

Instream Flow Protection Strategies for Wild and Scenic Rivers



A Technical Report of the Interagency Wild and Scenic Rivers Coordinating Council

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Reader's Guide

This paper is designed to provide tools and strategies to protect the instream flow needs of Wild and Scenic Rivers ("WSRs" plural or "WSR" singular). The term "instream flow" used in this paper simply refers to the amount of water flowing in a river. The Wild and Scenic Rivers Act of 1968(WSR Act) directs river managers to take steps within their authority to protect the flows necessary to protect and enhance the water quality and outstandingly remarkable values (ORVs) of each designated river. Significantly, Section 13(c) of the WSR Act includes express language that establishes a federal reserved water right for WSRs. A principal objective of this paper is to explain the significance of this language and how it relates to long term protections for instream flows consistent with the intent of the WSR Act.

This technical paper provides river managers with basic concepts, tools and strategies needed to incorporate instream flow considerations into planning, monitoring, data collection and outreach to stakeholders. In addition, this paper outlines specific steps river managers may take to protect and enhance instream flows, which includes working within state-based water rights administrative frameworks.

DISCLAIMER: The paper does not represent agency or interagency policy, nor should it be construed as either legal advice or the legal opinion of the United States Government or any of its departments or agencies. If a federal employee has questions regarding the application of the information in this paper to a specific situation or seeks to implement any of the strategies described, it is recommended that they contact their agency leadership, Interagency Wild and Scenic Rivers Coordinating Council agency representatives, and/or agency counsel, including to confirm that any proposed plan of action conforms with current agency guidance.

The intended audience for this paper is the entire range of professionals who manage and work on federally designated wild and scenic rivers. Broadly speaking, these professionals will be referred to as "river managers" in this paper. Professionals who are in leadership and staff management positions will benefit from the overview provided in the first four sections of this paper: Wild and Scenic Rivers Act Provisions Related to Flow Protection, Introduction to State Water Allocation Systems, Introduction To Federal Reserved Water Rights, and Development of a Flow Protection Strategy. Staff-level professionals, such as hydrologists and recreation planners, will benefit from the first four sections, but should also review the section entitled: Development of a Flow Prescription. Staff-level professionals should also review the Appendix A, which includes three flow protection case studies and conceptual examples of procedures used to quantify instream flow needs. All audiences will find useful references in Appendix B: Federal Agency Policy Direction.

All audiences are encouraged to use the following overarching principles when implementing flow protection strategies:

- Federal agencies possess multiple legal authorities that can be used to assist in the protection of flow dependent WSR values, but those authorities are not comprehensive. Water administration and management generally falls under the jurisdiction of state governments, so federal agencies must consistently participate within state administrative frameworks and anticipate state actions that could affect water allocation on a stream, to effectively protect instream flows. In addition, coordination with local governments and local entities (e.g., water conservancy and irrigation districts, municipal water suppliers and water user associations), may also be required for successful protection, since these entities often operate water delivery and management facilities that directly affect flow rates on designated rivers. Finally, Federally and State Recognized Tribes (tribes) may have a role in flow protection, and river managers should reach out to tribes to learn of their institutional and legal interests in flows.
- Early engagement and continued long-term coordination with federal agency legal counsel and the U.S. Department of Justice is essential for advocating and protecting instream flows. In many states, water rights are considered a property right that must be established, maintained and protected through specific legal procedures that are set forth in state statutes. Each state has different requirements, therefore understanding opportunities for participation in state water right processes is important for developing instream flow protections. Every water right in the watershed and in the groundwater contributing area to the stream has multiple legal elements that must be carefully analyzed to determine the potential effect on instream flows. Water rights processes often take years, and in some cases decades, to be resolved. In addition, if many years elapse between WSR designation and commencement of flow protection efforts, additional water uses may be established by other parties during this period. There may be reluctance among agency managers and river stakeholders to challenge these new water uses, even if they are clearly degrading the ORVs.
- Creating a plan for collection of flow data is essential and should be one of the earliest steps taken toward protecting instream flows. Baseline information representing the hydrologic condition of the river at the time of designation is necessary to establish a scientific foundation for water right claims and to develop instream flow protection strategies. Ideally, a long-term data collection plan should be specifically outlined and implemented as part of a Comprehensive River Management Plan (CRMP).
- Education, outreach and cooperation with stakeholders is essential for meeting flow protection goals. Most stakeholders are unfamiliar with the flow protection provisions of the WSR Act and will need education about those provisions to productively engage in the development of flow protection strategies. Specifically, most stakeholders are not familiar with the concept of federal reserved water rights for WSRs, how federal reserved water rights interact with water allocation systems run by state governments, and how federal reserved water rights differ from instream flow protection programs run by state governments. In addition, federal reserved water rights for WSRs, which have been created since the WSR Act was signed into law in 1968, generally hold lower priority in the water allocation systems run by state governments, where most water uses

were initiated well before 1968. WSRs typically hold higher water right priorities only in remote locations where there is little human water use. Therefore, effective flow protection is sometimes not possible by relying exclusively on federal reserved water rights, and other stakeholders, including state governments, must be engaged to initiate complementary strategies.

