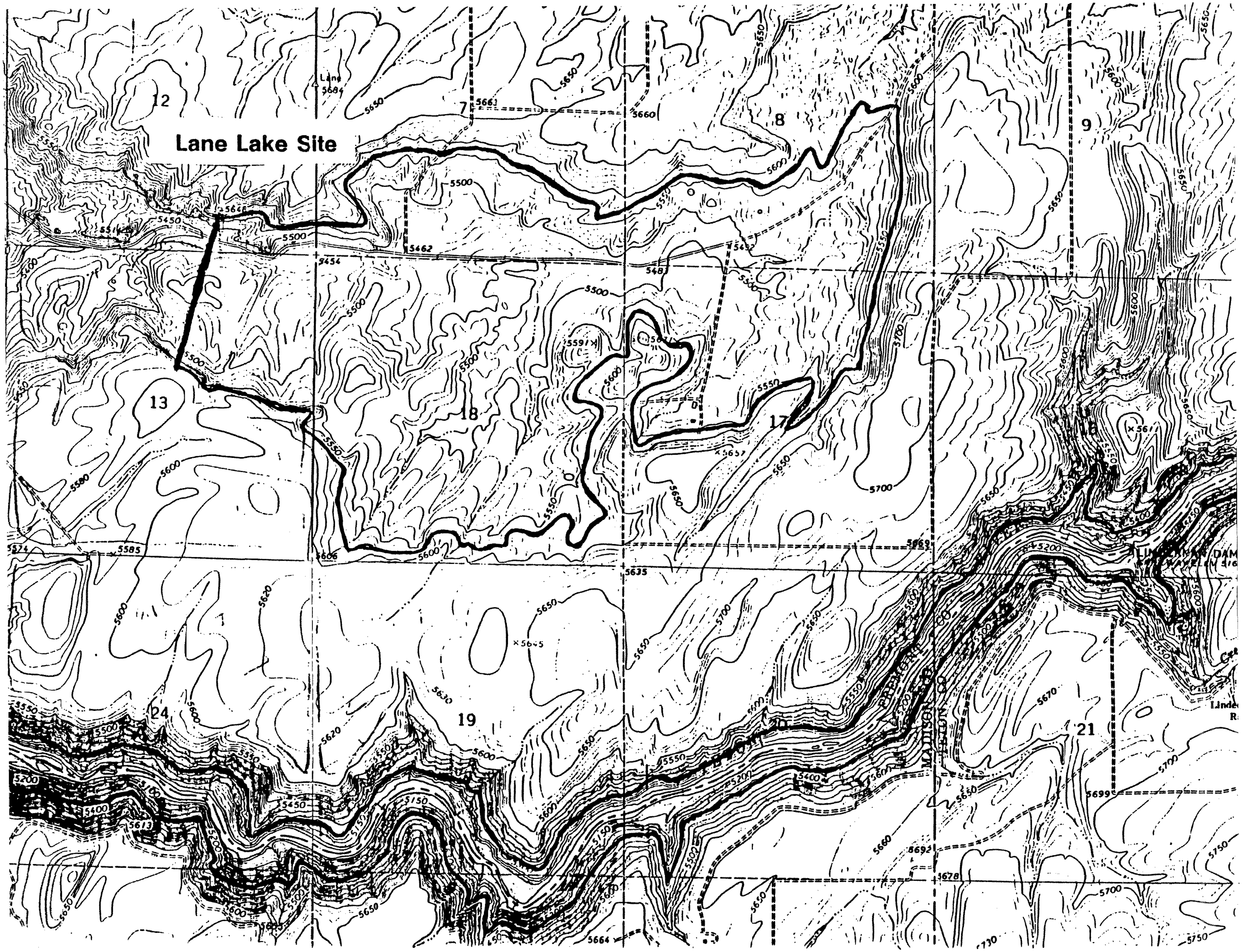
Recreational
Natural

Moody Creek Site

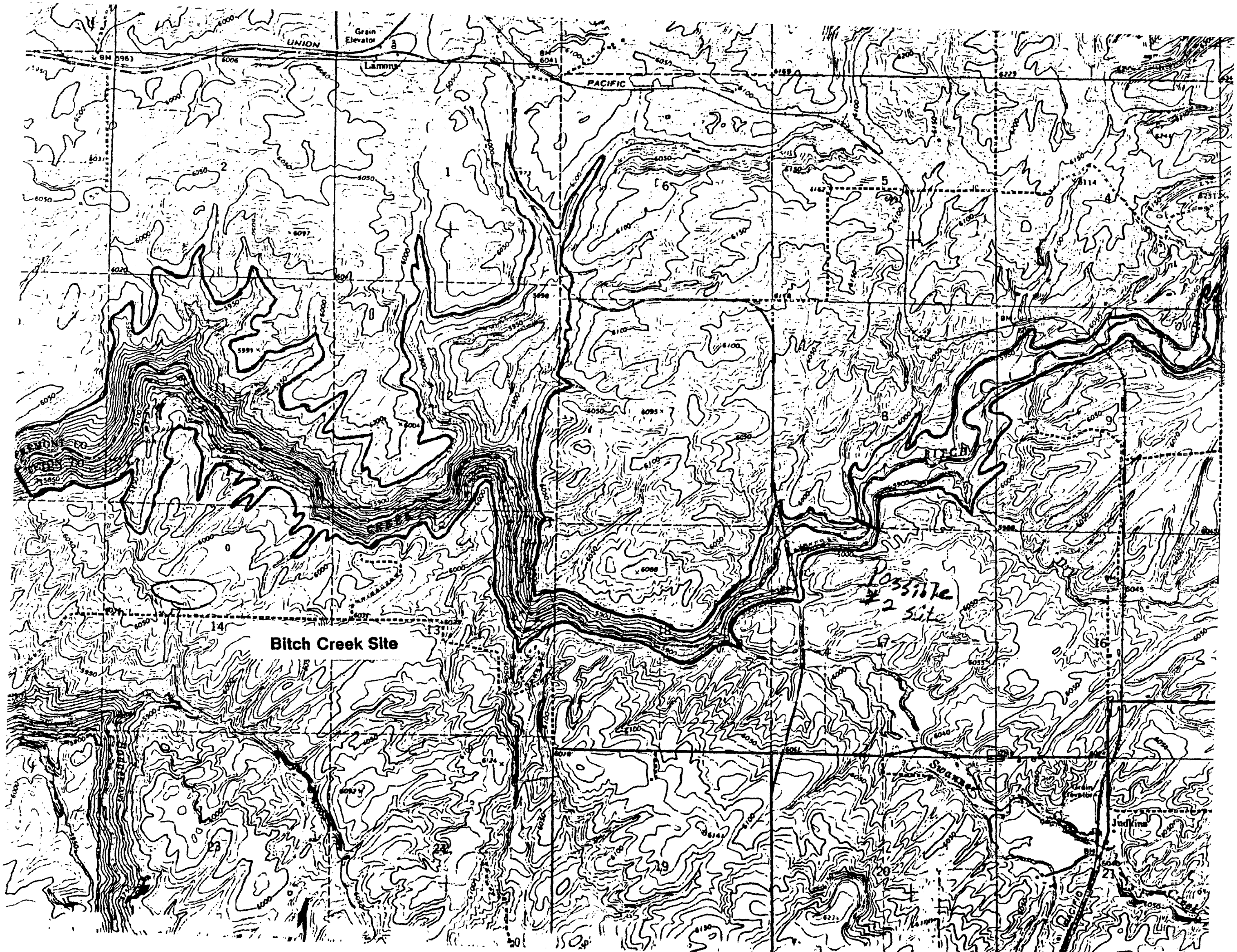


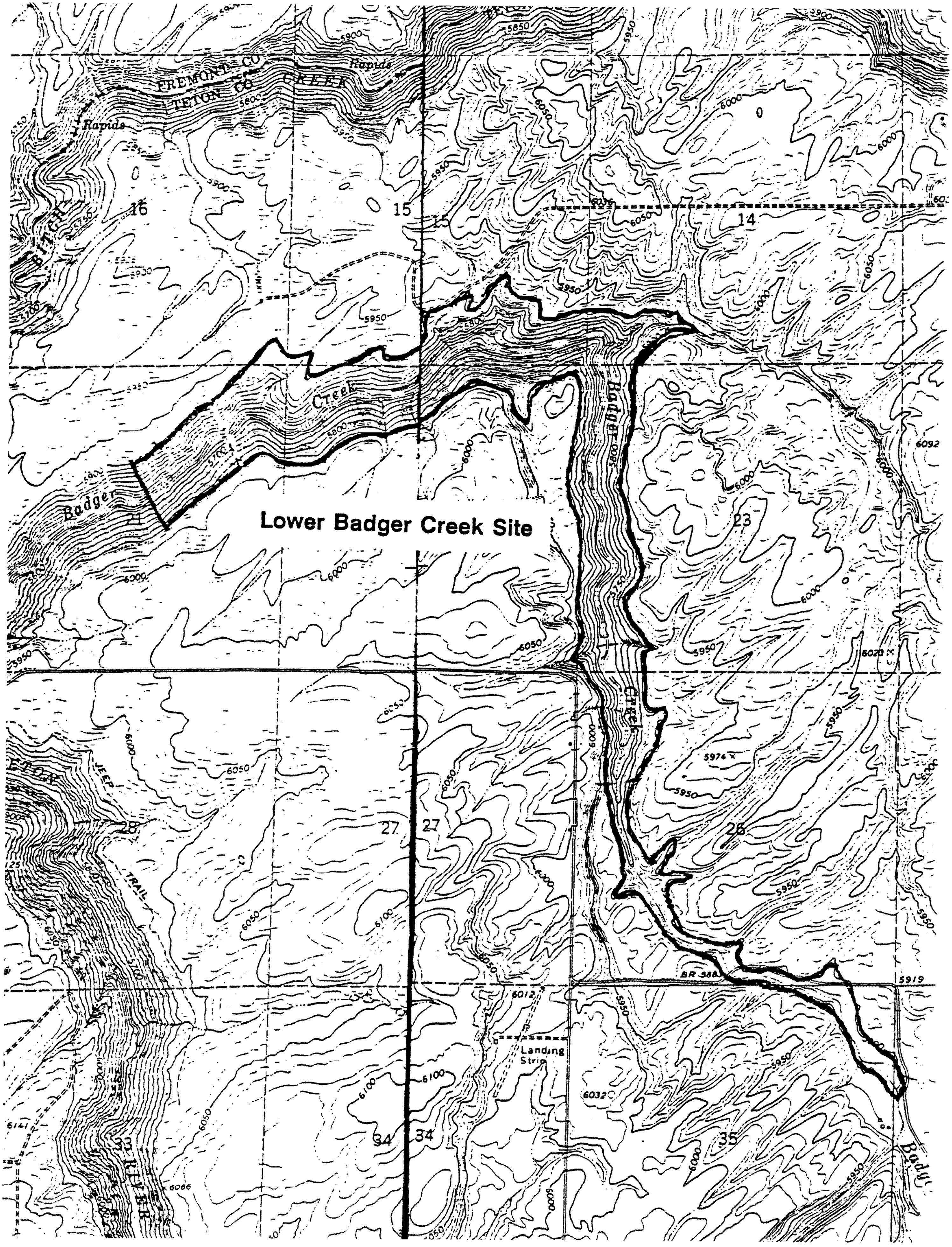


Spring Creek Site
Spring
Creek
Canyon
BM 6135
BM 6190
Spring

