THE ECOLOGICAL IMPLICATIONS OF YELLOWSTONE RIVER FLOW RESERVATIONS

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PREFACE

This report contains an analyses of the Montana Department of Fish and Game's efforts to secure an instream flow reservation for the Yellowstone Basin under provisions of Section 85-2-316, MCA. Background information is provided on historical efforts to secure instream flows, the development of the reservation concept in Montana Water law, recent events leading to the Yellowstone Moratorium and the impetus for allocation of the Yellowstone Basin's waters.

The procedures for obtaining instream flow reservations under Montana law are outlined. The role of this contract project in securing an instream flow reservation for the lower Yellowstone is discussed as well as the department's instream request for that reach of river. The results of the allocation of Yellowstone Basin water through the reservation process are presented.

A listing of current biological reports pertinent to the main stem of the Yellowstone is included. The implications of Yellowstone River instream flow reservations are discussed.

EXECUTIVE SUMMARY

The national energy situation requires serious energy conservation measures and the development of a high degree of national energy self-sufficiency. Suggested as part of the solution to the energy problem is the utilization of coal reserves in the western United States. These states, primarily rural in nature, with sparse human populations and little industrialization, are also habitat for some of the nation's finest fish and wildlife populations. Unrestrained energy development seriously threatens that wildlife abundance.

Flowing through and providing a key element to coal and energy development in the northern portions of the Fort Union coal deposit is the Yellowstone River and its tributaries. The Yellowstone River has survived as one of the last large, free-flowing rivers in the continental United States. Lack of main stem impoundments allows spring peak flows and fall and winter low flows to influence a unique ecosystem and aesthetic resource. From the clear, cold water cutthroat trout fishery in Yellowstone National Park to the warmer water habitat at its mouth, the river supports a variety of aquatic environments that remain relatively undisturbed. The adjacent terrestrial environment, through most of the 550 Montana miles of river, is an impressive cottonwood-willow bottomland. The river has also been a major factor in the settlement of southeastern Montana, and retains much cultural and historical significance.

Montana has taken the legislative initiative in trying to protect its fish and wildlife resource and moderate the rate of development. Its legislation in many respects is model legislation and many of the new concepts now contained in Montana's laws may have application for other western states. Under the 1973 Water Use Act, state and federal agencies, as well as political subdivisions of the state, may apply to the Board of Natural Resources and Conservation to reserve water for existing or future beneficial uses, or to maintain a minimum flow, level, or quality of water. In March of 1974, the legislature imposed a 3-year moratorium on water developments over 20 cubic feet per second or 14,000 acre-feet storage in the Yellowstone Basin. The moratorium emphasized the need for reserving water in the Yellowstone Basin for the protection of existing and future beneficial uses of water. Particular attention was to be given to reserving waters for municipal and agricultural needs as well as guaranteeing minimum instream flows for the protection of aquatic life, water quality and existing rights.

The Department of Fish and Game concentrated its efforts at determining instream flow needs on the lower Yellowstone where energy development and potential water demands were greatest. This project was developed to coordinate and

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ACKNOWLEDGEMENTS

It is difficult, if not impossible, to acknowledge personally the many individuals who contributed toward the effort to secure instream flows in the Yellowstone Basin. This project was a part of that total effort. No less than 25 individuals contributed all or part of their talents and energies toward obtaining the goals over the span of the study. Probably the individual most responsible for this project, as well as coordinating the overall Yellowstone effort, was James A. Posewitz, Administrator of the Ecological Services Division, Montana Department of Fish and Game. Jim recognized the need, developed the project outline and secured funding for this study. Without his efforts, this project and its accomplishments would not have been possible.

INTRODUCTION

Montana is one of the few western states which has the legal framework necessary to allocate a portion of its surface waters to remain instream for fish and wildlife purposes. In a radical departure from common western water law, the enactment of the 1973 Water Use Act by the Montana legislature made the "Reservation Concept" an integral part of appropriation doctrine for allocation of water. The provisions and implementation of that act provided the impetus for this project.

Prior to the 1973 Water Use Act, Montana functioned under the auspices of traditional western water law. The Doctrine of Prior Appropriation formed the foundation of earlier Montana water law, a doctrine best suited for promoting the maximum utilization of the state's water resources (Tarlock 1978). Under this law, the first use in time had the first use in right and water was dispensed on a first come, first served basis.

Montana operated under the "old" water law for over 100 years. During this time there was no legal means of securing instream flows for fish and wildlife and other uses and no recourse through the law when streams became severely dewatered. Two major obstacles in the old water law prevented securing instream flow protection for fish and wildlife. First, water could only be appropriated for a "beneficial" use and fish and wildlife simply were not specifically recognized as beneficial users of water. In addition, before water could be put to a "beneficial" use and appropriated, it had to be diverted from the streambed. Even if fish and wildlife had been considered "beneficial" users of water, the diversion requirement would have nullified an instream water appropriation effort.

The procedure for obtaining water rights did not contain a mechanism for denying anyone water based on environmental degradation per se. Even though all water rights are "subject to existing rights," the responsibility and burden of maintaining a senior water right rests with the senior right holders. As a result, several major rivers and many small streams and tributaries in Montana became severely dewatered through overappropriation and overuse.

Under the old water use law, little could be done to protect instream values. In the early 1960's, serious legislative efforts were initiated to obtain a "beneficial use" status for fish and wildlife and to develop a procedure for keeping water in the stream, instream flow, to meet fish and wildlife needs. These early efforts were largely unsuccessful.

The first instream flow consideration in Montana was given to fish and wildlife by the 1969 Montana Legislature with the passage of Chapter 345, Laws of 1969 and later codified as Section 89-801, RCM 1947. This act allowed the Montana Fish and Game Commission to file for the unappropriated waters of selected streams of the state in amounts necessary for the preservation of fish and wildlife habitat. Portions of 12 streams named in this act were filed upon. These appropriations are commonly referred to as the department's "Murphy's" rights, after the principal sponsor of the bill, Representative James Murphy. A summary of section 89-801 and the department's instream filings under that statute is included in Appendix A.

While Section 89-801 provided a measure of protection for 12 selected streams in the state, it did nothing for the rest of the waters. In 1973 Montana water law was completely revised. The resulting legislation was the Montana Water Use Act (Chapter 452, Laws of 1973 and codified as Sections 89-865 et. seq.). This act contained several significant sections for the maintenance and preservation of instream flows for fish and wildlife benefits. The instream features of the act have assumed landmark significance in water planning and allocation efforts in Montana. No longer is water law strictly utilitarian; now it contains mechanisms for the recognition and maintenance of instream rights.

The 1973 Montana Water Use Act overcame two major problems which previously prevented fish and wildlife from securing protection for instream flows. First, Section 85-2-102, Montana Code Annotated (MCA)[1] specifically defined fish and wildlife as a "beneficial use" of water:

> 85-2-102. Definitions. Unless the context requires otherwise, in this chapter the following definitions apply:
>
> . . . (2) "Beneficial use" means a use of water for the benefit of the appropriator, other persons, or the public, including but not limited to agricultural (including stock water) domestic, fish and wildlife, (emphasis added) industrial, irrigation, mining, municipal, power, and recreational uses. . . .

Second, a procedure was developed to secure water for instream purposes. No longer was it necessary to divert water before it could be put to a beneficial use. This procedure is contained in Section 85-2-316 MCA, commonly referred to as the Reservation Concept. Section 85-2-316 is presented below in its entirety.

> 85-2-316. Reservation of waters. (1) The state or any political subdivision or agency thereof or the United States or any agency thereof may apply to the board to reserve waters for existing or future beneficial uses or to maintain a minimum flow, level,

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[1] On January 12, 1979 the MCA replaced the RCM 1947 as the official codification of laws enacted by the Montana Legislature.

or quality of water throughout the year or at such periods or for such length of time as the board designates.

(2) Upon receiving an application, the department shall proceed in accordance with 85-2-307 through 85-2-309. After the hearing provided in 85-2-309, the board shall decide whether to reserve the water for the applicant. The department's costs of giving notice, holding the hearing, conducting investigations, and making records incurred in acting upon the application to reserve water, except the cost of salaries of the department's personnel, shall be paid by the applicant.

(3) The board may not adopt an order reserving water unless the applicant establishes to the satisfaction of the board:

(a) the purpose of the reservation;
(b) the need for the reservation;
(c) the amount of water necessary for the purpose of the reservation;
(d) that the reservation is in the public interest.

(4) If the purpose of the reservation requires construction of a storage or diversion facility, the applicant shall establish to the satisfaction of the board that there will be progress toward completion of the facility and accomplishment of the purpose with reasonable diligence in accordance with an established plan.

(5) After the adoption of an order reserving waters, the department may reject an application and refuse a permit for the appropriation of reserved waters or may, with the approval of the board, issue the permit subject to such terms and conditions it considers necessary for the protection of the objectives of the reservation.

(6) A reservation under this section shall date from the date the order reserving the water is adopted by the board and shall not adversely affect any rights in existence at that time.

(7) The board shall, periodically but at least once every 10 years, review existing reservations to ensure that the objectives of the reservation are being met.

> Where the objectives of the reservation are not being met, the board may extend, revoke, or modify the reservation.[2]

Basically, the reservation process allows for the allocation of the unappropriated waters of the state for future beneficial uses. The state or any political subdivision of the state or any agency of the federal government has the opportunity to reserve water. Waters may be reserved for existing or future beneficial uses or to maintain a minimum flow, level or quality of water.

The decision-making authority for approving, modifying or denying an application for reservation of water rests with the Board of Natural Resources and Conservation. An applicant desiring to reserve water must establish to the satisfaction of the Board four major items: (1) the purpose of the reservation, (2) the need for the reservation, (3) the amount of water necessary for the reservation, and (4) that the reservation is in the public interest. These items are debated and cross-examined at length through an adversary hearing process. The resulting record is then reviewed by the board and used as a basis for its decision.

The significance of the Reservation Concept to the fish and wildlife resources of Montana cannot be overemphasized. For the first time fish and wildlife as beneficial users of water may receive the protection and recognition of water law statutes. The agency responsible for and which receives the instream flow reservation has the opportunity to assume a protective role for fish and wildlife in the competition for unallocated surface waters of the state. No longer do the aquatic resources, recreational uses and other instream values have to accept merely what is left over after the diversionary uses have been satisfied; rather the Department of Fish and Game has the opportunity and, in fact, responsibility to actively seek protection and preservation for instream values.

Probably as significant as the Reservation Concept itself, at least from a practical standpoint, are the policy statements contained in the Montana Water Use Act. Policy considerations preface each chapter of the act and explain the intent of the law. The intent of the legislation is critical to the interpretation of the legislation itself. Section 85-1-101 MCA contains the policy considerations for the Water Use Act and is presented below:

> 85-1-101. Policy considerations. It is hereby declared as follows:
> (1) The general welfare of the people of Montana, in view of the state's population growth and expanding economy requires that water resources of the state be put to optimum beneficial use and not wasted.

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[2]At the time of this writing the Montana Legislature is considering amendments to this statute which will place maximum limits on instream flow reservations from a stream and prioritize reservations.

(2) The public policy of the state is to promote the conservation, development, and beneficial use of the state's water resources to secure maximum economic and social prosperity for its citizens.

(3) The state, in the exercise of its sovereign power, acting through the department of natural resources and conservation, shall coordinate the development and use of the water resources of the state so as to effect full utilization, conservation and protection of its water resources.

(4) The development and utilization of water resources and the efficient, economic distribution thereof are vital to the people in order to protect existing uses and to assure adequate future supplies for domestic, industrial, agricultural, and other beneficial uses.

(5) The water resources of the state must be protected and conserved to assure adequate supplies for public recreational purposes and for the conservation of wildlife and aquatic life.

(6) The public interest requires the construction, operation, and maintenance of a system of works for the conservation, development, storage, distribution, and utilization of water, which construction, operation, and maintenance is a single object and is in all respects for the welfare and benefit of the people of the state.

(7) It is necessary to coordinate local, state and federal water resource development and utilization plans and projects through a single agency of state government, the department of natural resources and conservation.

(8) The greatest economic benefit to the people of Montana can be secured only by the sound coordination of development and utilization of water resources with the development and utilization of all other resources of the state.

(9) To achieve these objectives and to protect the waters of Montana from diversion to other areas of the nation, it is essential that a comprehensive, coordinated multiple-use water resource plan be progressively formulated, to be known as the "state water plan."

Several of the policy considerations mentioned above have a significant bearing on instream values. Subsection 2 promotes the conservation and development of the state's water resources to ". . . secure maximum economic and social prosperity for its citizens. . . ." The inclusion of the word "social" adds a new dimension to the otherwise strictly utilitarian concept of water law and implies a social benefit to water.

Subsection 5 specifically addresses the need for preservation of adequate supplies of water ". . . for public recreational purposes and for the conservation of wildlife and aquatic life. . . ." This directly addresses the need for instream flows to maintain what can be termed "social values" as well as supporting the concept that wildlife in and of itself is to be protected and conserved.

An additional policy statement appears in Section 85-2-101 MCA and appears as follows:

> 85-2-101. Declaration of policy and purpose. (1) Pursuant to Article IX of the Montana constitution, the legislature declares that any use of water is a public use and that the waters within the state are the property of the state for the use of its people and are subject to appropriation for beneficial uses as provided in this chapter.
>
> (2) A purpose of this chapter is to implement Article IX, section 3 (4) of the Montana constitution, which requires that the legislature provide for the administration, control, and regulation of water rights and establish a system of centralized records of all water rights. The legislature declares that this system of centralized records recognizing and establishing all water rights is essential for the documentation, protection, preservation, and future beneficial use and development of Montana's water for the state and its citizens and for the continued development and completion of the comprehensive state water plan.
>
> (3) It is the policy of this state and a purpose of this chapter to encourage the wide use of the state's water resources by making them available for appropriation consistent with this chapter and to provide for the wise utilization, development, and conservation of the waters of the state for the maximum benefit of its people with the least possible degradation of the natural aquatic ecosystems. In pursuit of this policy, the state encourages the development of facilities which store and conserve waters for beneficial use, for the maximization of the use of those waters in Montana, for the stabilization of stream flows, and for groundwater recharge.

(4) Pursuant to Article IX, section 3 (1) of the Montana constitution, it is further the policy of this state and a purpose of this chapter to recognize and confirm all existing rights to the use of any waters for any useful or beneficial purpose.

Significant in this policy statement is subsection 3 which encourages the utilization of the state's water resources ". . . with the least possible degradation of the natural aquatic ecosystem. . . ." The intent of this statement is clear - streams and rivers of the state should not be depleted to the point where significant degradation to the natural ecosystem occurs. Again, this is a departure from the strictly utilitarian aspect of historic western water law. With this background, the Reservation Concept becomes an even more significant section of the Water Use Act.

While the 1973 legislature hammered out the specifics of the Montana Water Use Act, energy related events were about to occur in the Mideast which would profoundly influence the fate of eastern Montana, the future of the Yellowstone River and the course of the country itself. The Arab oil embargo emphasized our dependence on foreign crude oil, while at the same time, highlighted our reliance on all forms of energy. Energy self-sufficiency became a national goal and attention focused on domestic sources of fuel.

Suggested as a part of the solution to the energy problem was the utilization of the vast coal reserves of the western United States. The Fort Union coal formation underlies much of eastern Montana as well as portions of Wyoming and North Dakota. This formation contains an estimated 43 billion tons of economically recoverable coal in Montana (Matson 1974). The conversion of coal to more usable forms of energy requires significant quantities of water. The Yellowstone River and its tributaries are the primary source of surface water for coal conversion facilities in southeastern Montana. The development of the coal resources at the mine sites for electric power generation, synthetic gas, or liquid fuels will require diversion of water from the Yellowstone River and/or its tributaries and conveyance of aqueducts to the mine sites. Withdrawal of water from the Yellowstone River and its tributaries may require storage and diversion structures affecting the present flow regime and associated aquatic communities.

The early 1970's were a time of apprehension and concern in the lower Yellowstone Basin. Energy-related reports such as the North Central Power Study (1971) and the Montana-Wyoming aqueduct study (1972) took a national "boiler room" approach to energy development in southeastern Montana. Coal leasing activities were proceeding at a feverish rate and competition for the region's limited water supply was intense. In addition to a number of industrial options for water from Yellowtail Reservoir, seven energy and water-marketing companies applied for over 1.1 million acre feet of water annually from the main stem Yellowstone and its tributaries for industrial use.