Wild and Scenic Rivers Act Provisions Related to Flow Protection

Certain provisions of the WSR Act (16 U.S.C. §§ 1271–1287) provide direction for river managers in the protection and enhancement of WSR values and those sections are highlighted below.¹

Section 1(b) (§1271) describes the fundamental purpose of the WSR Act as follows:

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit of present and future generations.

Section 7 (§1278(b)) prohibits federal assistance for water resources projects that would adversely affect WSR values, including free-flowing condition:

...no department or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which [a Wild and Scenic] river was established, as determined by the Secretary charged with its administration.

Section 10(a) (§1281(a)) includes direction for river managers to not only protect and enhance or improve a river's values:

Each component of the national wild and scenic rivers system shall be administered in such a manner as to protect and enhance the values which caused it to be included in said system...

Direction to work cooperatively with states and their subdivisions in the administration of a WSR is provided in the following sections:

Section 10(e) (§11281(e)):

The federal agency charged with the administration of any component of the national wild and scenic rivers system may enter into written cooperative agreements with the Governor of a State, the head of any State agency, or the appropriate official of a political subdivision of a State for state or local government participation in the administration of the component.

Section 11(b)(1) (§1282(b)(1))

The Secretary of the Interior, the Secretary of Agriculture, or the head of any other Federal Agency, shall assist, advise, and cooperate with the States of their political subdivisions, landowners, private organizations, or individuals to plan, protect, and manager river resources.

¹ The entire text of the Wild & Scenic Rivers Act, along with technical papers addressing implementation of key portions of the act, can be found at www.rivers.gov.

Such assistance, advice and cooperation may be through written agreement or otherwise. This authority applies within or outside of a federally administered area and applies to rivers which are components of the national wild and scenic rivers system and to other rivers.

Direction on state and federal jurisdiction over the waters of any stream is found in Section 13 of the WSR Act:

Section 13(b) (§1284(b))

The jurisdiction of the States and the United States over waters of any stream included in the national wild, scenic or recreational river area shall be determined by established principles of law. Under the provisions of this Act ... Nothing in this Act shall constitute an express or implied claim or denial on the part of the Federal Government as to exemption from State water laws.

Section 13(c) (§1284(c))

Designation of any stream or portion thereof as a national wild, scenic, or recreational river area shall not be construed as a reservation of the waters of such streams for purposes other than those specified in this Act, or in quantities greater than necessary to accomplish these purposes.

Section 13(d) (§1284(d))

The jurisdiction of the States over waters of any stream included in a national wild, scenic or recreational river area shall be unaffected by this Act to the extent that such jurisdiction may be exercised without impairing the purposes of this Act or its administration.

Introduction to State Water Allocation Systems

Riparian, Prior Appropriation, and Hybrid Systems

State water law systems are a product of the hydrologic landscapes in which they are located. States in the eastern United States, where there is a relatively abundant supply of water, follow a system known as the “riparian doctrine.” States in the western United States, where water supplies are much more limited, follow the “prior appropriation doctrine.” There are ten states which include both wet and dry landscapes within their borders, and those states use a “hybrid” system that incorporates elements of the riparian doctrine and prior appropriation doctrine.