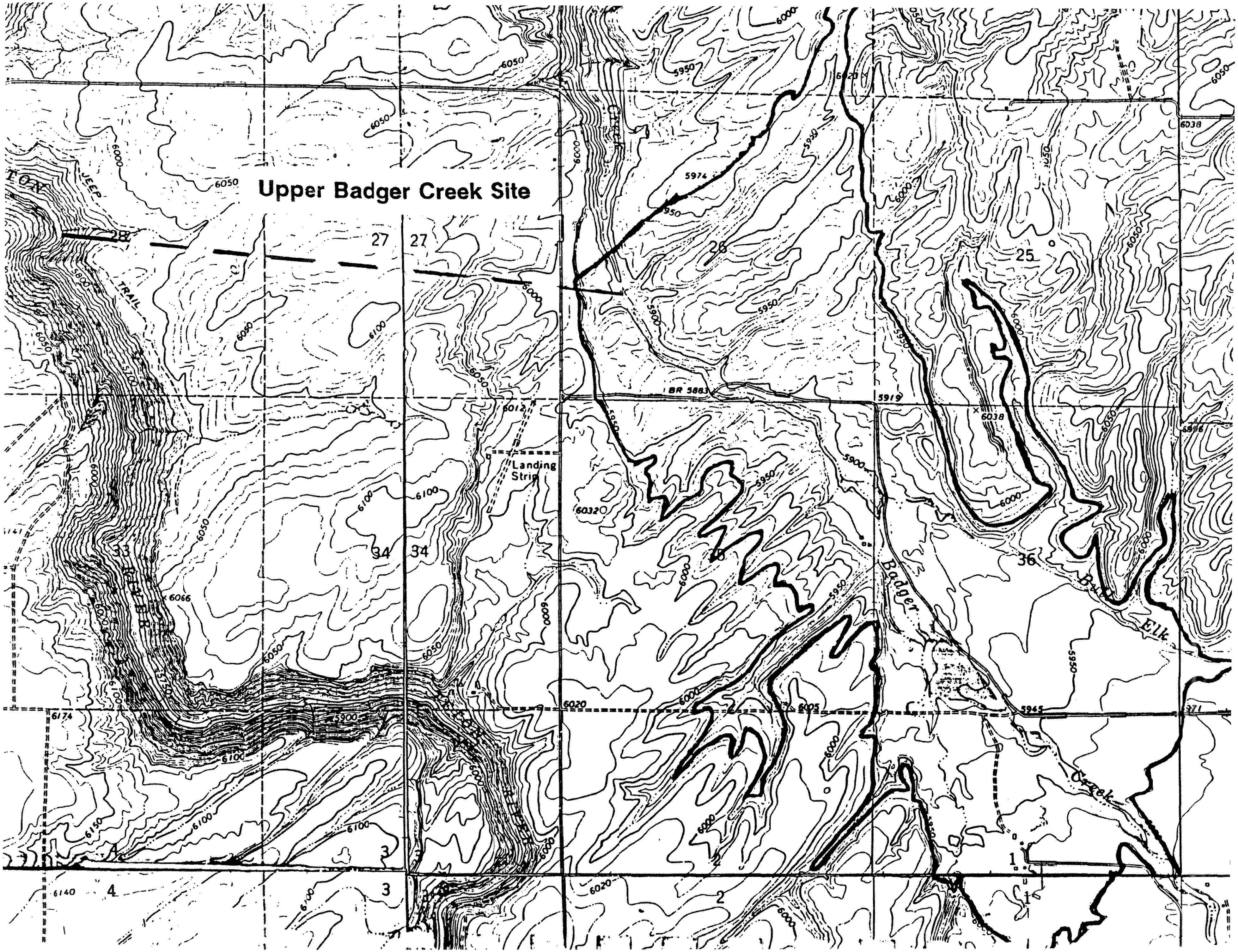


Lane Lake Site
12
7
8
9
13
18
17
19
24
21

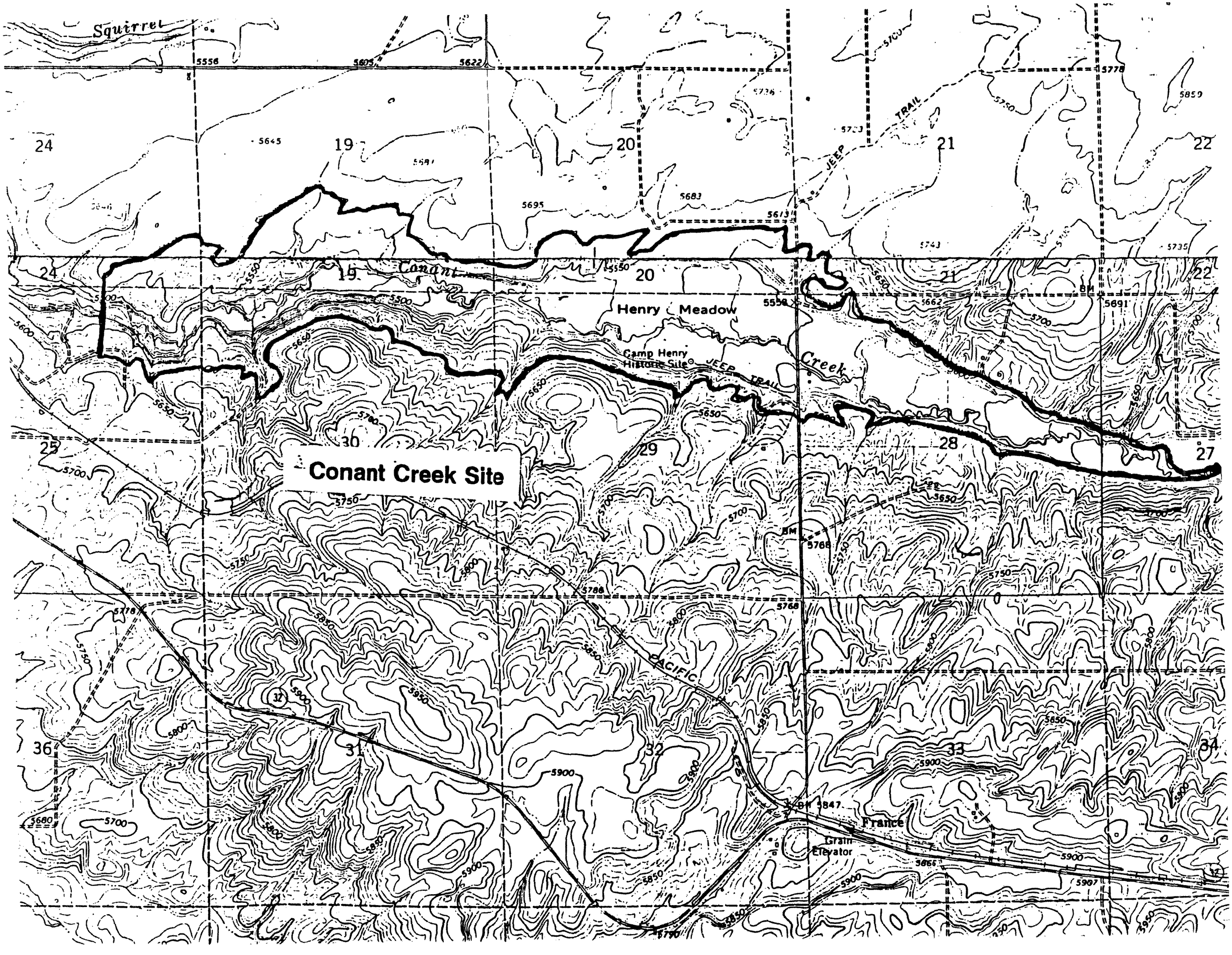

Grain Elevator
UNION
Lamont
PACIFIC
Bitch Creek Site
Possible #2 site
Grain Elevator
Judkins