Public sentiment ran heavily against the uncontrolled development of eastern Montana's coal resources and the accompanying water depletions in the semi-arid plains. A legislature which had just struggled with instream concepts and water allocation procedures in the Montana Water Use Act reacted predictably and, in 1974, passed a law commonly referred to as the Yellowstone Moratorium (Appendix B). This law suspended all large applications (diversions of over 20 cubic feet per second [cfs] or storage over 14,000 acre-feet [AF]) for water use permits in the Yellowstone Basin until March 10, 1977.[3]

The legislature noted that the widespread interest in Yellowstone Basin water threatened the existing and future beneficial uses of that water, including recreation and wildlife and aquatic habitat. The language of the moratorium emphasized the need for reserving water in the Yellowstone Basin for the protection of existing and future beneficial water uses; particular emphasis was given to the reservation of water for agricultural and municipal needs, as well as guaranteed minimum flows for the protection of existing rights and aquatic life.

The Yellowstone Moratorium held the line, at least temporarily, on gross depletions in the Yellowstone Basin. At the same time, it specified a 3-year time period for the identification of future beneficial uses in the basin and the allocation of the water to satisfy those uses.

The series of events just described led to the urgent need for a quantification of instream flows for the entire basin as well as an assessment of the impacts associated with water withdrawals and associated diversion structures in the lower river. Since little biological work had been done in the Yellowtone Basin, a major research effort was required to successfully capitalize on the new opportunities available for the protection of aquatic and wildlife habitats.

The two major goals of aquatic research on the Yellowstone were: (1) to determine instream flow needs and support an appropriate application for reservation of flows and (2) to assess the impacts of water withdrawals and associated diversion structures. The problems encountered in realizing these goals in the Yellowstone basin were immense. The Yellowstone drainage covers approximately one-third of the state with river length of over 550 miles. In some cases, the existing baseline data were inadequate for determining instream flows or assessing impacts. In other cases, baseline data were completely lacking. In addition, state funding was not available to cover more than a fraction of the necessary research costs.

It was apparent that the department's effort on the Yellowstone had to be greatly expanded and outside sources of funding secured. Several studies relative to the main stem of the Yellowstone were initiated which were designed to obtain basic life history and inventory data to better understand the ecology of the river. A summary of the research projects initiated or in progress on the main stem Yellowstone by the spring of 1975 is as follows:

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[3]By amendment and court action, the moratorium was extended until December 31, 1978.

(1) Yellowstone River Periphyton and Phytoplankton

(2) Lower Yellowstone Aquatic Invertebrate and Forage Fish Study

(3) Lower Yellowstone Fisheries Study - Bighorn River to Miles City

(4) Lower Yellowstone Fisheries Study - Miles City to Sidney

(5) Yellowstone River Migratory Bird Study

(6) Lower Yellowstone River Furbearer Study

(7) Upper Yellowstone and Shields River Fish and Wildlife Inventory and Planning Study

With the urgency of meeting the deadline for submitting water reservations imposed by the Yellowstone Moratorium, the need for a coordinating effort among the various disciplines and a project specifically charged with the task of determining instream flow needs was obvious.

The specific objectives of this project were as follows:

(1) To correlate and supplement the baseline data obtained from the various studies listed above and other available information and to assess the impacts where sufficient data exist of various assumed river flow regimes on the components of the natural biological system.

(2) To develop instream flow requirements for the stream system and to support an appropriate application for reservation of flows under terms of the applicable state statute.

(3) To evaluate the adequacy of the 3-year moratorium period for obtaining the necessary baseline data and to analyze the effectiveness of this project approach in accomplishing objectives 1 and 2.

(4) To assemble all data, analyses and conclusions in a manner suitable for use in future analyses related to anticipated alternative water development and use studies.

This report is intended to fulfill objectives 2 through 4 of this project. Objective 1 was partially fulfilled by providing supervisory and field assistance to studies referenced later in this report.

DESCRIPTION: THE YELLOWSTONE RIVER

The Yellowstone River is unique among the nation's major rivers. Two tributaries, the Tongue and Bighorn rivers, are regulated because of major dams but the Yellowstone main stem is virtually unimpounded for its entire length. The Yellowstone originates in the northwestern corner of Wyoming, and flows northeasterly through Montana before joining the Missouri River near Cartwright, North Dakota. It has a total drainage area of approximately 70,400 square miles, 35,900 of which lie in Montana. Its length, from its headwaters in Wyoming to its confluence with the Missouri River in North Dakota, is approximately 678 miles, 550 of which are in Montana.

Major tributaries entering the Yellowstone in Yellowstone National Park include the Gardner and Lamar rivers. In Montana, the only major south-flowing tributary to the Yellowstone is the Shields River near Livingston. Major north-flowing tributaries to the Yellowstone in Montana include the Boulder, Stillwater, Clarks Fork of the Yellowstone, Bighorn, Tongue and Powder rivers (Figure 1).

Headwaters of the basin are in the high mountain areas of southcentral Montana and northwestern Wyoming. Approximately 70% of the annual flow of the Yellowstone comes from mountain snowpack. Winter accumulation and summer melting of this variable snowpack give the Yellowstone River its basic characteristics of high spring runoff and low flows through the fall and winter. The average annual runoff from the Yellowstone Basin, adjusted to the 1970 level of depletion, is 8.8 million acre-feet (MAF). The maximum and minimum record annual basin outflows have been 15.4 and 4.3 MAF, respectively.

The Yellowstone is of great importance as a sport fishery and can be divided into three general zones as related to fish distribution. From its headwaters in Wyoming to its mouth in North Dakota, the river changes from an alpine, salmonid-type fishery to a diverse, warm-water aquatic ecosystem. A longitudinal profile of the Yellowstone is presented in Figure 2.

Montana's portion of the Yellowstone has 50 fish species, representing 13 families (Table 1). Although data are too limited to show distribution of 17 species, the probable distribution of the remaining 33 is illustrated in Figure 3 (Peterman and Haddix 1975).

The upper Yellowstone, from Gardiner to Big Timber (111 miles), supports cold-water salmonid populations of national significance and has been classified as a blue ribbon trout stream by the Montana Fish and Game Commission. This area is characterized by large populations of a relatively small number of fish species characteristic of clear, cold water rivers. The primary trout species

Table 1. Fish species recorded for the Yellowstone River (family, scientific and common names).

ACIPENSERIDAE (Sturgeon Family)	
Scaphirhynchus albus	Pallid sturgeon
Scaphirhynchus platorynchus	Shovelnose sturgeon
POLYODONTIDAE (Paddlefish family)	
Polyodon spathula	Paddlefish
HIODONTIDAE (Mooneye family)	
Hiodon alosoides	Goldeye
SALMONIDAE (Trout family)	
Prosopium williamsoni	Mountain whitefish
Salmo clarki	Cutthroat trout
Salmo gairdneri	Rainbow trout
Salmo trutta	Brown trout
Salvelinus fontinalis	Brook trout
ESOCIDAE (Pike family)	
Esox lucius	Northern pike
CYPRINIDAE (Minnow family)	
Cyprinus carpio	Carp
Carassius auratus	Goldfish
Notemigonus crysoleucas	Golden shiner
Semotilus margarita	Pearl dace
Semolitus atromaculatus	Creek chub
Hybopsis gracilis	Flathead chub
Hybopsis gelida	Sturgeon chub
Couesius plumbeus	Lake chub
Notropis atherinoides	Emerald shiner
Notropis stramineus	Sand shiner
Hybognathus hankinsoni	Brassy minnow
Hybognathus placitus	Plains minnow
Hybognathus nuchalis	Silvery minnow
Pimephales promelas	Fathead minnow
Rhinichthys cataractae	Longnose dace
CATOSTOMIDAE (Sucker Family)	
Carpoides carpio	River carpsucker
Cycleptus elongatus	Blue sucker
Ictiobus bubalus	Smallmouth buffalo
Ictiobus cyprinellus	Bigmouth buffalo
Moxostoma macrolepidotum	Shorthead redhorse
Catostomus catostomus	Longnose sucker
Catostomus commersoni	White sucker
Catostomus platyrhynchus	Mountain sucker
ICTALURIDAE (Catfish family)	
Ictalurus melas	Black bullhead
Ictalurus punctatus	Channel catfish
Noturus flavus	Stonecat
GADIDAE (Codfish family)	
Lota lota	Burbot
CENTRARCHIDAE (Sunfish family)	
Lepomis cyanellus	Green sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis macrochirus	Bluegill
Micropterus dolomieui	Smallmouth bass
Micropterus salmoides	Largemouth bass
Pomoxis annularis	White crappie
Pomoxis nigromaculatus	Black crappie
Ambloplites rupestris	Rock bass
PERCIDAE (Perch family)	
Perca flavescens	Yellow perch
Stizostedion canadense	Sauger
Stizostedion vitreum	Walleye
SCIAENIDAE (Drum family)	
Aplodinotus grunniens	Freshwater drum
COTTIDAE (Sculpin family)	
Cottus bairdi	Mottled sculpin

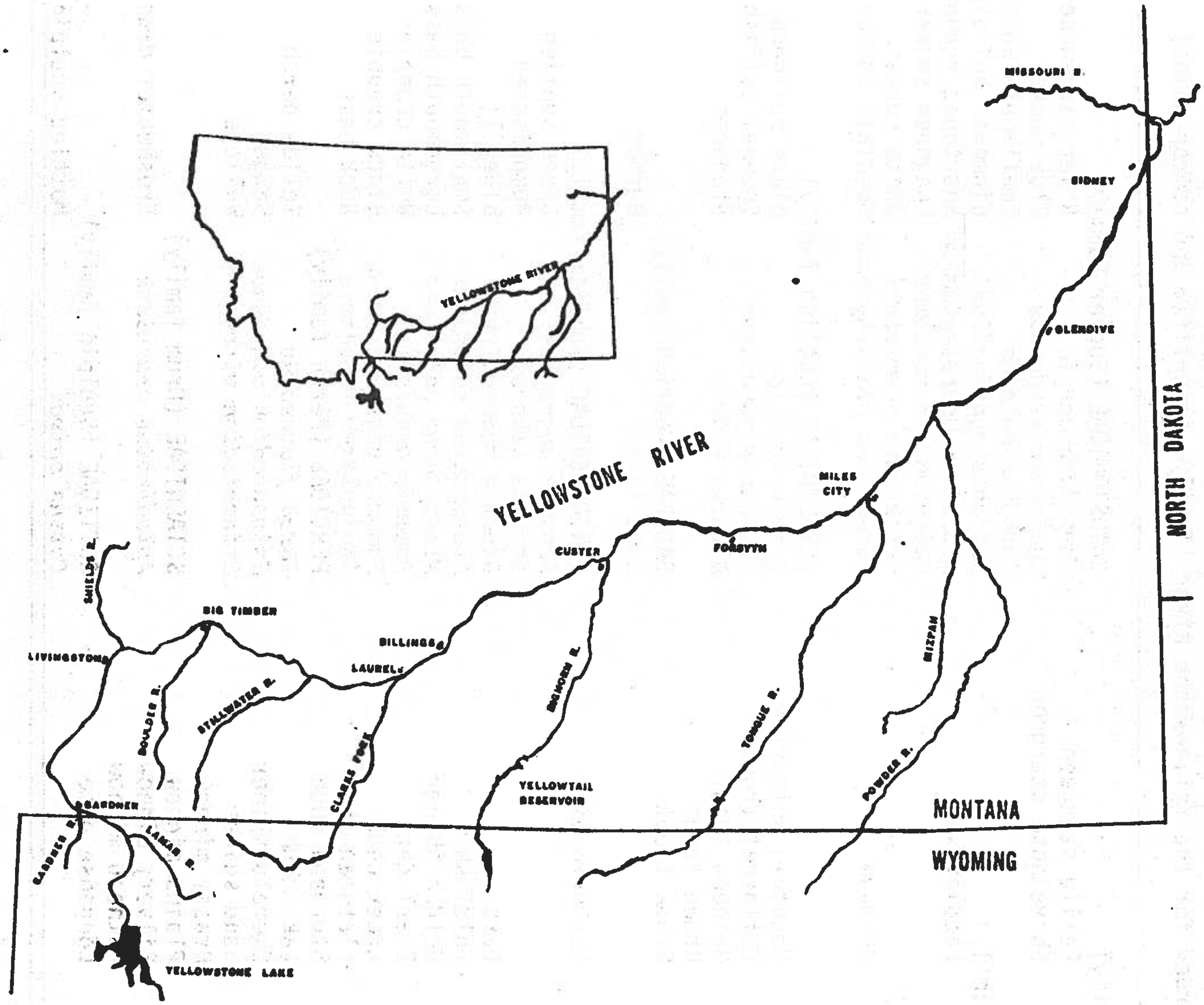

Figure 1. Yellowstone River drainage.

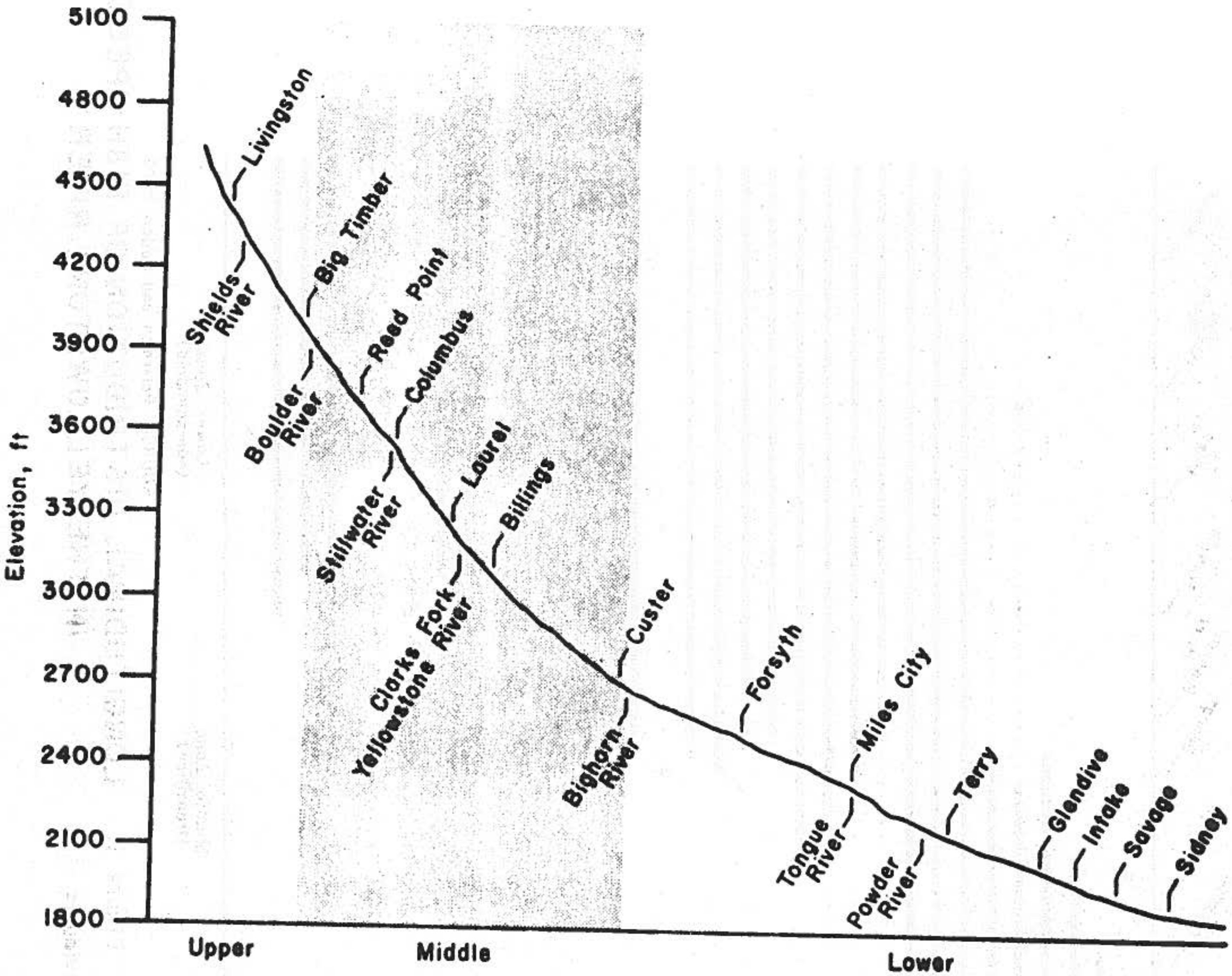

Figure 2.