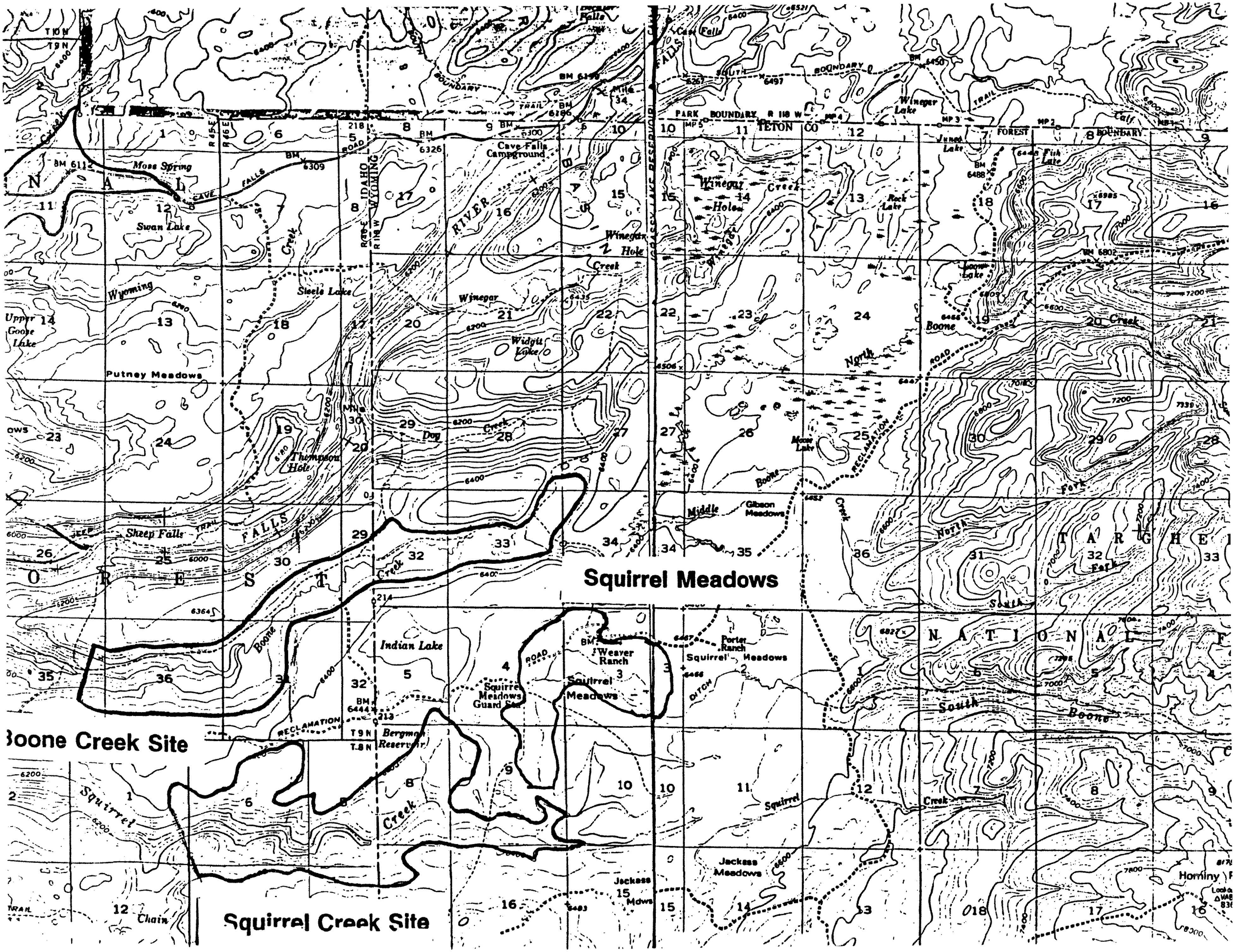
Lower Badger Creek Site
FREMONT CO
TETON CO
CREEK
Rapids
Rapids
Badger
Creek
Badger
Creek
Badger
Creek
JEEP
TRAIL
Landing Strip
16
15
15
14
21
23
27
27
26
28
34
34
35
6092
5974
6023
6012
6032
6066
6141
5919
BR 583

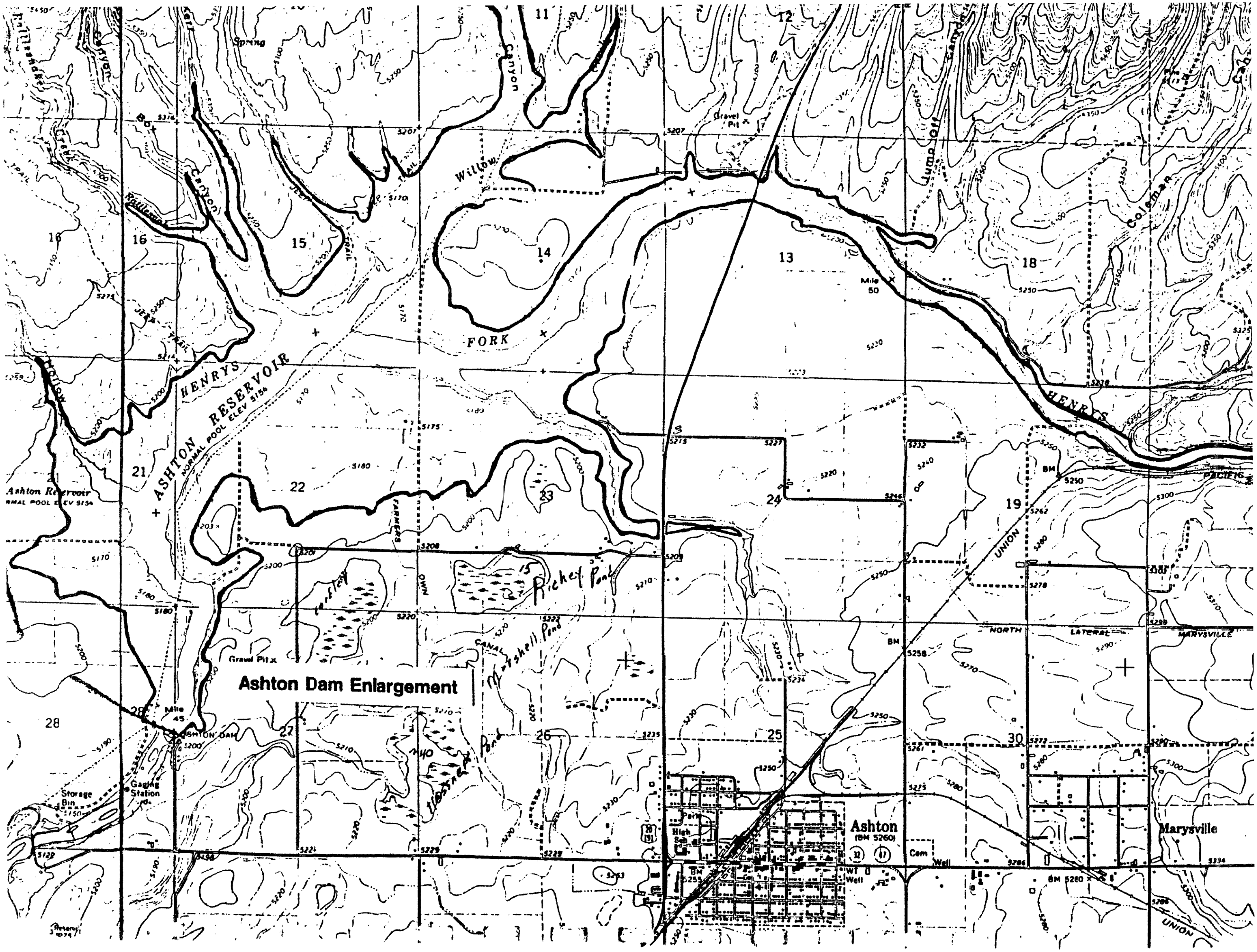


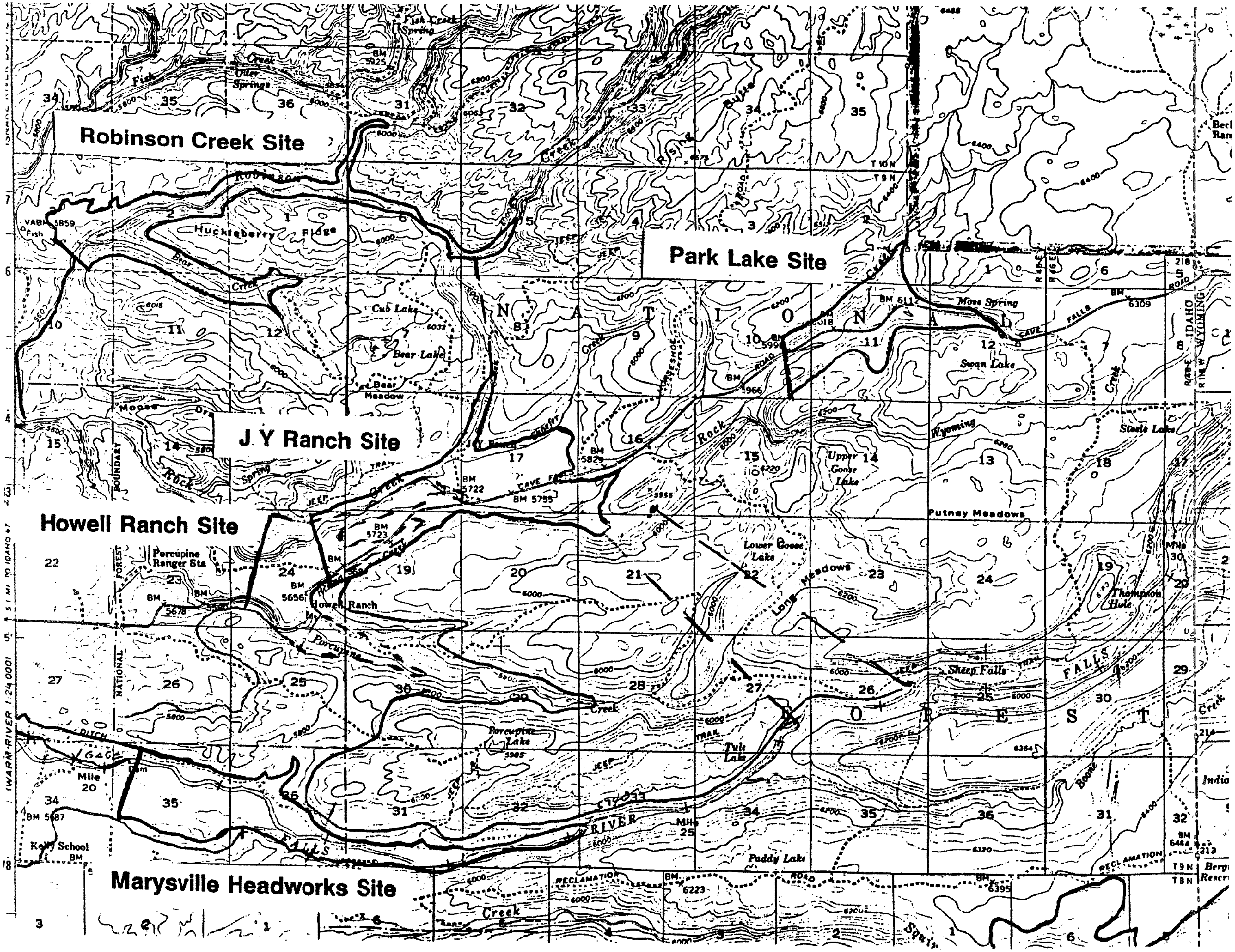
Upper Badger Creek Site
Landing Strip
Badger
Creek
Bull Elk
TRAIL
JEEP
RIVER
BR 5883
6038
6032
6066
6012
5974
5919
5945
6020
6005
6174
6140
25
26
27
28
33
34
35
36
1
2
3
4