LONGITUDINAL PROFILE OF THE YELLOWSTONE RIVER

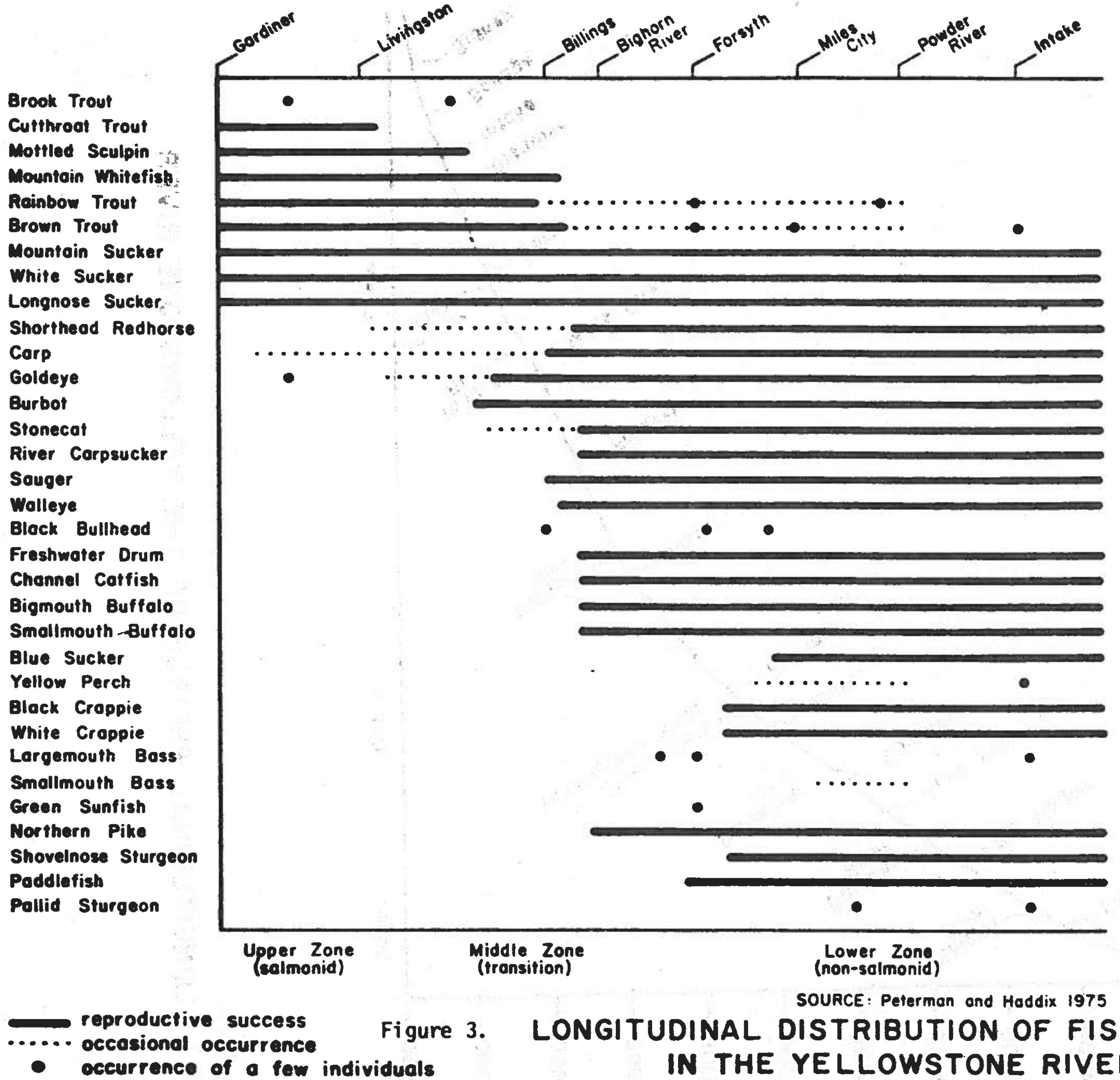

Figure 3. LONGITUDINAL DISTRIBUTION OF FISH SPECIES IN THE YELLOWSTONE RIVER

are cutthroat, rainbow and brown trout. Large populations of mountain whitefish exist and longnose sucker are also abundant. The principal forage fish species is the mottled sculpin.

The stream reach from Gardiner to the mouth of the Boulder River at Big Timber represents the longest single reach (103 miles) of blue ribbon trout stream in Montana and comprises 23 percent of the state's 452 total miles of blue ribbon water. An excellent fishery exists in this reach for rainbow, brown and Yellowstone cutthroat trout, as well as mountain whitefish. Rainbow and brown trout are the most sought-after species, and provide excellent fishing opportunities. Although not native to the area, they currently provide the bulk of the trout harvest.

The Yellowstone cutthroat trout is a unique and highly prized species. Found only in the headwaters of the Yellowstone Basin, its range appears to be quite restricted. Mountain whitefish are several times more abundant than trout and provide an important winter fishery (Berg 1975).

The transition zone between the primarily cold water environment of the upper river and the warm water environment of the lower river extends 160 miles from Big Timber to the mouth of the Bighorn River and is referred to as the middle Yellowstone. Although both cold and warm water species are present, their distribution and population dynamics are poorly understood.

Species known to occur in the vicinity of Reedpoint include rainbow and brown trout, mountain whitefish, longnose, white and mountain suckers, stonecat, shorthead redhorse, burbot, longnose dace, and mottled sculpin (Peterman 1974). Sampling from Laurel downstream to the Bighorn River produced, in addition to 13 other species, a small number of brown and rainbow trout, which became less numerous in the lower reaches.

The lower Yellowstone extends from the mouth of the Bighorn River to its confluence with the Missouri River, approximately 295 miles. This area supports a diverse aquatic ecosystem containing a wide variety of species commonly known as warm water fishes. Important sport species found in the lower Yellowstone include the paddlefish, shovelnose sturgeon, sauger, walleye, channel catfish, northern pike and burbot. In addition, large populations of nonsport species occur which represent a lightly utilized but potentially valuable resource.

There is an increase in species diversity as one progresses downstream on the Yellowstone. In Yellowstone National Park above Tower Junction, the cutthroat trout exist as the only trout species. Eleven species (five families) of fish have been recorded for the upper Yellowstone River in Montana; however, only six species (four families) are considered common or abundant. The middle river contains approximately 20 fish species representing eight families; however, sampling in this area has been very limited. The lower Yellowstone is the most diverse, with 46 species representing 12 families recorded.

METHODS

The method for obtaining instream flow protection had been determined legislatively. Section 85-2-316 MCA established the reservation process and the Yellowstone Moratorium selected the basin and determined the time period for the first effort.

The obligation of the Department of Fish and Game in this process was to represent the fish, wildlife and recreational resources of the basin for the public interest. The responsibility was to produce an application for reservation waters to cover the instream needs of 550 miles of main stem Yellowstone and 61 tributaries.

The approach adopted for reserving instream flows in the Yellowstone Basin was developed specifically for that situation. While portions of the strategy may be transferable to other basins, the overall approach may well be unique to the Yellowstone situation.

In general, the strategy adopted and followed for reserving instream flows in the Yellowstone Basin was as follows:

(1) *The basic concept underlying the reservation application strategy was to, as much as possible, obtain site specific biological data upon which to determine, support and defend recommended instream flows.*

At the time when instream flow determinations were being made for the Yellowstone River Basin, the science of instream flow methodology was in its infancy. Several methods utilized a percentage of the historical flow; however, these often lacked a specific reference to the biological attributes of a given stream. While some information was available on flow criteria for cold water fishes, very little could be found for warm water fishes or for large river habitats.

The Yellowstone Basin contained too many different sizes, categories and types of streams to lend itself well to the application of a single instream flow methodology. The problem of applying the existing percentage methodologies was in their inability to respond to specific biological or physical attributes of individual streams or stream reaches.

As an example of specific biological attributes, certain tributaries were found to be vital for spawning and recruitment for main stem fish populations. The location, timing and duration of spawning as well as the flows required varies with the species involved. Some species required only enough flow to cover spawning areas while others depended on certain flows to trigger the spawning and migration response and allow passage to spawning areas. Certain rivers or river reaches were heavily used by Canada geese for nesting. Adequate flows were necessary to provide security from predation for the island-nesting geese.

Additional instream flow considerations are the functions associated with the high flow period. Basic channel habitat features and island and gravel bar structure result from the channel-forming flows which occur during high water.

Neither the channel-forming flows nor the specific biological attributes of certain streams could be addressed in the instream flow methodologies available at the time. It was considered fundamental to the department's effort to base the instream flows, as much as possible, on specific biological functions associated with the various streams.

(2) *To rely on field personnel most familiar with a particular river or river reach for a site-specific determination of instream flows and to support and defend the flow recommendations.*

Since the basic goal was to have the instream flows reflect site specific biological conditions, the person most familiar with the area was assigned the task of determining instream flows for that area. In some cases, existing regional fisheries personnel were utilized for certain waters. In most cases, however, additional personnel were hired for specific areas.

The application for reservation of flows was submitted to the Department of Natural Resources and Conservation (the agency responsible for administration of the Water Use Act) and subjected to an adversary-type hearing before a hearings officer of the Board of Natural Resources and Conservation. During the course of the adversary hearing, the applications were subject to vigorous cross-examination by opposing parties. The advantage of having the person most knowledgeable about a particular river or stream testifying and available for cross-examination is obvious.

(3) *The lower portion of the basin (below the mouth of the Bighorn River) would receive the greatest emphasis.*

There are several reasons for concentrating on the lower portion of the basin. With the possibility of future irrigated agriculture expanding greatly and the prospect of considerable expansion of the energy industry in eastern Montana, the greatest potential for significant future depletions is in the lower basin. Since excessive downstream depletions invariably lead to upstream regulation through main stem impoundment, the best chance for maintaining the Yellowstone in a free-flowing condition (prevention of upstream dams) lies in tempering water demands on the lower river.

In addition, the lower Yellowstone Basin is a unique and valuable resource in its own right. Few, if any, large warm water riverine systems remain free-flowing. The channel form and aquatic biota reflect the free-flowing nature.

There was also a very pragmatic reason for emphasizing the lower basin. The upper Yellowstone currently enjoys a degree of protection from a 1970 instream filing under "Murphy's law," while the lower river suffers from the sum of all upstream depletions. With insufficient funding and manpower to adequately cover the entire basin, it was believed best to develop a strong instream recommendation for the lower river and proceed upstream requesting water in areas of little biological data on the basis of supply alone.

(4) *The development of a widespread and comprehensive public information program was essential for the success of the instream reservation request. There are a number of significant benefits, in addition to fish and wildlife, that accrue from adequate instream flows. To obtain a reasonable allocation for instream purposes, the instream benefits had to be identified and compared to the consumptive uses.*

A public information program was developed to inform interested parties of the reasoning behind the instream reservations, their functions and probable impacts. In addition to regional programs, a special issue of the department magazine (MONTANA OUTDOORS, Vol. 8, No. 2) and a film ("Yellowstone Concerto") were produced for this effort.

It quickly became apparent that the lower Yellowstone would become the focal point for the department's instream flow request. Competition for existing water supplies was high and a strong instream recommendation in the lower river would benefit upstream areas. It was also obvious that outside funding sources would have to be secured for the bulk of the aquatic research projects. A supervisory field project would be necessary to provide the individual projects with direction and coordination at the field level, to obtain additional biological data deemed necessary and prepare and support that portion of the reservation application pertaining to the lower Yellowstone main stem. This project (under FWS contract no. 14-16-0006-30) was designed to fulfill that need.

In meeting the previously stated objectives, the following study outline was utilized:

I. Supervision of and participation in existing baseline inventory projects

   A. Monitor and supervise data-gathering in all segments of ongoing fish and game projects in the study area

   B. Coordinate department activities with other agencies studying water quality, stream hydrology and water demands

II. Use existing methodologies and/or develop new methodologies for determining the instream flow needs of the present aquatic communities inhabiting the lower zone of the Yellowstone

   A. From ongoing studies and additional investigations establish baseline data on those species present and their distribution

B. Investigate life history requirements of selected species from the lower river

C. Define critical habitat types and associated flow requirements for various life history stages of important species

D. Develop food chain relationships of aquatic populations inhabiting the river

E. Define limiting factors affecting certain aquatic and wildlife populations under the current flow regime

III. Predict the impact of various flow alterations on the aquatic and wildlife populations inhabiting the Yellowstone River system

A. Predict changes in important hydrological parameters to be expected at various flow levels by using the Water Surface Profile Program (Bureau of Reclamation)

B. Relate important hydrological parameters (i.e. water depth, current, wetted perimeter, in addition to stream channel, bank and flood-plain characteristics) to previously determined life history requirements of selected species

C. Examine impacts of altered flow regimes and associated diversion structures on aquatic and wildlife biota of the lower Yellowstone

IV. Apply for and support appropriate flow reservations as provided for in Montana law to protect the aquatic and wildlife resource of the Yellowstone River.

This report is intended to fulfill the requirements for objectives 2, 3, and 4 (see introduction). For a more detailed discussion of instream flow needs for the lower Yellowstone River, see Peterman (1979a). For an analyses of impacts associated with water withdrawals and associated diversion structures on the lower Yellowstone, see Peterman (1979b).

RESULTS

RESERVATION APPLICATION

The Department of Fish and Game's application for reservation of Yellowstone River flows was submitted to the Department of Natural Resources and Conservation on November 1, 1976 (Mont. Dept. of Fish and Game 1976). This project was ultimately responsible for that part of the application pertaining to the lower 280 miles of the main stem Yellowstone plus the Bighorn River. Data and input were provided for the recommendation for the middle Yellowstone from Big Timber to the mouth of the Bighorn River. Introductory remarks concerning these areas were also prepared.

The lower Yellowstone, under predevelopment conditions, had an estimated mean annual flow of between 11 to 12 million acre feet (MAF) (J. Dooley, personal communication). The average annual discharge at Sidney for a 62-year period of record (1912-1974) was 9.47 MAF (USGS Surface Water Records for Montana 1974). Adjusted to the 1970 level of water depletion, the mean annual discharge at Sidney was calculated to be 8.8 MAF (NGPRP 1974).

The department's instream flow recommendations at Sidney was for 8.2 MAF. The purpose of this amount of water is to provide fish and wildlife habitat sufficient to perpetuate the diverse species comprising this natural resource at levels comparable to current existing levels. In other words, the amount of water requested is designed to maintain the "status quo" as far as the aquatic and wildlife communities of the lower river are concerned. With approximately 3.5 MAF depleted annually from the basin, the status quo represents a less than optimum condition . A detailed discussion of the recommended instream flows is presented by Peterman (1979a).

The following is a summary of the instream flows requested for maintenance of the existing aquatic and wildlife resources found in the lower Yellowstone River and its immediate riparian areas. The flows are presented for the periods March-April, May-July, August-November, and December-February. The methodology used for each period is briefly described. Where possible, the latest biological and hydraulic data from current studies on the Yellowstone River were used. The literature is cited to substantiate current data and as a supplement where specific data is incomplete. Those methodologies selected were based on their suitability to the biological conditions found on the lower Yellowstone and reflect the existing data base at the time of the application.

March-April

The March and April flows are those required for successful Canada goose reproduction on the lower Yellowstone. An estimated 30 percent of the breeding population of Canada geese in the surveyed areas of the Central Flyway portion of Montana utilize the Yellowstone River main stem for nesting (T. Hinz, personal communication; Witt 1975). An additional 15 percent nest on the Powder, Tongue and Bighorn rivers. Maintaining conditions favorable for Canada goose production on these rivers is thus highly important.

The date of initiation of the first goose nest in the spring is to some degree dependent on spring weather conditions. In most years, however, the period from March 1 through April 30 will encompass the period of goose nest initiation on the lower river (T. Hinz, personal communication). Islands are the most preferred nesting areas for Canada geese on the Yellowstone (Hook 1975, Hinz 1975).

The security of a given island for nesting depends on its isolation from predators. The farther an island is from a large island or main bank where predators occur and the deeper the water is separating the island from this area, the more secure the nest will be. Island security as related to distance from a predator source and depth of the channel separating the island from that source has been demonstrated by a number of workers (Sherwood 1965, Hammond and Mann 1956, Hook 1973).

The security of islands utilized for nesting on the lower Yellowstone is directly related to river flows. Steady, high flows throughout the nesting period will produce greater depths of channels between islands and the mainland, and therefore greater security, than low flows. Canada goose nesting studies on the lower Yellowstone in 1975 and 1976 indicate that a flow of approximately 11,000 cfs during March and April would prevent excessive nest predation on islands (Hinz 1977). Low flows (around 9,000 cfs) during the early part of the nesting period in the spring of 1976 resulted in an overall predation rate of 28 percent on 96 nests surveyed. Predation rates in individual study sections ranged from 7 percent to 57 percent. The period of low flows in the spring of 1976 (9,000 cfs) was the result to regulation of the Bighorn River by Yellowtail Dam. In 1975, higher flows (11-12,000 cfs) during the early part of the nesting season were associated with an overall predation rate of 11 percent (range 0 percent to 20 percent) (Hinz 1977). Irregular flows with peaks higher than 12,000 cfs may produce substantial nest flooding. Using a similar methodology, Merrill and Bizeau (1972) determined that uniform releases of 16,000 cfs from Palisades Dam on the Snake River prevented goose nest predation yet did not produce nest flooding.

May-June-July

To maintain the integrity of the lower Yellowstone River and its associated aquatic and wildlife populations, it is necessary for the reservation to reflect the historic flow regime. The high water period of the Yellowstone occurs during May, June and July with June commonly having the highest flows. The portion of the reservation for these months is designed to preserve a portion of the spring flood flows for maintenance of the channel formation processes and for necessary biological functions.

Channel Maintenance Flows. The channel configuration of the lower Yellowstone is characterized by channel bars, islands, braided channel areas and an accompanying divided flow pattern in such areas. The diversity of channel, island and channel bar types found in the lower river leads to a diversity of habitat types for both aquatic and terrestrial populations.

The major process in establishing and maintaining the channel form in view of its geology and bed and bank material is the annual flood characteristics of the river (Roy Koch, personal communication). The Yellowstone has a flow regime characterized by an annual spring flood which occurs during May, June and July with June commonly having the highest flows. The low water period normally occurs from late August through February with December, January and February having the lowest monthly flows.

It is the higher spring flood flows that determine the form of the channel rather than the average or low flows. Reducing these flows beyond the point where the major amount of bedload and sediment is transported would interrupt the ongoing channel processes and change the channel form (Roy Koch, personal communication. A significantly altered channel configuration would effect both the abundance and species composition of the present aquatic and terrestrial populations by altering the present habitat types.

It is generally accepted that the bank full flow during the spring flood is the most important determining factor in channel formation processes (Leopold, Wolman and Miller 1964, U.S. Bureau of Reclamation 1973). Actual field determination of the bank full stage is extremely difficult; however, the flow of the 1½ year frequency flood is considered by many to approximate the bank full flow (Leopold, Wolman and Miller 1964). Bank full flow was estimated for the Yellowstone River at Miles City and Sidney by using the 1½ year frequency flood from flood frequency relationships.

The estimated bank full flow at Miles City and Sidney is 47,000 cfs and 52,000 cfs, respectively (Roy Koch, personal communication). It is not known how long the bank full flow must be maintained. Until studies further clarify the necessary duration of the bank full flow, a conservative duration period of 24 hours was chosen.

Paddlefish Passage Flows. In addition to maintaining the physical integrity of the channel and associated islands, the high water period also functions as a stimulus for spawning of certain important sport fish and provides passage flow necessary for successful migration to traditional spawning areas.

The two notable species which spawn during the high water period are the shovelnose sturgeon and the paddlefish. The paddlefish was selected as the key species for the high water period based on its importance as a sport fish (Elser 1973), its uniqueness as a species (Vasetskiy 1971), its migratory habits (Robinson 1966, Elser 1973, Rehwinkel 1975), and the importance of the lower Yellowstone as a spawning area for the species.

Bovee (1974) also suggests use of the paddlefish as an indicator species for large rivers of the Northern Great Plains. Since the paddlefish is the largest fish in the system, its passage requirements will be the greatest. It follows that if the paddlefish passage requirements are met, then the passage needs of other species will also be met.

The paddlefish is a seasonal inhabitant of the Yellowstone. Spending most of the year in Garrison Reservoir, they ascend the Missouri and Yellowstone rivers during the spring high water period to spawn. The most commonly reported upstream migration point in the Yellowstone is at Forsyth, Montana (river mile 238). To reach Forsyth, the paddlefish must first negotiate a low head irrigation diversion dam at Intake, Montana (river mile 71.1) which acts as a partial barrier to the upstream migration of the paddlefish (Robinson 1966, Rehwinkel 1975). A side channel bypasses the irrigation diversion, however, it only contains water during the high water period.

The importance of paddlefish reaching traditional upstream areas during their spawning migration is obvious. By negotiating the diversion dam at Intake, at least an additional 166 miles of main stem Yellowstone and two major tributaries (Tongue and Powder rivers) are made available for spawning. Paddlefish have been documented in the Powder River by Jean Smith (personal communication) and in the Tongue by Elser and McFarland (1975). In addition, a popular fishery exists for the paddlefish in areas upstream from the Intake diversion at the Forsyth diversion and at the mouths of the Tongue and Powder rivers.

The Intake diversion consists of a wood, stone and steel apron over which rocks are periodically dumped to maintain an adequate diversion head (E. Denson, personal communication). Since the nature of the diversion may change with additional rock, the passage requirements of paddlefish over the diversion may also change. In addition, the possibility exists of a more efficient concrete diversion being installed at some future date. It is not presently known what flows would be required for paddlefish passage over a concrete structure.

A passage flow for paddlefish through the side channel which bypasses the Intake diversion appears to be the best measure of the necessary long-term passage flow for paddlefish. Recent studies indicate that the side channel is used for passage by the paddlefish (Peterman 1976a) and the required flows are unlikely to change with alterations in the diversion structure, provided the side channel itself is left unaltered.

For most of the year the Intake side channel is dry, flowing water only during the spring high water period. Water first enters the side channel at a flow of approximately 24,000 cfs (all flows related to the USGS gage at Sidney, approximately 40 miles downstream). Intensive sampling (electrofishing) of this side channel during the 1976 paddlefish spawning migration revealed that a flow of approximately 45,000 cfs in the main stem allows sufficient flow in the side channel for adequate passage of the paddlefish (Peterman 1976b).

Observations by others (Purkett 1961, Elser 1973) suggest that the duration of the high flows, as well as the magnitude, is significant in determining the extent of upstream migration of the paddlefish during their spawning run. Therefore, a 45,000 cfs flow at Sidney is recommended from June 8 through 30.

Paddlefish migrations are believed to be triggered, at least in part, by rising water conditions (Purkett 1961). The May portion of the reservation is designed to preserve the period of rising flows prior to high water. The flows from May 1 through 20 are set at 11,000 cfs (Miles City and Sidney) and are an extension of the goose nesting flows for March and April. By May 20, the period of nest establishment is over and the bulk of the incubation is complete. Flows for May 21 to May 31 are 20,000 cfs at Sidney and 17,000 cfs at Miles City and approximate the 70 percent exceedance level (A flow which is equaled or exceeded 70 percent of the time) for that period.

Flows requested for June 1 through 7 are 26,000 cfs at Sidney and 25,000 cfs at Miles City and again, are designed to preserve a portion of the rising stage prior to the peak of high water. The flows for the remainder of June (8 through 30) should reflect those required for paddlefish passage plus the bank full flows for maintenance of the channel forming processes.

The bank full flow at Sidney (52,000 cfs) is approximately 7,000 cfs higher than those required for paddlefish passage around Intake (45,000 cfs). After June 7, the flow should be allowed to peak at 52,000 for 24 hours. After peaking at bank full stage, the minimum flow becomes 45,000 cfs for the remainder of June. Corresponding flows for June 8 through 30 at Miles City are 47,000 cfs (peak) and 42,000 cfs (minimum).

The July flows requested represent a gradual dropping of water levels from the high water period of June to the lower water month of August. A gradual drop in water levels is designed to allow downstream migration of both larval and adult paddlefish back to Garrison Reservoir. Using 70 percent exceedance flows and a two stage drop for July, flows requested at Sidney for July 1-20 are 20,000 cfs and for July 21-31 are 10,000 cfs. Corresponding flows at Miles City are 17,000 and 9,200 for the respective time periods.

<u>August-September-October-November</u>

Flows for the August through November period are based on those required for adequate rearing purposes. The successful rearing of stream fishes is dependent upon an adequate food supply, adequate habitat areas and suitable water quality (White 1975).

The principal food of most sub-adult fishes in river systems is aquatic invertebrates (Scott and Crossman 1973, Bjorn 1940, Miller 1970a and 1970b, Schwehr 1977). While some game species in the Yellowstone switch to a piscivorous diet as adults (sauger, walleye, burbot and northern pike), others remain almost exclusively aquatic invertebrate feeders throughout their entire life (shovelnose sturgeon). Some fish, such as the channel catfish, are omnivorous as adults, feeding on both fishes and aquatic insects (Schwehr 1977, Carlander 1969).

The necessity of maintaining suitable aquatic invertebrate production is apparent. Aquatic invertebrate production takes place primarily in riffle areas in most river systems (Hynes 1970). Riffles are also the areas which are most affected by reduced discharges (Bovee 1974). It is generally accepted that the maintenance of suitable riffle conditions (for food production) will also maintain suitable pool conditions (for habitat rearing). With the flows recommended for rearing, water quality deterioration will not be a factor (J. Thomas, personal communication).

The USGS - Washington Department of Fisheries Method for recommending rearing flows in Washington is based on the assumption that rearing is proportional to food production, which in turn is proportional to the wetted perimeter in riffle areas (Collings 1974). This method has been recommended by White (1975) and is used here to determine rearing flows for the August through November period.

The primary consideration in assuring adequate rearing flows is to maximize the wetted perimeter of the streambed in the riffle (food production) areas, in view of the flow levels commonly occurring during August through November. In determining the rearing flows, representative riffle areas were located at three sites on the lower Yellowstone (Hysham - river mile 274.3, Kinsey - river mile 177.2, and Intake - river mile 71.1) and a minimum of four cross-sectional profiles surveyed at each site. Standard physical measurements were made and the hydraulic characteristics of the riffles at various flows were computed using the Water Surface Profile Program according to Spence (1975) and Dooley and Keys (1975).

In analyzing riffle areas in relation to flow, the wetted perimeter is commonly plotted against discharge. Wetted perimeter generally increases rapidly for small increases in discharge up to the point where the channel nears its maximum width (wetted perimeter extends from bank to bank). Beyond this point, wetted perimeter increases more slowly in relation to discharge. White (1975) suggests that the optimum quantity of water for rearing be selected near this inflection point.

Since the channel configuration of the Yellowstone varies from site to site, a given flow will not produce the same results at each riffle. In some riffle areas, the median flow for August through November will easily cover the riffle from bank to bank. At other riffles, an expanse of gravel separates the actual river channel from the high water bank, or an island gravel bar may be present. Under these circumstances, an unseasonably high flow would be required to extend the wetted perimeter from bank to bank. In this situation, a flow was considered which would cover only the main portion of the river channel.

At the Hysham and Kinsey sites, flows of between 6,000 and 8,000 cfs were sufficient to cover shallow riffle areas. The river immediately below the Intake diversion is believed to be a rearing area for shovelnose sturgeon and is the only location where sub-adult shovelnose can be consistently taken (Peterman and Haddix 1975). This reach commonly has large areas of exposed gravel during the August-November period and unseasonably high flows would be necessary to cover this area from bank to bank. A 7,000 cfs flow, however, would be adequate to cover the riffles in the active portion of the main channel.

In summary, a 7,000 cfs flow level appears adequate for rearing purposes (food production) at the surveyed riffles. This is only slightly less than the median flow level for August through November and would be expected to be equaled or exceeded approximately half of the time. A rearing flow of 7,000 cfs is recommended both at Miles City and Sidney since flows are very similar at the two gage sites from August through November and flow requirements from the surveyed riffles are also approximately equal.

An additional consideration in requesting adequate flows for August and September is the dissolved oxygen content of the river. If domestic, industrial, or agricultural water consumption were to expand in the Yellowstone River Basin, increases in nutrients would occur through lowered river flows (loss of dilution) and by the return to the river of nutrient "wastes." Knudson (1976), using algal assays, demonstrated that increases in nutrients (particularly phosphorus) could lead to exponential increases in algal biomass. Diel measurements demonstrated that increases in dissolved oxygen fluctuations can be expected with increases in this algal accumulation. The flow at which near critical (growth limiting) dissolved oxygen fluctuations occurred at Custer was approximately 4,000 cfs (measured) and at Miles City near 6,000 cfs (calculated). Diel dissolved oxygen and algal accumulation data indicate that the lower river has a greater potential for reaching harmful dissolved oxygen fluctuations with decreased flows than does the middle river. Flows of 7,000 cfs for rearing purposes during this period should adequately cover the dissolved oxygen consideration.

<u>December-January-February</u>

The winter months (December, January and February) commonly have the lowest flows of the year. This is also the period when the aquatic populations are under the greatest stress. Growth for most species is slowed or halted, largely a result of near 32^{o}F water and reduced production and availability of food organisms. Aquatic populations suffer their greatest natural mortality and biomass reduction during this period. The aquatic habitat available to fish and their food organisms is at its lowest point.

The riffles are commonly areas of greatest insect production in streams (Hynes 1970) and are most affected by reduced flow levels in the winter. Riffles are not only affected by reductions in wetted bottom areas, but also by anchor ice formations in winter months.

From a biological standpoint, the winter months have the least quantitative data available. While it is known that this period produces the greatest natural mortality, the exact causes of winter mortalities in a stream are poorly understood. Burbot spawn during the winter months, but the exact times, locations, and conditions are largely unknown. The habitat, movements and food habits of the important sport and forage fishes are poorly understood for the winter months. The biological effects of ice, both anchor ice and the massive ice jams which commonly occur on the lower river, remain a mystery.

In view of the critical nature of the winter period, it is felt that any significant depletion at this time could produce severe impacts on the fishes and related aquatic life and the furbearers (Martin 1977) of the lower Yellowstone.

The lack of quantitative data makes a determination of a minimum stream flow for the winter months very difficult. At present, it is felt the best protection to be provided the aquatic and wildlife resources of the lower river during this period would be to reserve the median flow for the winter months.

Median flow values for the Yellowstone River at Sidney and Miles City were computed by the U.S. Geological Survey for the period 1936-1974. Median flow values at Sidney for December, January and February are 5,680, 4,870, and 5,940, respectively. Corresponding median flows at Miles City are 5,600, 4,820, and 5,460. Median flows were rounded to the nearest 100 for the requested flows.

Summary of Flows

The requested flows for the lower Yellowstone (mouth of Bighorn River to Montana-North Dakota state line) are summarized in Table 2. The lower river was divided into two sections (section 1 - mouth of Bighorn River to mouth of Powder, section 2 - mouth of Powder River to Montana-North Dakota state line) to accommodate those months where significant variations in flow between the two USGS gage sites (section 1 - Miles City, section 2 - Sidney) occur.

Requested flows for the March - May 20 period are the same for both sections, even though in certain years significant differences in flow between the two gage sites occur.

Goose nesting studies indicate that the major nest predation problems occur in section 1 and the requested flow of 11,000 cfs for goose nesting relates to the Miles City gage (section 1). Correspondingly higher flows during March and April were not requested for section 2, since deeper channels present in section 2 minimize nest predation under lower flow conditions and 11,000 cfs is believed adequate from March to May 20 for section 2 also (T. Hinz, personal communication).

Bighorn River Flows at Mouth

The Bighorn River enters the Yellowstone near Custer, Montana and is the largest tributary to the lower river. U.S. Geological Survey records indicate an average annual contribution of approximately 30 percent to the Yellowstone (USGS 1975). During certain months, the Bighorn may contribute as much as 50 percent of the flow of the Yellowstone at Miles City. The need for maintaining adequate flows in the Bighorn is apparent. A recommended flow for the Bighorn River at its mouth is based on inflow from the Bighorn necessary to maintain the proposed instream flows for the Yellowstone.