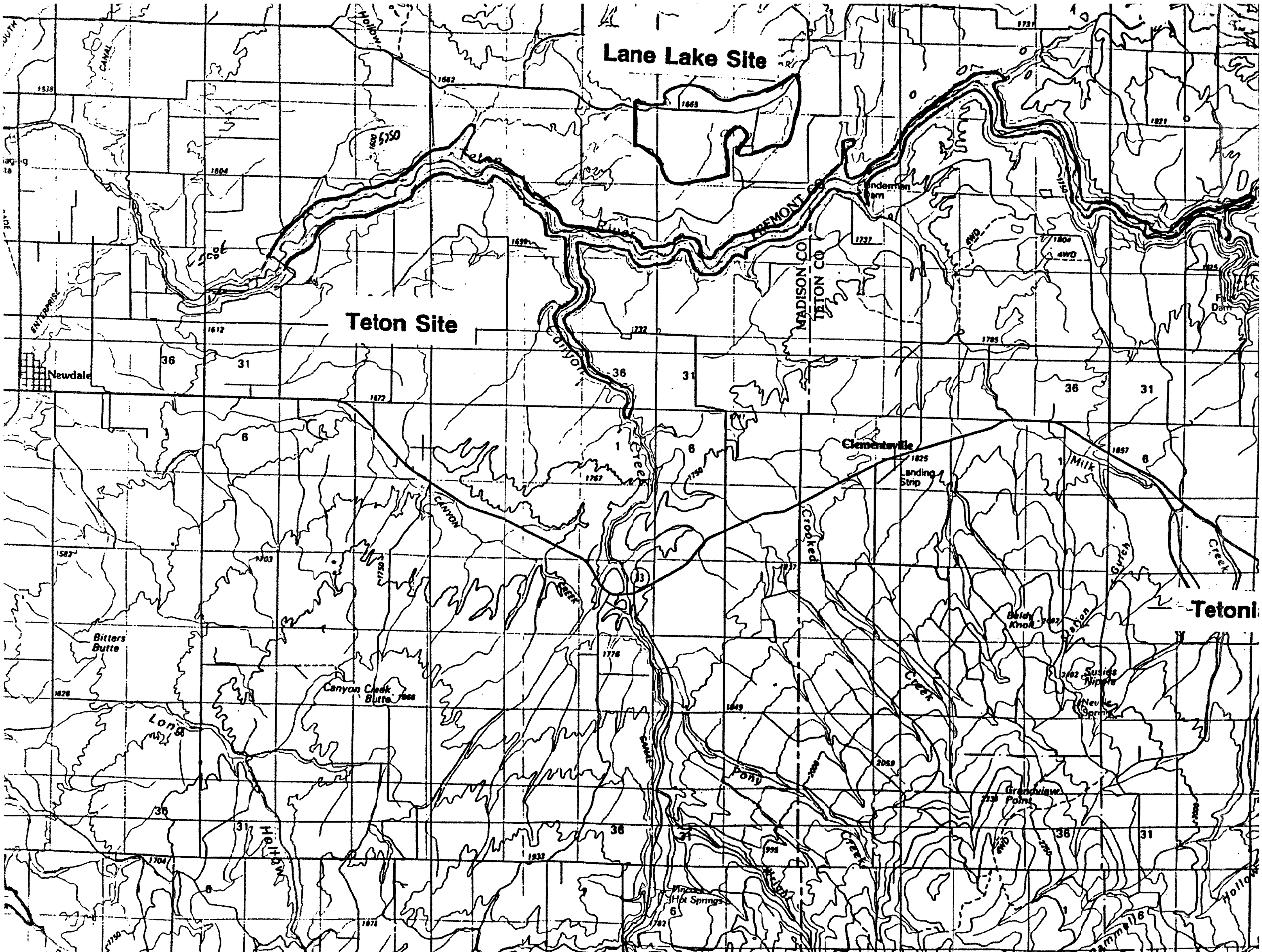


Squirrel
Conant
Henry Meadow
Camp Henry Historic Site
JEEP TRAIL
Creek
Conant Creek Site
PACIFIC
France
Grain Elevator

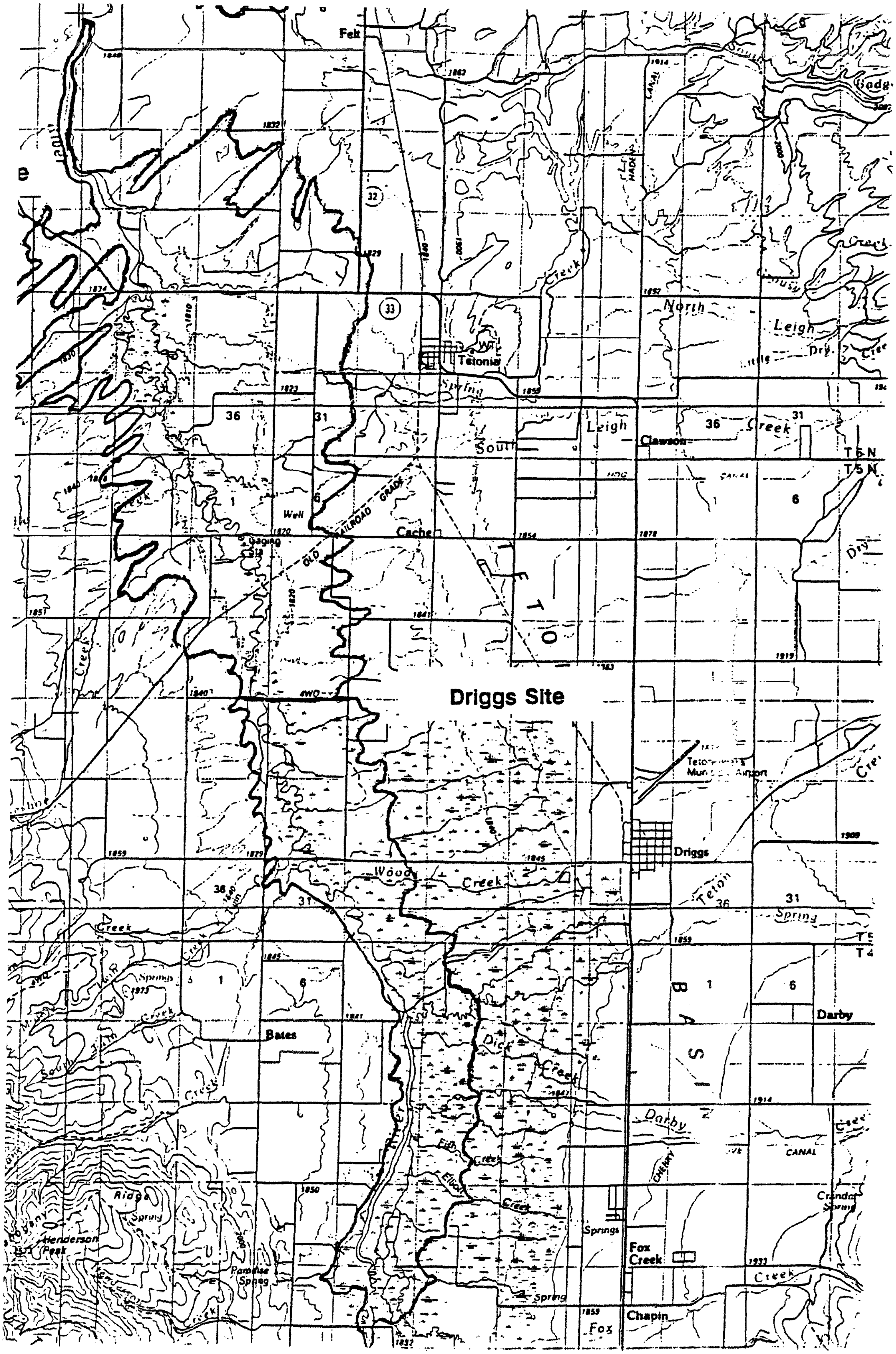

Squirrel Meadows
Boone Creek Site
Squirrel Creek Site
Cave Falls Campground
Moss Spring
Swan Lake
Steele Lake
Putney Meadows
Thompson Hole
Sheep Falls
Winegar Hole
Widgit Lake
Indian Lake
Weaver Ranch
Porter Ranch
Squirrel Meadows Guard Sta
Bergman Reservoir
Gibson Meadows
Jackass Meadows
Moose Lake
Rock Lake
Fish Lake
Loon Lake
Hominy


Ashton Dam Enlargement
ASHTON RESERVOIR
NORMAL POOL ELEV 5154
HENRYS
FORK
Willow
Ashton Reservoir
Ashton
(BM 5260)
Marysville
Richey Pond
Marshall Pond
Jump Off Canyon
Coleman
Box Canyon
Rattlesnake Canyon
Gravel Pit
Spring
Storage Bin
Gaging Station
ASHTON DAM
Mile 45
Mile 50
NORTH LATERAL
MARYSVILLE
CANAL
UNION PACIFIC