Table 2. Flow Reservation For the Lower Yellowstone River From the Mouth of the Bighorn River to the Montana-North Dakota State Line.

Time Period	Section 1-Mouth Bighorn River to Mouth Powder River[1/] CFS	Acre-Feet	Section 2-Mouth Powder River to Mont-N.Dakota state line[2/] CFS	Acre-Feet
January	4,800	295,200	4,900	301,350
February	5,500	309,745	5,900	332,271
March	11,000	676,500	11,000	676,500
April	11,000	654,500	11,000	654,500
May 1-20	11,000	436,260	11,000	436,260
May 21-31	17,000	337,110	20,000	396,600
June 1- 7	25,000	347,025	26,000	360,906
June 8-30	42,000	1,925,493[3/]	45,000	2,066,286[4/]
July 1-20	17,000	674,220	20,000	739,200
July21-31	9,200	182,436	10,000	198,300
August	7,000	430,500	7,000	430,500
September	7,000	416,500	7,000	416,500
October	7,000	430,500	7,000	430,500
November	7,000	416,500	7,000	416,500
December	5,600	344,400	5,700	350,550
Total		7,876,889		8,206,723

1/ All flows in section 1 relate to the USGS gage at Miles City.

2/ All flows in section 2 relate to the USGS gage at Sidney.

3/ Total acre-foot figure for June 8-30 includes 1 day of bankfull flow at 47,000 cfs.

4/ Total acre-foot figure for June 8-30 includes 1 day of bankfull flow at 52,000 cfs.

Bighorn River flows were derived by comparing the occurrence of requested flows at Miles City with the corresponding discharge from the Bighorn considering a 2-day lag time. Comparisons were made on a monthly basis and data from post-regulation water years 1968 through 1975 were considered. An average percent contribution was calculated and applied to the requested flows at Miles City.

In addition, average monthly discharge figures from Yellowtail Dam were calculated and compared to the discharge figures obtained by the above method. The lower of the two figures for the comparison period was used. Requested Bighorn flows at the mouth are shown in Table 3.

All calculations for Bighorn River flows were based, for the most part, on better than average flow conditions which occurred during the post-impoundment period of record. Alternate methods of arriving at recommended flows for the lower Bighorn are being considered. As such, the lower Bighorn flows should be considered tentative and may be subject to possible revision as the data or methods indicate.

Table 3. Flow Reservation for Bighorn River at Bighorn, Montana (mouth).

Period	CFS	Acre-Feet	Period	CFS	Acre-Feet
January	3,300	202,950	July 1-20	3,800	150,708
February	3,200	179,263	July 21-31	3,200	63,456
March	4,000	264,000	August	2,800	172,200
April	3,600	214,200	September	2,600	154,700
May 1-20	3,800	150,708	October	2,700	166,050
May 21-31	3,800	75,354	November	3,100	184,450
June 1-7	5,200	72,181	December	3,200	196,800
June 8-30	5,200	237,167			

THE ALLOCATION OF YELLOWSTONE BASIN WATER

As a result of the Yellowstone Moratorium and the reservation provisions of the Water Use Act, 36 applications for reservation of Yellowstone Basin water were filed with the Department of Natural Resources and Conservation (DNRC). Diversionary requests to reserve water to irrigate 443,712 acres totaled 1,186,582 AF and were submitted by 14 conservation districts, 2 irrigation districts and 3 governmental agencies. Eight municipalities applied for 391,517 AF with Billings alone asking for 317,456 AF. Four reservations were filed for multipurpose storage projects totaling 1,175,800 AF (Summary by DNRC, Appendix C). These are total diversion figures; actual consumptive use would be less due to return flow.

Instream flow reservation applications were filed by the Department of Fish and Game (8.2 MAF) and the Department of Health and Environmental Sciences (6.6 MAF). The North Custer County Conservation District requested a uniform flow of 4,000 cfs instream during the irrigation season at their Kinsey pumping plant and the Bureau of Land Management requested instream flows on several tributary streams for riparian habitat maintenance.

Since the allocation of water in the Yellowstone Basin was considered a major action, an Environmental Impact Statement was required under Montana law. The DNRC had responsibility for preparation of the EIS and was aided by an ongoing Yellowstone Impact Study funded by the Old West Regional Commission. Various scenarios were constructed using the application requests as a data base and the hydrology modeling techniques and other information from the Yellowstone Impact Study. The Department of Fish and Game's input was solicited for fish and wildlife impacts. The draft EIS for water reservation applications was completed on December 13, 1976. After a comment period, the final EIS was released on January 31, 1977.

The applications for reservation of Yellowstone Basin water were subjected to examination through contested case hearings as specified under the combined procedures of the Montana Administrative Procedures Act and the Montana Water Use Act. The adversary hearings began on August 8, 1977 and extended through September 27, 1978. Because of the large amount of testimony anticipated, prefiled testimony was required. The actual hearings were confined to the cross-examination and redirect examination. Even so, the hearings lasted for nearly 2 months.

In defense of the application for instream flows in the Yellowstone Basin, the Department of Fish and Game produced 22 witnesses expert in a variety of disciplines and offered exhibits for inclusion into the record. The application covered the entire main stem Yellowstone in Montana (550 miles) and 62 of its tributaries.

Parties, other than applicants, appearing in support of the department's instream request included the Montana Wildlife Federation, Trout Unlimited, the Federation of Fly Fishermen, the Environmental Information Center and members of the general public. Parties, other than the applicants, opposing the department's instream request included Intake Water Company, Utah International, Inc., the Montana Power Company, the Clark Fork Valley Water User's Association and the Montana Water Development Association.

A major area of controversy centered around the department's application on the Powder River. The Powder River lies in the eastern Montana coal fields. Both Intake Water Company and Utah International, Inc. are competing to build storage projects to utilize Powder River water for industrial water marketing. Both companies hold large industrial water filings on the Powder River. These filings were held in abeyance by the Yellowstone Moratorium.

The Powder River instream reservation was vigorously defended throughout the hearing process. The Powder River has substantial regional importance as it is the only major water source east of the Tongue and south of the Yellowstone River. In addition, the Powder provides spawning areas for several populations of Yellowstone fish as well as containing resident populations of catfish and the rare sturgeon chub.

The entire hearing proceedings were incorporated into 33 volumes of testimony. On August 17 and 18, 1978, the Board of Natural Resources and Conservation heard final arguments from each party. The reservation application requests, the numerous exhibits, the 33 volumes of testimony, and the final argument transcripts were combined to form the record. The record became available to the board members for their deliberation in mid-September 1978.

The Board of Natural Resources and Conservation is a lay board consisting of seven members from a variety of backgrounds. Members of the board involved in decisions on the Yellowstone water reservations were: Cecil Weeding, Jordan, chairman; William H. Bertsche, Great Falls; Dr. Wilson F. Clark, Billings; David G. Drum, Billings; Charles L. Hash, Kalispell; J. Viola Herak, Charlo, and Dr. Roy E. Huffman, Bozeman. These individuals collectively represent the ranching, educational, legal and business communities.

The task confronting the board and the significance of their decision was enormous. To review the immense quantity of record associated with this process and justly allocate the waters of the Yellowstone Basin required perseverance, dedication and insight seldom encountered in a lay board. To more fully understand the position of the board during their deliberations and the final order establishing the Yellowstone allocation, a statement of philosophy by board member Dr. Wilson Clark which appeared in a recent article (MONTANA OUTDOORS 1979) is reproduced below:

> "In making their decisions, the board members were in general agreement on several critically important concepts and on the philosophy with which they approached the decisions. These include:
>
> (1) Board members believed their ultimate responsibility was to the people of Montana in general and to those in the Yellowstone River Basin in particular. Such responsibility transcended the reservation requests of the many applicants, each of which considered its own reservation paramount. The board endeavored to take a long-range overview, to put the applications into perspective and, as far as possible, to reconcile the many conflicting and sometimes excessive water reservations requests.
>
> (2) Board members were fully aware of the complexity of this case. From the outset, it was evident that the newness of the reservation concept, the stringency of the regulations and the magnitude of the task of preparing applications put a heavy burden on the applicants

and on the Department of Natural Resources and Conservation charged with reviewing the applications. The board viewed those difficulties with understanding and did not take an ultralegalistic stance.

(3) Board members were inclined to grant, in each case, the largest reservation that could be justified by the application, the record, the evidence and the available water supply. The decisions are not etched on stone, since the law requires a thorough review of the reservations at least once every 10 years, at which time the board may "modify" the reservation.

(4) Board members believed that every encouragement should be given to development of off-stream storage with pumping from the Yellowstone River during high-water periods. We saw off-stream storage as the only way high-water flows could be made available for later release during low-flow periods to benefit all down-stream users and in-stream reservations.

(5) Board members also believed they had an obligation to foster, encourage and suggest conservation measures for the use of water. The prodigal-use attitudes of the past are no longer tenable. Efficiency of water delivery and use, conservation in use and a sense of personal responsibility must be developed by each user. Only through such changes in attitudes leading to changes in habits and patterns of use will we leave a water legacy for future generations of Montanans.

In making decisions within this framework, board members recognized that Montana is a state where natural resources - especially water - support both economic activity and nonmarket uses. This has produced a classic conflict between economic values and environmental values. The availability of water is central to the natural resources situation in most instances. Board members had the responsibility of achieving a balanced allocation of water in the Yellowstone River Basin to meet the needs of consumptive uses and in-stream reservations. The major problem was to ensure realistic consideration of all factors that should enter into the water reservations."

The court ordered further extensions of the moratorium to allow the board time to make reasonable deliberations. On December 15, 1978 the order of the Board of Natural Resources and Conservation establishing water reservations in the Yellowstone Basin was signed. A summary of the board's order granting the Yellowstone reservations has been compiled by the Department of Natural Resources and Conservation and is included as Appendix C. The monthly distribution of flows granted by the board for the Yellowstone River at Sidney is shown in Table 4.

Table 4. Instream Reservation Established for the Yellowstone River at Sidney, Montana by Order of the Board of Natural Resources and Conservation, December 15, 1978.

Month	CFS	AF/Y
January	3,738	229,831
February	4,327	240,281
March	6,778	416,711
April	6,808	405,031
May	11,964	735,528
June	25,140	1,495,644
July	10,526	647,090
August	2,670	164,166
September	3,276	194,917
October	6,008	369,377
November	5,848	347,920
December	3,998	245,814
Total Reservation		5,492,310

ANALYSIS OF MORATORIUM AND PROJECT EFFECTIVENESS

Moratorium

The Yellowstone River Moratorium (Section 85-8-601 *et seq*. MCA, formerly Section 89-9-103 *et seq*. RCM 1947) passed by the 1974 Montana Legislature became effective in March 1974. This act created a 3-year moratorium on major water allocations and was to last until March 1977. It also mandated that reservations of water within the basin must be established as rapidly as possible for the preservation and protection of existing and future beneficial uses, thus setting the stage for the allocation of the waters of the basin.

Before the end of the moratorium period, rules for reservation applications had to be formulated; the reservation applications had to be completed and filed; an EIS on the reservations had to be prepared, commented on, revised and finalized; hearings to examine the reservation applications had to be held; the record had to be compiled; the board members had to review the record; and finally, the decision on the allocation of the waters had to be made. The deadline for submitting the reservation applications was November 1, 1976.

This allowed approximately 2.6 years for the applicants to prepare and submit an application. The remaining 5 months were for preparation of an EIS, holding of hearings, compilation of the record and the deliberation and decision by the board.

From a strictly administrative standpoint, it became readily apparent that the 3-year time period of the moratorium was going to be inadequate for the allocation of Yellowstone Basin waters. The moratorium was extended legislatively and through court appeal to December 31, 1978 and the final decision of the board was made on December 15, 1978 - 4 years, 9 months after the imposition of the moratorium.

In retrospect, it would appear that the minimum time period for allocation of waters in a basin the size of the Yellowstone should be approximately 5 years. This is considered a minimum time period for several reasons. First, a great deal of impact analysis had already been initiated in the lower portion of the basin as a result of a substantial grant from the Old West Regional Commission. This information was available for impact analysis and was responsible for the short time required for preparation of the EIS. The time scale for preparation of the EIS may have been different had the necessary corollary information not been available.

Second, the wheels of justice can seldom be hurried, and the water allocation hearing is no exception. If a similar adversary hearing process is adhered to and major opponents to the applications are present, it is unlikely that the hearing process can be conducted in less than a year's time. Smaller basins with less complicated filings may, however, require less time.

Lastly, the Yellowstone Basin was an opportune location for securing outside funding to obtain the needed information. The appeal of the Yellowstone as the nation's last, large free-flowing river, the national energy problems, the intense interest in the Fort Union coal fields as the solution to that problem, and the growing interest in instream flows enabled the department to obtain funding from a variety of sources including federal government agencies, regional commissions and the private industrial sector.

This ability to secure outside funding enabled the department to carry out a broad program of biological research necessary for even a rudimentary understanding of the Yellowstone ecosystem. The department's chief source of funding comes from the sales of hunting and fishing licenses with a major portion of the license dollars supplemented on a percentage basis with federal fish and wildlife funding. With this type of a funding base, it is difficult, if not impossible, to greatly accelerate funding in one area without sacrificing other portions of the department's overall program. Without outside funding, a substantive determination and support of a reservation for instream flows on the lower Yellowstone could not have been accomplished as quickly. Without outside funding a 3-year moratorium period would have been inadequate for determining supportable instream flows for the lower river.

In summary, it appears that a 5-year moratorium period would have better suited the allocation of waters in the Yellowstone Basin than a 3-year period.

Other drainages, however, may vary significantly from this figure depending on the requirement of the existing laws, their size, existing data base, availability of funding and degree of competition for the waters.

Project Effectiveness

In the initial stages of the effort to determine and secure instream flows for the lower Yellowstone, the department was faced with a number of unrelated research projects in the Yellowstone Basin, a critical need for several additional projects in a variety of disciplines and the responsibility to secure additional funding for those projects. It was apparent that a separate position was needed to supervise, coordinate and supplement the existing field research activities.

This project was solicited to fulfill the need for an on-site field supervisory position. The basic functions of this project are as follows:

(1) Supervision of existing baseline inventory and research projects.

This project provided the supervision necessary to insure that contract inventory and research projects were successfully carried out and contractual obligations were met. Those portions of the various projects relating to stream flow were stressed and results closely monitored for use in the instream flow request.

(2) Supplementation of existing projects.

The need for additional information not produced from existing projects became evident. This project developed proposals and sought funding to generate short-term projects to obtain the needed data. In addition, this project undertook certain portions of field research directly related to stream flow and not covered under other studies.

(3) Coordination of department activities with other agencies.

This project coordinated the department's instream flow efforts on the Yellowstone with other agencies. In some cases, the department solicited funds, or information on technical expertise in related disciplines. In other cases, the department supplied instream flow data to other agencies for impact assessments, water management planning efforts and instream flow determinations.

(4) Determination of instream flow needs for lower Yellowstone River through the use of existing and/or new methodologies.

The determination of instream flows for the lower Yellowstone River has been previously summarized and can be found in more detail in Peterman (1979a).

(5) Application for and support of an appropriate flow reservation as provided for in Montana law.

This project applied for and supported a reservation for flows in the lower Yellowstone River through the process previously described. The duration of this project extended beyond the actual application deadline and provided the opportunity for input into the EIS, to present supportive testimony at the hearings, to analyze and comment on opponents' testimony and to aid in preparation and review of the department's findings.

(6) Prediction of impacts of various flow alterations on the aquatic and wildlife populations inhabiting the lower Yellowstone River.

Since this project had supervisory control over a multidisciplinary effort on the lower Yellowstone, it is the obvious source of an impact analyses summary. This will be included in a later report.

The effectiveness of a coordinated multidisciplinary approach in dealing with an instream flow problem on a large river is evident from the department's instream flow reservation request and subsequent defense for the lower Yellowstone. For various segments of the year, waterfowl nesting conditions, paddlefish passage requirements, channel morphology considerations, riparian wildlife habitat areas, minimum dissolved oxygen levels and adequate aquatic insect production were all given consideration in the development of a desirable annual flow regime.

Although indicator species were selected for various periods of the year, the concept of relying on a single "key" species for the entire year was considered undesirable. With a system as large and complex as the Yellowstone's, the reliance on a single species' needs for flows would result in a significant loss of ecological sensitivity for the total system. The multidisciplinary approach allowed several aspects of the ecosystem to be addressed in relation to stream flow and levels of stream flow identified which are necessary for certain hydraulic functions to occur. This approach also allows for a broader analysis of impacts to occur, since several disciplines are involved.

SUMMARY OF YELLOWSTONE RIVER STUDIES

During the course of the water allocation process on the Yellowstone and the varous impact assessments associated with coal development in eastern Montana, a large number of articles, reports and publications were generated. A partial compilation of reports pertinent to the biology of the main stem of the Yellowstone or to the department's effort to reserve instream flows in the Yellowstone Basin is presented below:

(1) Bahls, L. L. 1974. Microflora of the Yellowstone River. I. Microflora in the plankton at the confluence of the Bighorn River. Preliminary report to the Montana Department of Fish and Game, Environment and Information Division, Helena. 14 pp.

(2) Bahls, L. L. 1975. Microflora of the Yellowstone River: A progress report. Proceedings of the Fort Union Coal Field Symposium, Vol. 2, pp. 195-198.

(3) Bahls, L. L. 1976a. Microflora of the Yellowstone River. II. Perturbations through Billings. Paper prepared for presentation to the thirty-sixth annual meeting of the Montana Academy of Sciences, April 23-24, Havre. 13 pp.

(4) Bahls, L. L. 1976b. Microflora of the Yellowstone River. III. The Non-Diatom Algae. Environmental Quality Council, Helena. 37 pp.

(5) Berg, R. K. 1975. Fish and game planning, upper Yellowstone and Shields river drainages. Fisheries inventory and planning, Fed. Aid in Fish & Wildl. Rest. Proj. No. FW-3-R, Job I-a. pp. 1-125.

(6) Elser, A. A. 1973. Southeast Montana Fisheries Investigations. Montana Dept. of Fish and Game, Job Prog. Rept., Fed. Aid in Fish & Wildl. Rest. Proj. No. F-30-R-9, Job 1-b. 18 pp.

(7) Elser, A. A., B. McFarland and D. Schwehr. 1977. The effects of altered stream flow on fish on the Yellowstone and Tongue rivers, Montana. Technical rept. no. 8, Yellowstone Impact Study. Final rept to the Old West Reg. Comm., Mont. Dept. of Nat. Res. and Cons., Helena. 180 pp.

(8) Graham, P. J. and R. F. Penkal. 1978. Aquatic environmental analysis in the lower Yellowstone River. For U.S. Dept. of Inter., Bur. of Reclamation by Mont. Dept. of Fish and Game, Ecological Services Div., Helena. 102 pp.

(9) Haddix, M. H. and C. C. Estes. 1976. Lower Yellowstone River fisheries study. Final Rept. for U.S. Dept. of Interior, Bureau of Reclamation by Montana Dept. of Fish and Game., Environment and Information Division, Helena. 81 pp.

(10) Hinz, T. 1977. The effect of altered stream flow on migratory birds of the Yellowstone River Basin, Montana. Technical Rept. no. 7, Yellowstone Impact Study. Final rept. to Old West Regional Comm. Mont. Dept. of Nat. Resources and Conservation, Helena. 107 pp.

(11) Knudson, K. and D. Swanson. 1976. Effects of decreased water quantity and increased nutrient addition on algal biomass accumulation and subsequently, the dissolved oxygen balance of the Yellowstone River. Progress Rept., Montana Dept. of Fish and Game. Env. & Inf. Div., Helena. 22 pp.

(12) Knudson, K. 1979. Effects of decreased water quality and increased nutrient addition on algal biomass accumulation, and subsequently the dissolved oxygen balance of the Yellowstone River. Final rept., Mont. Dept. of Fish and Game, Ecological Services Div., Helena (in progress).

(13) Marcuson, P. 1973. Southcentral Montana fisheries study. Mont. Dept. of Fish and Game, Job Prog. Rept., Fed. Aid in Fish & Wildl. Rest. Proj. No. F-20-R-16, Job I-a. 11 pp.

(14) Martin, P. R. 1977. The effect of altered stream flow on furbearing mammals of the Yellowstone River Basin, Montana. Tech. Rept. No. 6, Yellowstone Impact Study. Final Rept. to Old West Reg. Comm. Mont. Dept. of Nat. Res. and Conservation, Helena. 79 pp.

(15) Montana Department of Fish and Game. 1976. Application for reservation of water in the Yellowstone Basin. Mont. Fish and Game Comm., Helena. 300 pp.

(16) Montana Department of Fish and Game. 1977. MONTANA OUTDOORS/Special Issue. Vol 8, No. 2. 45 pp.

(17) Newell, R. L. 1976. Yellowstone River study. Final rept. to Intake Water Company by Mont. Dept. of Fish and Game, Helena. 259 pp.

(18) Newell, R. L. 1977. Aquatic invertebrates of the Yellowstone River Basin, Montana. Tech. Rept. no. 5, Yellowstone Impact Study. Final rept. to Old West Reg. Comm, Mont. Dept. of Nat. Res. and Cons., Helena. 109 pp.

(19) Peterman, L. G. and M. H. Haddix. 1975. Preliminary fishery investigations on the lower Yellowstone River. Proceedings of the Fort Union Coal Field Symposium, Vol. 2, pp. 97-111.

(20) Peterman, L. G. and M. H. Haddix. 1975. Lower Yellowstone River fishery study, Prog. Rept. No. I. For U.S. Dept. of Interior, Bureau of Reclamation by Mont. Dept. of Fish and Game, Env. and Information Div., Helena. 56 pp.

(21) Peterman, L. G. 1977a. Lower Yellowstone fishery. MONTANA OUTDOORS/ Special Issue, Vo. 8, No. 2. pp. 33-35.

(22) Peterman, L. G. 1977b. Ample flows for fish and wildlife. MONTANA OUTDOORS/Special Issue, Vol. 8, No. 2. pp. 39-41

(23) Peterman L. G. 1978. Electrofishing large rivers - the Yellowstone experience. Presented at the Electrofishing Workshop, St. Paul, Minn., Montana Dept. of Fish and Game, Ecological Services Div., Helena. 30 pp.

(24) Peterman, L. G. 1979a. Instream flow needs for the lower Yellowstone River, Montana. Mont. Dept. of Fish and Game, Ecological Services Div., Helena. (In progress)

(25) Peterman, L. G. 1979b. Impacts associated with altered stream flow patterns, water withdrawals and associated diversion structures on the lower Yellowstone River, Montana. Mont. Dept. of Fish and Game, Ecological Services Division, Helena. (In progress)

(26) Rehwinkel, B. J. 1975. The fishery for paddlefish at Intake, Montana during 1973 and 1974. Unpubl. thesis (M.S.) Mont. St. Univ., Bozeman. 37 pp.

(27) Schwehr, D. J. 1976. Distribution and diversity of aquatic macroinvertebrates of the middle Yellowstone River. Unpubl. thesis (M.S.) Univ. of Montana, Missoula. 136 pp.

(28) Schwehr, D. J. 1977. Temperature related zonation of aquatic insects in the Yellowstone River. Environment and Information Div., Montana Dept. of Fish and Game, Helena. 23 pp.

(29) Stadny, K. L. 1971. Factors affecting the distribution of stoneflies in the Yellowstone River, Montana. Unpubl. PhD dissertation, Mont. State University, Bozeman. 36 pp.

(30) Stevenson, H. R. 1979. Southwestern Montana fisheries investigations. Job. Prog. Rept., Fed Aid in Fish & Wildl. Rest. Proj. No. F-9-R-26, Job 1-c. 31 pp.

Referring to the studies mentioned above, this contract had responsibility for the supervision of Berg (1975), that portion of Elser, McFarland and Schwehr (1977) dealing with the Yellowstone River, Graham and Penkal (1978), Haddix and Estes (1976), Newell (1976), Newell (1977), Schwehr (1976) and Schwehr (1977). The following reports were produced as a result of this contract: Peterman (1977a, 1977b, 1978, 1979a and 1979b). Portions of studies by Hinz (1977), Knudson and Swanson (1976), and Martin (1977) were monitored closely and results incorporated into the section of the department's application for reservation of flows produced by this contract. In addition, field support was provided to Bahls (1975, 1976a and 1976b).

DISCUSSION

The concept of reserving waters for future beneficial uses and instream values represents a significant departure from traditional western water law. In the past, Montana's resources have been exploited in a rapid and often destructive manner, as in the quest for gold in the 1800's and early hard rock mining operations. Under the old water law, the water resources of the state faced the possibility of similar exploitation. When the water resources of the Yellowstone Basin were threatened by large scale industrial depletions in the early 1970's, a moratorium on water filings over 20 cfs was imposed, and most of the unallocated waters in the basin were reserved for future beneficial uses under a revised water use act. The very fact that the reservation principle was introduced into the Montana Water Use Act and subsequently carried out in the Yellowstone Basin reflects a desire by the people that the water resources of Montana be developed in an orderly and environmentally sensitive fashion. The orderly development of a region's water resources carries with it a control on the degree and rate of exploitation of other resource developments dependent on water.

On December 15, 1978 the order was signed by the Board of Natural Resources and Conservation reserving uncommitted waters of the Yellowstone Basin for future uses. While the full significance of this allocation will not be known for many years, several implications of the reservation process itself and the instream reservations in particular are readily apparent.

The reservation process, as it applied to the Yellowstone Basin, provided a means to obtain a secure water supply for those future consumptive water users who were least likely to be competitive for future high priced water. These users, principally agricultural and municipal in nature, were unable to satisfy their future needs through the water use permit system since water use permits generally address only immediate or present uses of water. These two entities typically do not have the financial resources necessary to undertake costly water development projects or to pay high prices for water. Their future well-being depends on securing a certain amount of water for reasonably defined growth and development.

The reservation process also provided a means for securing water for minimum instream flows. As a result of the board's order of December 15, 1978, a minimum instream flow for rivers and streams in the Yellowstone Basin was established. This establishment of a minimum flow provides benefits to a broad segment of society.

Adequate minimum flow levels in a stream ensure existing water right holders of a secure future water supply. Without a secure minimum flow, existing water right holders during low water periods or under extremely depleted conditions may have difficulty exercising their existing rights.

Montana water law prioritizes water rights on a first in time, first in right basis. The burden of proof and responsibility for obtaining that right, however, lies with the senior right holder. The practicality of the matter suggests that by the time the existing right user notifies junior users, takes the junior user to court if necessary, and obtains a court order to halt the junior user from obtaining water, either the critically low flow period has passed or the irrigation season is over. The guarantee of a minimum stream flow throughout the basin benefits holders of existing water rights by insuring that the source of supply for their water is not severely depleted.

Each of the 13 applicant conservation districts applied for minimum flows to reasonably protect water levels at diversion sites of present irrigators. Minimum instream flows protect existing water rights by avoiding the necessity of expensive reconstruction of pumping facilities, ditches, canals, or other facilities which would result from depleted flow conditions.

Securing a minimum instream flow contributes to the maintenance of water quality in a river. The concentration of pollutants and consequently the degree of pollution in a river is generally dependent on the flow of that river. In the Yellowstone, this is particularly true for the concentration of total dissolved solids (TDS). Generally, the lower the stream flow, the higher the concentration of total dissolved solids and other pollutants. High TDS levels not only affect water quality for domestic purposes, but high concentrations of salts in the water also adversely affect use for irrigation. The establishment of adequate instream flows will prevent certain pollution problems from becoming critical because of excessive depletions and dewatering.

The establishment of minimum instream flow levels affects water availability for appropriators junior to the reservations. When flow levels drop below the specified minimums, appropriators junior to the instream reservation will be required to cease withdrawals.

In the Yellowstone Basin, the annual discharge and pattern of runoff is generally dependent on the mountain snowpack and its rate of thawing, although it is influenced to a certain extent by precipitation throughout the remainder of the year. In a free-flowing river system, a given flow will occur with a certain frequency that can be determined from historical flow records. The minimum instream flows granted for the lower Yellowstone can be expected to be equaled or exceeded approximately 85 percent of the time. In other words, appropriators junior to the instream flow reservation could expect to obtain a reliable water supply approximately 85 years out of 100.

For efficient, full service irrigation systems, a good water supply is usually considered to be necessary about 8 years out of 10 on the average (DNRC 1976). In addition to the irrigation reservations approved in the Yellowstone Basin, the instream flow levels granted for the lower Yellowstone should allow for a certain degree of additional irrigated agricultural development.

For industrial energy development in the lower basin, the situation is different. Coal conversion facilities usually require a constant source of water. Industrial water applications junior to the established instream flow reservation cannot be guaranteed of a constant, uninterrupted supply of water. They would have to (1) provide offstream storage capabilities sufficient to maintain the operation of their plant through extended drought periods, or (2) modify the design of the plant cooling systems to require less water, or both.

With a minimum instream flow established, water availability may well become a limiting factor before the streams and rivers actually become severely depleted. The establishment of minimum instream flows, rather than a severely depleted stream situation, becomes the impetus for water conservation alternatives.

From a fish and wildlife perspective, the implications of the instream reservations and the allocation process on the Yellowstone are indeed significant. Under provisions of the Water Use Act in Montana, it is no longer necessary to abdicate water or critical riparian habitat areas dependent upon water to competing resource users due to a lack of legal standing. The unprecedented opportunity to defend aquatic and riparian habitat on the basis of water quantity ultimately leads to the preservation of population abundance as well as species diversity.

The results of the Yellowstone water allocation proceedings reveal that, at least in Montana, the aquatic and wildlife resources are recognized as serious competitors for the unallocated surface waters of the state. Successful competition in this arena by wildlife agencies can significantly aid in the effort to preserve the state's aquatic and riparian habitats.

The successful implementation of the instream flows granted in the Yellowstone Basin may very well help ensure its continuance as one of the nation's last remaining free-flowing rivers. The major impetus for main stem impoundment on the Yellowstone would come from severe annual depletions mainly affecting the lower river.

A depleted condition in the lower basin would impact municipalities depending on the Yellowstone for a water supply, irrigated agriculture, which is quite extensive in the lower basin, and also industrial development. By tempering water demands throughout the basin, the threat of main stem impoundment on the upper Yellowstone can be minimized and the distinct possibility exists that the Yellowstone will remain in a free-flowing condition.

The Yellowstone Basin currently enjoys a significant measure of protection for its aquatic and riparian wildlife communities as a result of the order of the Board of Natural Resources and Conservation establishing instream flow reservations. The protection, however, is neither absolute nor for all time. The order is subject to legal appeal through the courts and litigation could extend for many years. In addition, the reservations must be reviewed at least once every 10 years, but this probably will occur every 5 years as presently ordered. The reservations granted may be modified by the board during the review process.

To maintain the instream protection for the basin, the reservation must be supported and defended during the review process and a number of conditions required by the board for obtaining additional data must be met. While the reservations on the Yellowstone are not the final word in instream flow protection for the basin, they set a significant precedent for future instream considerations and the development of a river ethic. Perhaps most significant is the fact that the instream reservations substantially strenthen the opportunity to preserve the Yellowstone River in a free-flowing condition and maintain its characteristic channel configuration with its associated aquatic, wildlife and riparian communities.

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Appendix A. Section 89-801 (RCM 1947)

89-801. What waters may be appropriated. (1) The right to the use of the unappropriated water of any river, stream, ravine, coulee, spring, lake, or other natural source of supply may be acquired by appropriation, and an appropriator may impound flood, seepage, and waste waters in a reservoir and thereby appropriate the same.

(2) But the unappropriated waters of the streams and portions of streams hereafter named shall be subject to appropriation by the fish and game commission of the state of Montana in such amounts only as may be necessary to maintain stream flows necessary for the preservation of fish and wildlife habitat. Such uses shall have a priority of right over other uses until the district court in which lies the major portions of such stream or streams shall determine that such waters are needed for a use determined by said court to be more beneficial to the public. The unappropriated water of other streams and rivers not named herein may be set aside in the future for appropriation by the fish and game commission upon consideration and recommendation of the water resources board, fish and game commission, state soil conservation committee, the state board of health and approval of the legislature.

(a) Big Spring creek in Fergus county from its mouth in T17N, R16E, Sec. 26 to the state fish hatchery in T14W, R19E, Sec. 5.

(b) Blackfoot river in Missoula and Powell counties from its mouth in T13N, R18W, Sec. 21 to the mouth of its North Fork in T14N, R12W, Sec. 9.