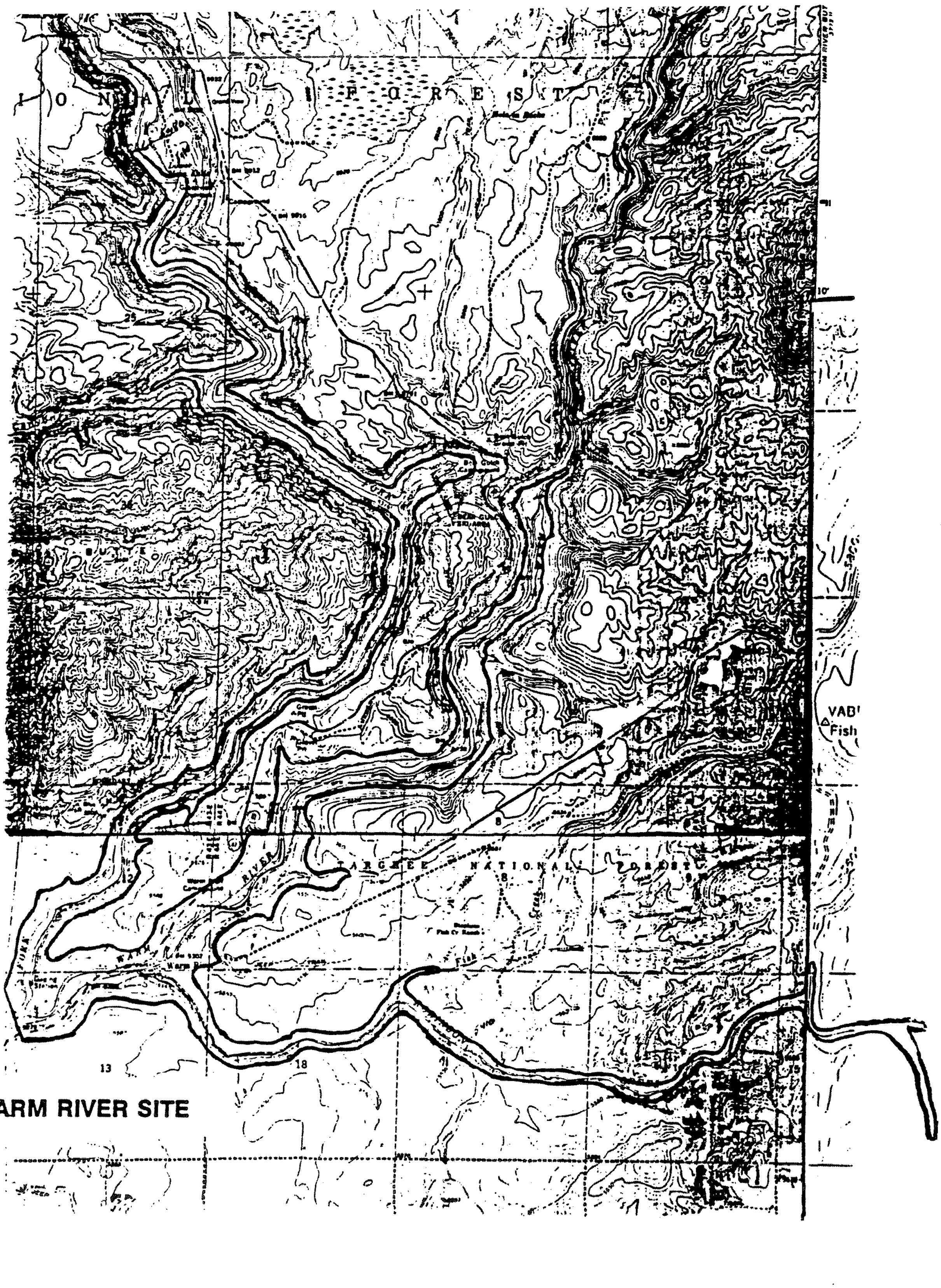

Robinson Creek Site
Park Lake Site
J Y Ranch Site
Howell Ranch Site
Marysville Headworks Site



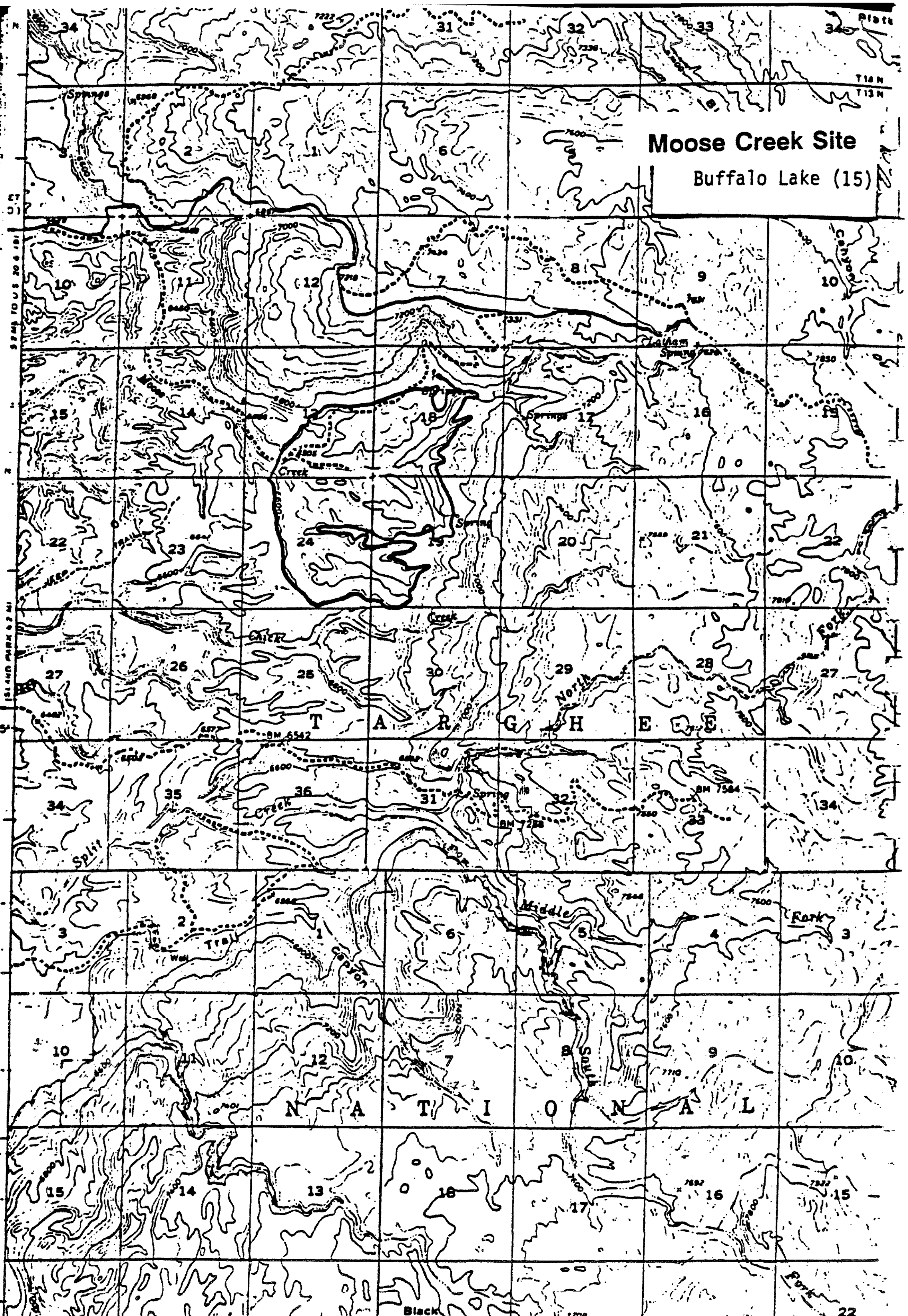
Lane Lake Site
Teton Site
Teton River
Newdale
Canyon Creek
FREMONT CO
MADISON CO
TETON CO
Clementsville
Landing Strip
Milk Creek
Crooked Creek
Bitters Butte
Canyon Creek Butte
Long Hollow
Pony Creek
Baldy Knoll
Susies Nipple
Grandview Point
Hot Springs
Tetoni