(c) Flathead river in Flathead county from its mouth in T27N, R20W, Sec. 34 to the Canadian border in T37N, R22W, Sec. 4 & 5, including the section commonly known as the North Fork of the Flathead river.

(d) Gallatin river in Gallatin county from its mouth in T2N, R2E, Sec. 9 to the junction of its East Fork in T2N, R3E, Sec. 27.

(e) Gallatin river in Gallatin county (commonly called the West Gallatin) from the Beck & Border ditch intake in T2S, R4E, Sec. 14 to where it leaves the Yellowstone Park boundary in T9S, R5E, Sec. 18.

(f) Madison river in Madison and Gallatin counties from its mouth in T2N, R2E, Sec. 17 to Hebgen dam in T11S, R3E, Sec. 23.

(g) Missouri river in Lewis and Clark, Broadwater and Cascade counties from its junction with the Smith river in T19N, R2E, Sec. 9 to Toston dam in T4N, R3E, Sec. 7.

(h) Rock creek in Granite and Missoula counties from its mouth in T11N, R17W, Sec. 12 to the junction of its East and West Forks in T6N, R15W, Sec. 31.

(i) Smith river in Cascade and Meagher counties from the mouth of Hound creek in T17N, R3E, Sec. 20 to the Fort Logan bridge in T11N, R5E, Sec. 31.

(j) Yellowstone river in Stillwater, Sweetgrass and Park counties from the North-South Carbon-Stillwater county lines in T3S, R21E, Sec. 10 to where it leaves the Yellowstone Park boundary in NT9S, R8E, Sec. 23.

(k) Middle Fork Flathead river in Flathead county from its mouth in T31N, R19W, Sec. 7 to the mouth of Cox creek in T27N, R12W, (a nonsectioned township).

(l) South Fork Flathead river in Flathead and Powell counties from its mouth at Hungry Horse reservoir in T26W, R16W, Sec. (unknown), to its source at the junction of Danaher and Youngs creeks in T20W, R13W, Sec. 36.

Continued

Appendix A (Continued)
Instream Water Filings Under Sec. 89-801 (RCM 1947)

Stream	Section	Amount (CFS)	Time Period
Big Spring Creek	From its mouth in T17N, R16E, Sec. 26 to mouth of Cottonwood Creek T16N, R17E, Sec. 28	150	1/1 to 12/31
Big Spring Creek	From mouth of Cottonwood Cr. in T16N, R17E, Sec. 28 to State Fish Hatchery in T14N, R19E, Sec. 5	120	1/1 to 12/31
Blackfoot River	From its mouth in T13N, R18W, Sec. 21 to mouth of Clearwater River in T14N, R14W, Sec. 16	2000 650	4/1 to 8/31 9/1 to 3/31
Blackfoot River	From mouth of Clearwater River in T14N, R14W, Sec. 16 to the mouth of its N. Fk. T14N, R12W, Sec. 9	1750 350	4/1 to 8/31 9/1 to 3/31
Flathead River	From its mouth in T27N, R20W, Sec.24 to the mouth of its S. Fk. T30N, R19W, Sec. 6	8125 3625	4/1 to 9/30 10/1 to 3/31
Flathead River	From mouth of S. Fk Flathead River T30N, R19W, Sec.6 to mouth of Middle Fk. Flathead River T31N, R19W, Sec.7	5000 1950	4/1 to 9/30 10/1 to 3/31
Flathead River	Flathead River from the mouth of Middle Fk. T31N, R19W, Sec. 7 to the mouth of Bowman Creek T35N, R21W, Sec. 22	2625 987.5	4/1 to 9/30 10/1 to 3/31
Flathead River	From mouth of Bowman Creek T35N, R21W, Sec. 22 to the Canadian Border	1500 625	4/1 to 9/30 10/1 to 3/31
Middle Fork Flathead River	From its mouth in T31N, R19W Sec. 7 to the mouth of Bear Creek in T29N, R15W, Sec. 31	2325 970	4/1 to 9/30 10/1 to 3/31

Continued

Appendix A (Continued)

Stream	Section	Amount (CFS)	Time Period
Middle Fork Flathead River	From the mouth of Bear Cr. in T29N, R15W, Sec.31 to the mouth of Cox Cr. in T27N, R21W, Sec. 28	180 75	4/1 to 9/30 10/1 to 3/31
South Fork Flathead River	From its mouth in T30N, R19W, Sec. 6 & 7 to Hungry Horse Dam in T30N, R19W, Sec. 22 & 27	3000 1400	4/1 to 9/30 10/1 to 3/31
South Fork Flathead River	From the Powell-Flathead Co. line to its mouth at Hungry Horse Reservoir	1750 600	4/1 to 9/30 10/1 to 3/31
South Fork Flathead River	From its confluence with Danaher and Young's creeks in T20N, R13W, Sec. 36 to the Flathead-Powell Co. line	270 100	4/1 to 9/30 10/1 to 3/31
Gallatin River	From its mouth in T2N, R2E, Sec.9 to its junction with the East Gallatin River in T2N, R3E, Sec. 27	1500 800	5/1 to 8/31 9/1 to 4/30
Gallatin River (commonly called West Gallatin River)	From the Beck-Border Ditch intake in T2S, R4E, Sec. 14 to Yellowstone Park boundary in T9S, R5E, Sec. 18	800 400	5/1 to 8/31 9/1 to 4/30
Madison River	From Ennis Lake to its mouth in T2N, R2E, Sec.17	1500 1200	6/1 to 12/31 1/1 to 5/31
Madison River	From mouth of W. Fork of Madison River in T11S, R1E, Sec. 10 to Ennis Lake	1400 900	6/1 to 12/31 1/1 to 5/31
Madison River	From Hebgen Dam to the confluence of the W. Fk of the Madison River in T11S, R1E, Sec. 10	500	1/1 to 12/31
Missouri River	Missouri River from mouth of Smith River in T19N, R2E, Sec. 9 to the Cascade-Lewis & Clark line in T16N,R2W,Sec.20	3000	1/1 to 12/31

Continued

Appendix A (Concluded)

Stream	Section	Amount (CFS)	Time Period
Missouri River	From the Lewis & Clark-Cascade Co. line in T16N, R2W, Sec. 19 to Holter Dam in T14N, R3W, Sec.8	3000	1/1 to 12/31
Missouri River	From Canyon Ferry Reservoir to Toston Dam in T4N, R3E, Sec. 7	4000 3000	5/16 to 9/14 9/15 to 5/15
Rock Creek	From its mouth in T11N, R17W, Sec. 12 to the mouth of Ranch Cr. in T10N, R17W, Sec. 25	300 1250	9/1 to 3/31 4/1 to 8/31
Rock Creek	Rock Creek from mouth of Ranch Cr. in T10N, R17W, Sec.36*to the junction of the east & west forks in T6N, R15W, Sec. 31. *(Not Sec. 36 but Sec. 25)	210 1125	8/1 to 3/31 4/1 to 7/31
Smith River	Smith River from the mouth of Hound Cr. in T17N, R3E, Sec.20 to the Cascade Co. line in T15N, R3E, Sec. 36	150 400	9/1 to 3/31 4/1 to 8/31
Smith River	Smith River from Meagher-Cascade Co. line in T14N, R3E, Sec. 1 to Fort Logan Bridge T11N, R5E, Sec. 31	125 150	9/1 to 3/31 4/1 to 8/31
Yellowstone River	From the mouth of the Still-water River to the North-South Carbon-Stillwater Co. lines T3S, R21E, Sec. 10	2600 1500	4/16 to 10/31 11/1 to 4/15
Yellowstone River	From the mouth of Stillwater River to the mouth of the Boulder River	2200 1300	4/16 to 10/31 11/1 to 4/15
Yellowstone River	From mouth of Boulder River to mouth of Tom Miner Creek	2000 1200	4/16 to 10/31 11/1 to 4/15
Yellowstone River	From Yellowstone Park boundary to mouth of Tom Miner Cr. in T7S,R7E, Sec.30	800	1/1 to 12/31

Appendix B. (Yellowstone Moratorium)

Yellowstone River Basin

85-2-601. Statement of legislative findings and policy. The legislature, noting that appropriations have been claimed, that applications have been filed for, and that there is further widespread interest in making substantial appropriations of water in the Yellowstone River basin, finds that these appropriations threaten the depletion of Montana's water resources to the significant detriment of existing and projected agricultural, municipal, recreational, and other uses and of wildlife and aquatic habitat. The legislature further finds that these appropriations foreclose the options to the people of this state to utilize water for other future beneficial purposes, including municipal water supplies, irrigation systems, and minimum flows for the protection of existing rights and aquatic life. The legislature, pursuant to its mandate and authority under Article IX of the Montana constitution, declares that it is the policy of this state that before these proposed appropriations are acted upon, existing rights to water in the Yellowstone basin must be accurately determined for their protection and that reservations of water within the basin must be established as rapidly as possible for the preservation and protection of existing and future beneficial uses.

History: En. 89-8-103 by Sec. 1, Ch. 116, L. 1974; R.C.M. 1947, 89-8-103.

85-2-602. Definitions. Unless the context clearly requires otherwise, in this part the following definitions apply:

(1) (a) "Application" means an application for a permit under part 3 of this chapter to appropriate surface water from any source of supply within the basin for either or both of the following purposes:

(i) a reservoir with a total planned capacity of 14,000 acre-feet or more; or

(ii) for a flow rate greater than 20 cubic feet of water per second.

(b) The term also includes an application for approval under 85-2-402 to change the purpose of use.

(2) "Basin" means the Yellowstone River basin.

(3) "Reservation" means a reservation of water provided for by 85-2-316.

History: En. 89-8-104 by Sec. 2, Ch. 116, L. 1974; R.C.M. 1947, 89-8-104(Intro.), (2) thru (4).

85-2-603. Suspension of action. (1) The department may not grant or otherwise take any action on an application until one of the following first occurs:

(a) The board of natural resources and conservation makes a final determination on the applications for reservations of water in the basin filed before January 1, 1977, in accordance with 85-2-316;

(b) A final determination of existing rights has been made in the source of supply in accordance with part 2 of this chapter; or

(c) January 1, 1978; however, if a court stays or enjoins the continuance of proceedings on any pending application for reservation of water in the basin filed before January 1, 1977, and such stay or injunction prevents the board from making a final determination on such application before January 1, 1978, the court shall extend this date by the length of delay incurred. The court may not extend this date beyond January 15, 1979.

(2) A reservation established before such application for permit is granted is a preferred use over the right to appropriate water pursuant to the permit, and the permit, if granted, shall be issued subject to that preferred use.

History: En. 89-8-105 by Sec. 3, Ch. 116, L. 1974; amd. Sec. 1, Ch. 26, L. 1977; R.C.M. 1947, 89-8-105.

Continued

85-2-604. When department may suspend action. The department may suspend action on applications not meeting the definition of application in 85-2-602 if it determines, after a public hearing conducted under the contested case procedures of the Montana Administrative Procedure Act, that the cumulative impact of those applications, if granted, would be contrary to the policies and purposes of this part. If the department suspends action on such applications, the provisions of 85-2-603 apply.

History: En. 89-8-106 by Sec. 4, Ch. 116, L. 1974; R.C.M. 1947, 89-8-106.

85-2-605. Reservations. The department may apply for reservations and shall, as rapidly as possible, assist other appropriate state agencies and political subdivisions in applying for reservations within the basin. The United States or any agency thereof may apply for reservation of water in the basin under 85-2-316 for beneficial use of that water in the state of Montana. Particular emphasis shall be given to applications to reserve water for agricultural, municipal, and minimum flow purposes for the protection of existing rights and aquatic life.

History: En. 89-8-107 by Sec. 5, Ch. 116, L. 1974; amd. Sec. 10, Ch. 416, L. 1977; R.C.M. 1947, 89-8-107.

85-2-606. Application of part. This part applies to applications currently pending with the department, as well as applications filed with the department after March 11, 1974.

History: En. 89-8-108 by Sec. 6, Ch. 116, L. 1974; R.C.M. 1947, 89-8-108.

85-2-607. Utility facilities. This part does not apply to applications to appropriate water for use by a utility facility for which a certificate of environmental compatibility and public need is granted pursuant to the Montana Major Facility Siting Act.

History: En. 89-8-109 by Sec. 7, Ch. 116, L. 1974; R.C.M. 1947, 89-8-109.

85-2-608. Certain changes of use allowed. Notwithstanding any provision of this part, the department may approve a change of purpose of use to agricultural, irrigation, domestic, and municipal uses if it determines that the change is not contrary to the policies and purposes of this part.

History: En. 89-8-110 by Sec. 8, Ch. 116, L. 1974; R.C.M. 1947, 89-8-110.

APPENDIX C

Summary of Yellowstone River Basin Water Reservations

Thomas L. Judge, Governor

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION DNRC

Ted J. Doney, Director

Under the 1973 Montana Water Use Act, state and federal agencies, as well as political subdivisions of the state may apply to the Board of Natural Resources and Conservation to reserve water for existing or future beneficial uses, or to maintain a minimum flow, level, or quality of water. Before an order reserving water may be adopted, the applicant must establish to the Board's satisfaction:

1) the purpose of the reservation;
2) the need for the reservation;
3) the amount of water necessary for the purpose of the reservation; and,
4) that the reservation is in the public interest.

A water reservation when adopted becomes a water right. However, if objectives of the reservation are not being met, the Board can later modify that water right. In addition, if the use of the reserved water requires diversion or storage, progress must be shown, over time, towards completion of those facilities. Such progress is to follow a previously submitted plan.

The Yellowstone Moratorium suspended action on applications for water in the Yellowstone basin for any use over 20 cubic feet per second or 14,000 acre-feet in storage. Seven applications, all of which are primarily for industrial water use were suspended. By law water use permits now pending will begin to be processed by DNRC on January 1, 1979. The priority date of any new water right subsequently approved will reflect the original date of application. Since the application for reservations were approved before the end of the Moratorium the suspended permits are junior to the reservations if a controversy arises between them.

The language of the Moratorium emphasized the need for reserving water in the Yellowstone Basin for the protection of existing and future beneficial water use; particular emphasis was given to the reservation of water for agricultural and municipal needs as well as guaranteed minimum flows for the protection of existing rights, future uses, water quality, and aquatic life.

Reservation applications were received from the 14 conservation districts, the Department of State Lands, the Bureau of Land Management, the Bureau of Reclamation, the Montana Department of Natural Resources and Conservation, the Montana Department of Health and Environmental Sciences, the Department of Fish and Game, and 8 municipalities.

WATER RESOURCES DIVISION
ORRIN FERRIS, ADMINISTRATOR
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FLOODPLAIN MANAGEMENT (406) 449-2864 · ENGINEERING (406) 449-2864 · WATER PLANNING (406) 449-2872 · TECHNICAL SERVICES (406) 449-2872 · WATER RIGHTS (406) 449-3634 · WEATHER MODIFICATION (HIPLEX) (406) 449-2872

32 SOUTH EWING, HELENA, MONTANA 59601

In August and September of 1977 hearings were held in Billings and Helena on the water reservation applications. The Board of Natural Resources and Conservation adopted the final order for the reservations on December 15, 1978.

Enclosed is a summary of the water reservations. The instream flows are summarized by year, but a breakdown by month is available from the Department of Natural Resources and Conservation.

The priority of the water reservations is as follows: 1) municipalities; 2) instream flows upstream of the Bighorn River; 3) irrigation; 4) instream flows downstream of the Bighorn River; and 5) storage.

If you have any further questions do not hesitate to contact us.

Sincerely,

Gary Fritz, Chief
Water Planning Bureau

Enclosures

GF/lh

MUNICIPAL RESERVATIONS

		Request				Reservation			
Applicant	Application Number	Population	Year	Maximum Diversion (cfs)	Annual Diversion (acre-feet)	Population	Year	Maximum Diversion (cfs)	Annual Diversion (acre-feet)
City of Livingston	9940-r43B	35-40,000	2000	20.8	15,060	23,000	2007	6.23	4,510
City of Big Timber	8476-r43BJ	3,000	2000	6.19	4,482	3,000	2000	.50	365
City of Columbus	9937-r43Q	4,500	2007	3.6	2,606	4,500	2007	1.22	883
City of Laurel	9939-r43QJ	35,000	2007	23.2	16.830	30,000	2007	9.88	7,151
City of Billings	9646-r43Q	600,000	2070	1190	317,456	206,000	2010	56.9	41,229
City of Miles City	9954-r42K	20,000	2000	30	21,720	20,000	2000	4.0	2,889
City of Glendive	9938-r43M	38,800	2007	17.62	12,756.9	18,000	2007	4.53	3,281
Town of Broadus	8476-r43BJ	4,000	1995	.84	605	4,000	1995	.84	605
TOTAL					391,516.9				60,913

MULTIPURPOSE RESERVATION

Applicant	Application Number	Project	Request acre-feet	Request cfs	Reservation acre-feet	Reservation cfs
U.S. Bureau of Reclamation	12330-r42KJ	Cedar Ridge Offstream Storage	121,800	450	121,800	B
U.S. Bureau of Reclamation	12331-r43Q	Buffalo Creek Offstream Storage	65,000	450	68,700	B
U.S. Bureau of Reclamation	12332-r42K	Sunday Creek Offstream Storage	539,000	2100	539,000	B
Montana Department of Natural Resources and Conservation	9942-r42C	Tongue River Reservoir	450,000	A	383,000	B
TOTAL			1,175,800		1,112,500	

A) Maximum Diversion rate was not specified in request

B) Maximum Diversion rate was not specified by the Board of Natural Resources and Conservation

INSTREAM RESERVATIONS

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
		MONTANA FISH AND GAME COMMISSION	
Yellowstone River at Sidney	8,206,723	80th percentile flow minus consumptive reservations	5,492,310
Powder River at Locate	198,350	90th percentile flow	95,201
Rosebud Creek (Cottonwood Cr. to Yellowstone River)	11,452	80th percentile flow	
Tongue River (inlet to reservoir)	237,900	Approximately equal to request	244,799
Tongue River (at mouth)	243,090	75 cfs	54,289
Hanging Woman (from mouth of the east fork to the Tongue River)	1,883	Historic minimum monthly flows	A
Otter Creek (from the mouth of Bear Creek to Tongue River)	7,268	Historic minimum monthly flows	A
Pumpkin Creek (from the mouth of Deer Creek to the Tongue River)	1,943	Historic minimum monthly flows	A
Bighorn River at Bighorn	2,484,187	Approximately equal to request	2,477,987
Yellowstone River at Miles City	7,876,889	80th percentile flow minus consumptive reservations	5,578,892
Yellowstone River at Billings	4,041,913	B	3,914,455
Clarks Fork of the Yellowstone	504,020	90th percentile flow Jan-May and Oct-Dec and 70th percentile flow June-Sept.	A

Montana Fish & Game Commission (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Butcher Creek (Headwaters to West Butcher Creek to mouth)	14,540	85th percentile flow	A
Willow Creek (F.S. Boundary to the Cooney Reservoir)	22,562	85th percentile flow	A
Red Lodge Creek (Custer N.F. to the Cooney River)	35,175	85th percentile flow	A
Clear Creek (headwaters to the mouth)	13,874	85th percentile flow	A
Dry Creek (Headwaters to the mouth)	1,448	85th percentile flow	A
Rock Creek (Custer N.F. to mouth)	Instantaneous flow	85th percentile flow	A
Sage Creek (Headwaters to Crow Reservation)	10,866	85th percentile flow	A
Bluewater Creek (Headwaters to the mouth)	18,823	85th percentile flow	A
Stillwater River at mouth	438,827	90th percentile flow	379,795
Castle Creek (mouth to 1,500 ft above Picket Pin Creek)	16,526	85th percentile flow	A
Picket Pin Creek (mouth to mouth of Swamp Creek)	5,546	85th percentile flow	A
West Fork of the Stillwater (mouth to Castle Creek to Sweetgrass-Stillwater County Line to Tumble Creek)	57,530	85th percentile flow	A
Little Rocky Creek (mouth to F.S. Road #1414 Crossing)	3,380	85th percentile flow	A

Montana Fish and Game Commission (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
West Fishtail Creek (East Fishtail Creek to Richmond-Kennedy Ditch)	4,586	85th percentile flow	A
East Fishtail Creek (West Fishtail Creek to its east fork)	3,740	85th percentile flow	A
Fishtail Creek (from the confluence of East and West Fishtail Creeks to mouth)	8,563	85th percentile flow	A
West Rosebud Creek (Custer N.F. Boundary to Fiddler Creek to mouth)	61,537	85th percentile flow	A
East Rosebud Creek (Custer N.F. Boundary to West Rosebud Creek)	55,809	85th percentile flow	A
Bridger Creek (from headwaters to the Krone Ditch headgate)	3,268	90th percentile flow	A
Lower Deer Cr. (from Headwaters to Interstate 90 bridge)	5,615	90th percentile flow	A
Upper Deer Cr. (from Headwaters to point upstream from the Interstate 90 bridge)	5,615	90th percentile	A
Sweet Grass Creek (from F.S. Boundary to mouth)	27,218	90th percentile flow	A
Boulder River at Big Timber	217,990	B	195,163
Boulder River at Contact	148,947	B	137,120
East Boulder River (at its mouth)	23,157	B	23,146
West Boulder River (at its mouth)	74,096	B	74,853
Big Timber Creek (at its mouth)	28,701	B	28,267

Montana Fish and Game Commission (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Mission Creek (mouth to Little Bear Draw)	Instantaneous Flow	50th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec and 90th percentile flow for May, June, July, Aug, Sept.	A
Little Mission Creek	Instantaneous Flow	50th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec and 90th percentile flow for May, June, July, Aug, Sept.	A
Shields River (near Wilsall)	Instantaneous Flow	90th percentile flow	21,764
Shields River (near Clyde Park)	21,214 (Partial Year) Instantaneous Flow (Remainder of Year)	90th percentile flow	35,434
Smith Creek (from mouth to Bitter Cr.)	Instantaneous Flow	50th percentile Flow	A
Flathead Creek (from mouth to Muddy Cr, from Muddy Cr. to Cache Cr. to South Fork of Flathead Cr)	Instantaneous Flow	50th percentile Flow	A
Cottonwood Cr. (from mouth to Little Cottonwood Cr. and from Little Cottonwood Cr. to Trespass Cr.)	Instantaneous Flow	50th percentile flow	A
Rock Creek (from mouth to F.S. west boundary in Sec. 8 from F.S. West Boundary in Sec. 8 to Smeller Creek)	Instantaneous Flow	50th percentile flow	A

Montana Fish and Game Commission (continued)

Stream	Request (acre-feet/year	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Brackett Creek (from mouth to Sheep Cr. and Sheep Cr. to Skunk Cr. and Skunk Cr. to one mile up North, Middle and South Forks)	9,676 (Partial Year) Instantaneous (remainder of year)	50th percentile flow	A
Bear Creek (from mouth to the mouth of North Fork of Bear Creek and North Fork of Bear Creek to Fish Creek)	Instantaneous flow	20th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec and 50th percentile flow for May, June, July, Aug, Sept.	A
Cinnabar Creek (from mouth to Cottonwood Creek and Cottonwood Cr. to F.S. Boundary at T8S, R7W, Sec. 32)	Instantaneous Flow	"	A
Mol Heron Creek (from mouth to Cinnabar Creek and Cinnabar Creek to Yellowstone Park Boundary)	Instantaneous Flow	"	A
Cedar Creek (from mouth to second Fork of Cedar Creek and from second fork to north fork)	Instantaneous Flow	"	A
Tom Miner Creek (from mouth to Canyon Cr. and Canyon Cr. to Trail Cr.)	Instantaneous Flow	"	A
Rock Creek (from mouth to Steele Creek)	Instantaneous Flow	"	A
Big Creek (from mouth to Millfork Creek and Millfork Cr. to Bark Cabin Cr.)	Instantaneous Flow	"	A

Montana Fish and Game Commission (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Six Mile Creek (from mouth to the north fork of Six Mile Cr.)	Instantaneous Flow	20th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec. and 50th percentile flow for May, June, July, Aug, Sept.	A
Fridley Creek (from mouth to Miller Cr. and from Miller Cr. to Needle Cr.)	Instantaneous Flow	"	A
Eight Mile Creek (from mouth to Big Draw and Big Draw to North Fork of Eight Mile Cr.)	Instantaneous Flow	"	A
Mill Creek (from mouth to the East Fork)	Instantaneous Flow	"	A
Trail Creek (from mouth to West Pine Cr. and West Pine Cr. to the south boundary of Section 35)	Instantaneous Flow	"	A
Suce Creek (from mouth of Lost Cr.)	Instantaneous Flow	"	A
Coke Creek (from mouth to Minor Cr.)	Instantaneous Flow	"	A
Billman Creek (from mouth to mouth of Coke Creek to Fork South of NE corner, Sec. 20.)	Instantaneous Flow	"	A
Fleshman Creek (from mouth to Perkins Cr.)	Instantaneous Flow	"	A

Montana Fish and Game Commission (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Armstrong Spring Creek (from mouth to origin)	Instantaneous Flow	10th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec and 50th percentile flow for May, June, July, Aug, Sept.	A
Nelson Spring Creek (from mouth to origin)	Instantaneous Flow	"	A
McDonald Spring Creek (from mouth to northern Boundary of Sec. 32)	Instantaneous Flow	"	A
Emigrant Spring Creek	Instantaneous Flow	"	A
Yellowstone River (Gardiner through Livingston)	935,007 (Partial year) Instantaneous (remainder of year)	20th percentile flow for Jan, Feb, Mar, Apr, Oct, Nov, Dec, and 95th percentile flow for May, June, July, Aug, Sept. plus dominant discharge	1,879,013

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
	MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES		
Yellowstone River at Sidney	6,643,000	80th percentile flow, less consumptive reservation	5,492,310
Yellowstone River at Miles City	5,015,000	80th percentile flow, less consumptive reservations	5,578,892
Yellowstone River at Billings	3,184,000		3,914,455
Yellowstone River at Livingston	C	20th percentile flow of the Yellowstone River for Jan, Feb, Mar, Apr, Oct, Nov, Dec and 95th percentile flow for May, June, July, Aug, Sept.	1,879,013
	NORTH CUSTER COUNTY CONSERVATION DISTRICT		
Yellowstone River (at Miles City)	4,000 cfs	Equal to request	4,000 cfs
	U.S. BUREAU OF LAND MANAGEMENT		
Hay Creek	2,172	B	723
Allison Creek	2,172	B	723
Dry Creek	2,172	B	723
Horse Creek	2,172	B	723
North Fork of Bowers Creek	2,172	B	723
Bell Creek	2,172	B	723

U.S. Bureau of Land Management (continued)

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Records
Wright Creek	2,172	B	723
South Fork of Wright Creek	2,172	B	723
Ranch Creek	2,172	B	723
Williams Creek	2,172	B	723
Prairie Creek	2,172	B	723
Mizpah Creek	2,172	B	723
Sheep Creek	2,172	B	723
North Fork of Sheep Creek	2,172	B	723
South Fork of Sheep Creek	2,172	B	723
Horse Creek	2,172	B	723
Meyers Creek	2,172	B	723
Locate Creek	2,172	B	723
Archdale Creek	2,172	B	723
Snow Creek	2,172	B	723
Cole Creek	2,172	B	723
Bolocate Creek	2,172	B	723
Dislocate Creek	2,172	B	723
Ten Mile Creek	2,172	B	723
Little Powder River	7,240	B	2,172

U.S. Bureau of Land Management (continued

Stream	Request (acre-feet/year)	Reservation	Approximation of Reserved Flow in Acre-Feet Per Year Based on Existing Streamflow Record
Powder River	144,795	Request Denied	Request Denied
Tongue River	94,117	Request Denied	Request Denied
Clarks Fork of the Yellowstone River	18,099	Request Denied	Request Denied
Boulder River	18,099	Request Denied	Request Denied
Bridger Creek	3,620	Request Denied	Request Denied
Stillwater River	18,099	Request Denied	Request Denied
Upper Deer Creek	3,620	Request Denied	Request Denied
Lower Deer Creek	3,620	Request Denied	Request Denied
Yellowstone River	144,795	Request Denied	Request Denied
Bluewater Creek	3,620	Request Denied	Request Denied
Bear Creek	3,620	Request Denied	Request Denied
Cottonwood Creek	3,620	Request Denied	Request Denied
Five Mile Creek	3,620	Request Denied	Request Denied
Sage Creek	3,620	Request Denied	Request Denied
Crooked Creek	3,620	Request Denied	Request Denied

A) Flows not estimated by Board of Natural Resources and Conservation

B) General percentile flows not specified by Board of Natural Resources and Conservation

C) DHES did not request instream flows at Livingston

IRRIGATION RESERVATIONS

APPLICANT	APPLICATION NUMBER	REQUEST			RESERVATION			
		ACRES	MAXIMUM DIVERSION (cfs)	ANNUAL DIVERSION (acre-feet)	ACRES	MAXIMUM DIVERSION (cfs)	ANNUAL DIVERSION (acre-feet)	
Park Conservation District	10004-r43B	36,570	752.6	108,143	21,664	445.9	64,125	
Sweet Grass Conservation District	9948-r42M	18,510	438.7	55,822	15,313	363.4	46,245	
Stillwater Conservation District	9935-r43QJ	5,290	122.1	16,755	5,290	122.1	16,755	
Carbon Conservation District	9944-r43D	21,015	274.2	47,557	10,034	130.7	22,676	
Yellowstone Conservation District	9949-r42M	24,835	378.2	57,963	24,835	378.2	57,963	
Big Horn Conservation District	9952-r43P	9,645	151	21,200	9,645 (Total)	143.8	21,219	(Total)
					9,175		20,185	
					470		1,034 B	(Tongue River Dam)
Treasure Conservation District	10003-r42KJ	7,645	129	19,978	7,035	118.6	18,361	
Rosebud Conservation District	10005-r42KJ	37,360	585	94,129	37,360 (Total)	540.7	94,147	(Total)
					34,525		87,003	
					2,835		7,144 B	(Tongue River Dam)
North Custer Conservation District	9947-r42M	44,980	1306.4	117,856	18,330 (Total)		39,375	(Total)
					7,440		18,301	(Yellowstone River)
					6,785		10,177	(Powder River)
					4,605		10,897 B	(Tongue River Dam)
Powder River Conservation District	9943-r42J	34,365	1289.2	89,240	9,120		13,680	
Prairie County Conservation District	9946-r42M	22,536	567.5	68,467	22,536 (Total)	567.5	68,467	(Total)
					22,241		68,024	(Yellowstone River)
					295		433	(Powder River)
Dawson County Conservation District	9951-r42M	18,127	330.8	45,855	18,127	330.8	45,855	

APPLICANT	APPLICATION NUMBER	ACRES	MAXIMUM DIVERSION (cfs)	ANNUAL DIVERSION (acre-feet)	ACRES	MAXIMUM DIVERSION (cfs)	ANNUAL DIVERSION (acre-feet)
Richland County Conservation District	9945-r42M	21,710	354.2	45,620	21,710	354.2	45,620
Little Beaver Conservation District	11349-r42L&M	13,300	A	25,566			12,773 (Total) 4,273 (Irrigation) 6,000 (Waterspreading) 1,300 (Stockwatering Ponds) 700 (Recreational Ponds)
Huntley Project Irrigation District	9942-r43Q	4,000	92	27,372.3	Request Denied		
Buffalo Rapids Irrigation District	6294-r42M	41,306	171.16	124,435	3,100	16.55	11,997
Montana Department of State Lands	9931-r	7,143	143.64	21,429	4,763 (Total) 4,286 477	86.11	14,289 (Total) 12,858 1,431B (Tongue River Dam)
Montana Department of State Lands	9933-r	10,875.62	218.03	30,898	9,366 (Total) 9,236 130		26,279 (Total) 25,889.78 390B (Tongue River Dam
Montana Department of State Lands	9934-r	10,270	A	15,078	10,730		15,078
Bureau of Land Management	12334-01-r	1,992	12.287	2,924.24	1,992	12.287	2,924
Bureau of Land Management	12334-02-r	8,738	75.76	17,476	8,738	75.76	17,476
Bureau of Land Management	12334-03-r	549	4.60	1,098	Request Denied		
Bureau of Reclamation	12333-r43P	42,950	862	131,700	Request Denied		
TOTAL		443,711.62		1,186,581.54	260,318		655,304.78

A) Maximum diversion rate not specified in request.

B) Water reservation was given to DNRC but water is to be used by this reservant.