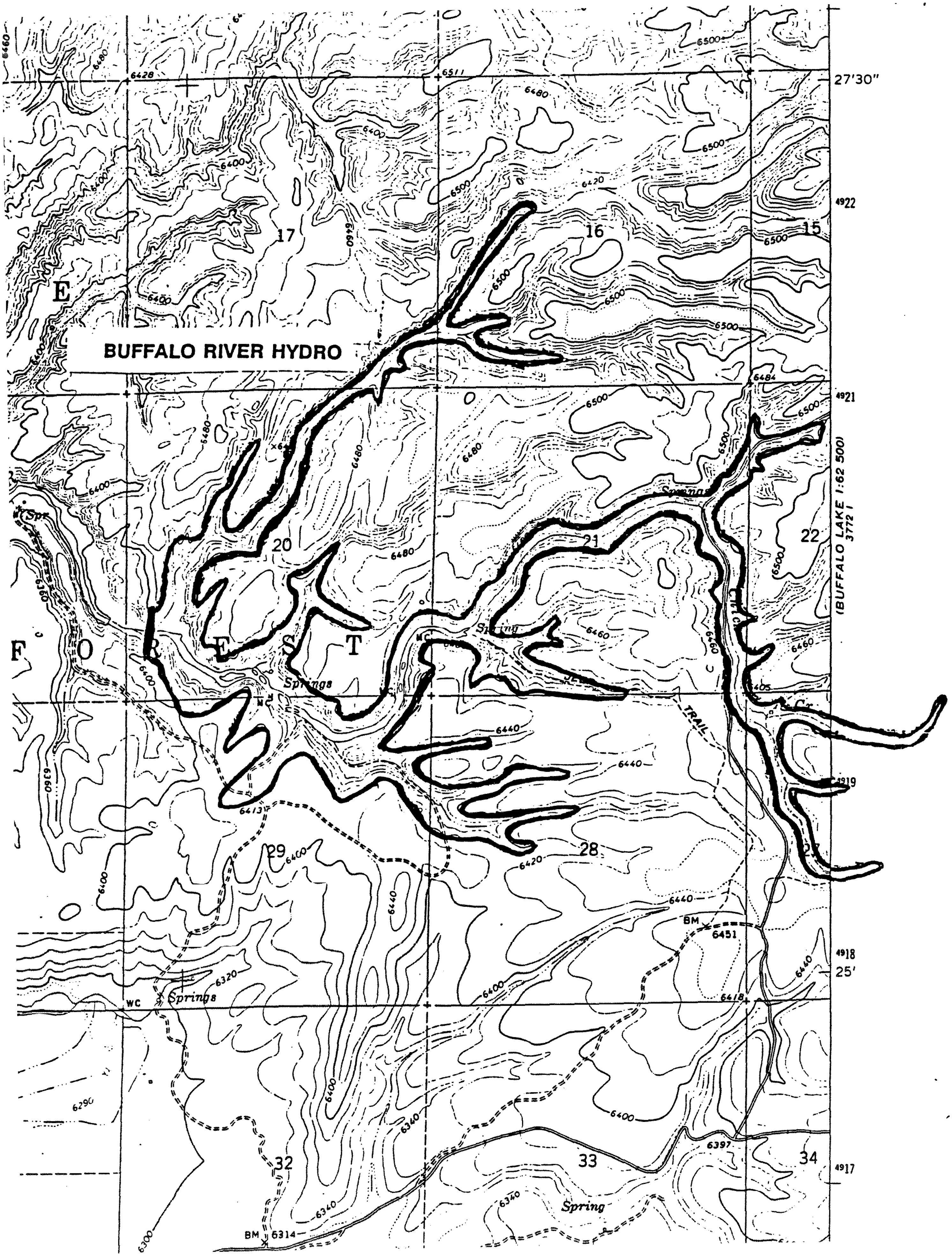

Felt
Tetonia
North
Leigh
Creek
South
Leigh
Clawson
Cache
OLD RAILROAD GRADE
Gaging Sta
Well
Driggs Site
Driggs
Wood
Creek
Teton
Spring
Dick
Creek
Darby
CANAL
Bates
Darby
Fox Creek
Chapin
Fox
Springs
Henderson Peak
Ridge
Paradise Spring
T 5 N
T 5 N
36
31
1
6

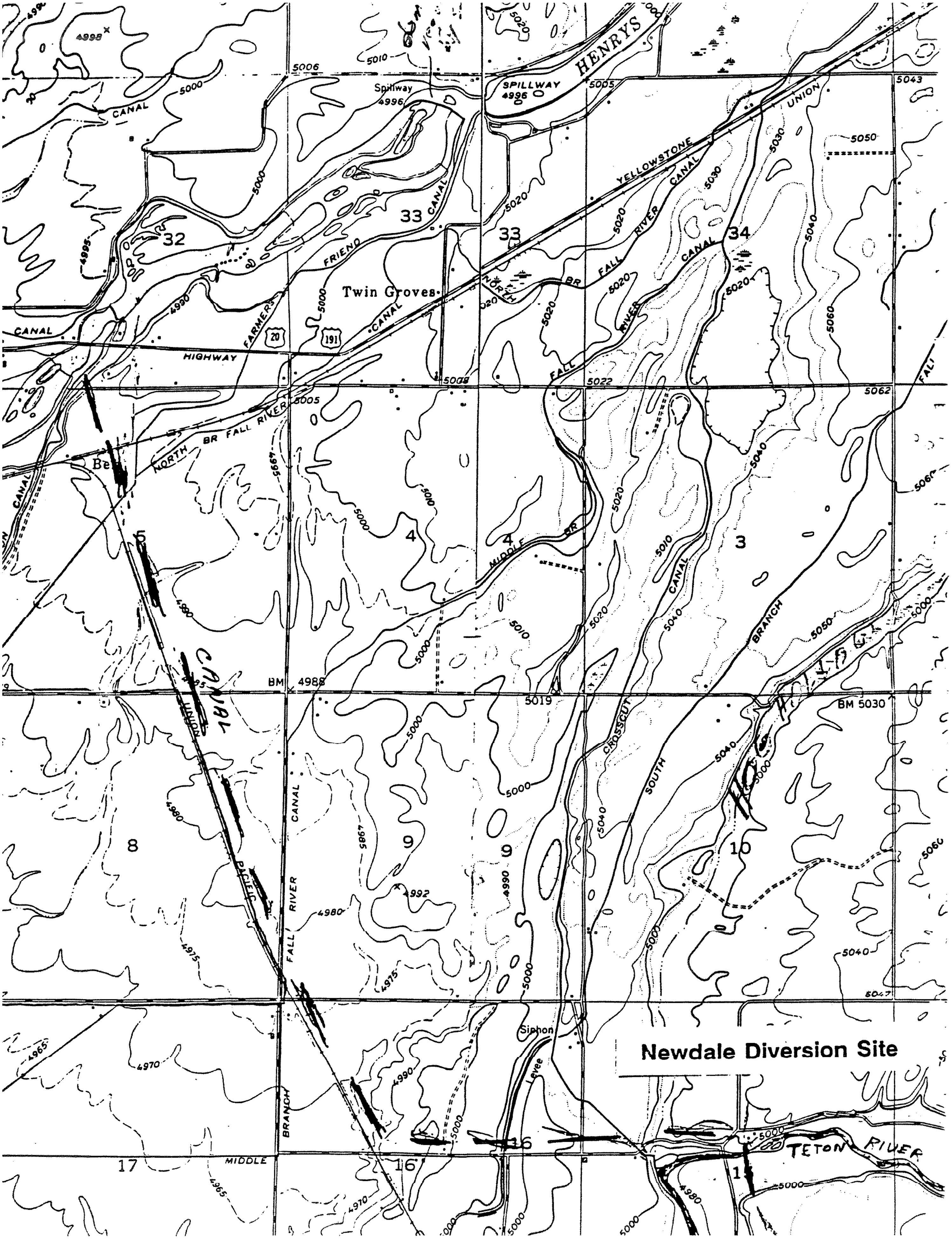
25



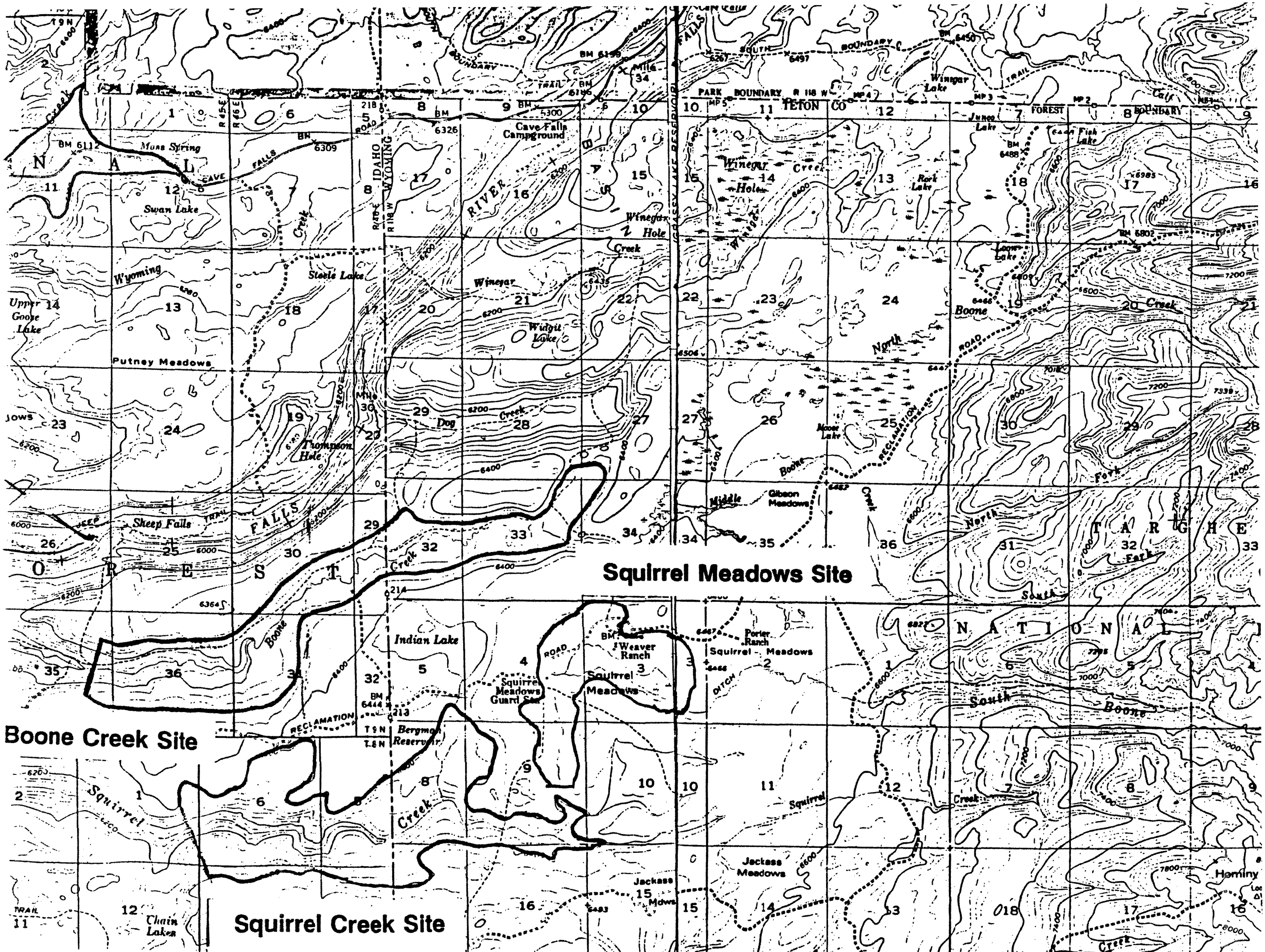
WARM RIVER SITE


Moose Creek Site
Buffalo Lake (15)
T A R G H E E
N A T I O N A L
Moose
Creek
Split Creek
Trail
Canyon
Middle Fork
North Fork
South
Latham Spring
Spring
Springs
BM 6542
BM 7584
Black Mtn
T14 N
T13 N

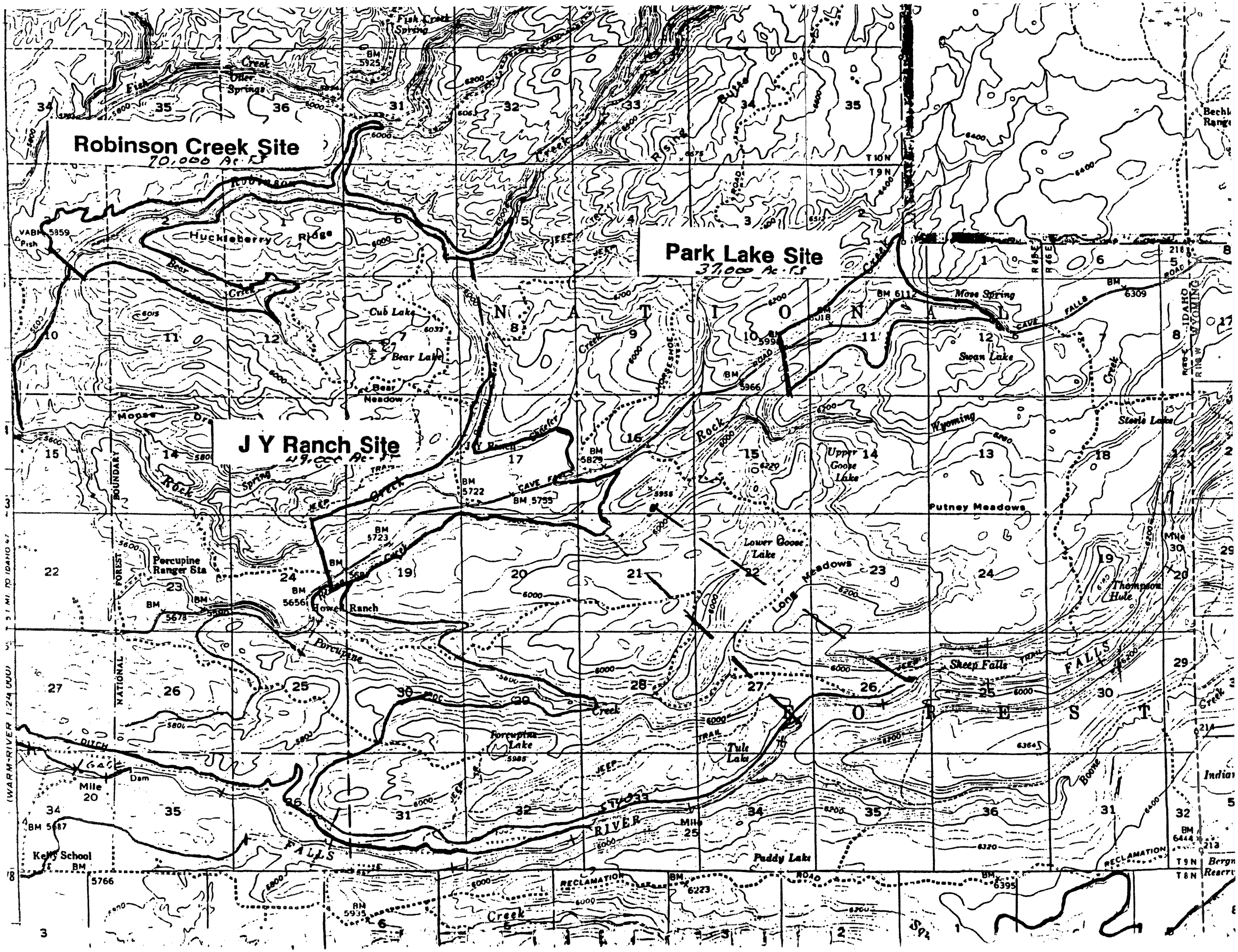

BUFFALO RIVER HYDRO
27'30"
25'
4922
4921
4919
4918
4917
(BUFFALO LAKE 1:62 500)
3772 I
F O R E S T
17
16
15
20
21
22
29
28
27
32
33
34
Springs
Spring
TRAIL
BM 6451
BM 6314
6397
6418
6413
6511
6428
6484
WC



Newdale Diversion Site
HENRYS
SPILLWAY
Spillway
CANAL
FRIEND
FARMERS
HIGHWAY
Twin Groves
YELLOWSTONE
UNION
NORTH BR FALL RIVER
MIDDLE BR
FALL RIVER CANAL
CROSSCUT CANAL
SOUTH BRANCH
UNION PACIFIC
FALL RIVER CANAL
MIDDLE BRANCH
Siphon
Levee
TETON RIVER
CANAL
BM 4988
BM 5030
32
33
34
4
3
5
8
9
10
17
16



Squirrel Meadows Site
Boone Creek Site
Squirrel Creek Site



Robinson Creek Site
70,000 Ac. Ft
Park Lake Site
37,000 Ac. Ft
J Y Ranch Site
49,000 Ac. Ft
Fish Creek Spring
Otter Springs
Huckleberry Ridge
Bear Creek
Cub Lake
Bear Lake
Bear Meadow
Moose Spring
Swan Lake
Upper Goose Lake
Lower Goose Lake
Putney Meadows
Long Meadows
Steele Lake
Thompson Hole
Porcupine Ranger Sta
Howell Ranch
Porcupine Creek
Porcupine Lake
Sheep Falls
Tule Lake
Puddy Lake
Kelly School
Rock Creek
Cave Falls Road
Reclamation Road
Falls River
N A T I O N A L
F O R E S T
T 10 N
T 9 N
T 8 N
IDAHO
WYOMING