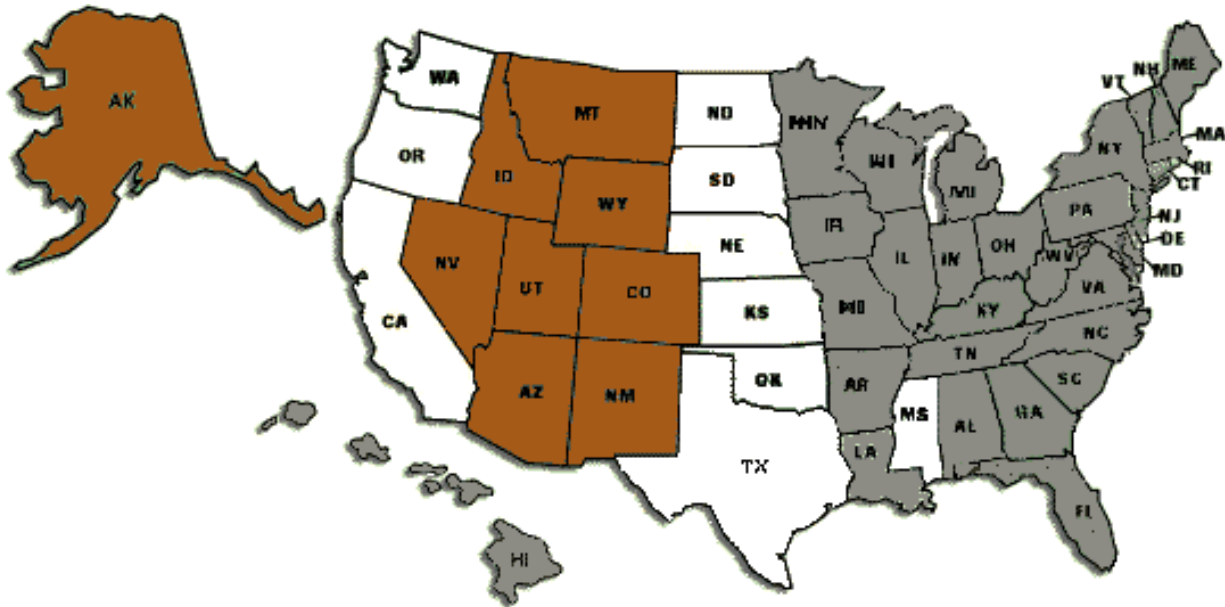


Figure 1. Map showing which states use the riparian doctrine, prior appropriation doctrine, or hybrid water allocation systems. States shaded in gray use the “riparian” doctrine for water allocation, states shaded in brown use the “prior appropriation” doctrine, and states shaded in white use a “hybrid” system with elements of the riparian and prior appropriation doctrines.

In states that operate under a riparian doctrine, any landowner abutting a stream or other body of water has the right to make “reasonable use” of water from the stream. “Reasonable use” is defined as a quantity and timing of water use that does not infringe upon reasonable use of water by other riparian landowners. In a riparian system, shortages are shared among all water users during dry periods. However, some riparian states have law specifying that certain uses, such as irrigation or domestic water supply, receive higher priority than other uses during times of shortage.

Many parties who use water in riparian doctrine states have no formalized, legally-binding document that authorizes the water use. Instead, the water use is authorized exclusively by ownership of riparian lands, and that water right cannot be lost by non-use. However, most riparian doctrine states are moving toward water rights permitting systems, where all water uses or proposed large uses of water, above a certain flow rate or volume specified by the state, are required to obtain a water use permit

from the state government. These permitting systems help ensure that large water users do not infringe upon the water rights of riparian landowners or infringe upon the state's "public trust" responsibilities, which are discussed below.

In states that operate under the "prior appropriation doctrine," water is allocated on the principle of "first in time, first in right." Every water right is assigned a priority date, based upon the date on water use first occurred. Older water rights are called "senior" water rights, while newer water rights are called "junior" water rights. During dry periods, shortages are not shared in prior appropriation systems. Instead, the water right with the earliest priority date receives the entire amount of water allocated to it before the next priority date receives any water. States operating under the prior appropriation doctrine may or may not invest substantial resources in active, real-time administration of water right priorities. Accordingly, to protect their interest, water rights owners may have to spend substantial resources measuring their water use, reporting water shortages to state authorities, and seeking enforcement through administrative or litigation processes.

Under the prior appropriation doctrine, water right ownership may be separated from land ownership. Water rights are considered real property interests that can be bought, sold and transferred just like other real property. In addition, water rights can be lost through long-term non-use through processes known as "forfeiture" (non-use of a water right for statutorily defined period of time) or "abandonment" (owner does not utilize the water right, and in certain states, does not demonstrate any intent to use the water right). This principle is frequently referred to as "use it or lose it." Finally, all states that use prior appropriation systems require that water must be used without waste, meaning that water must be applied to a designated beneficial use and that the user can use only the amount needed to achieve that purpose. Waste of water can result in abandonment of the wasted amount.

In states that utilize hybrid systems, the first settlement of the state typically occurred in wetter areas, where a riparian system was sufficient for allocating the relatively abundant supply. However, as settlement of drier areas commenced, populations grew, and competition for water became more intense, it became apparent that there was a need for a different system that would allow water to be used in locations distant from riparian properties. In hybrid states, historic riparian water rights exist alongside "appropriative" water rights established pursuant to statutorily defined processes. An ongoing challenge for water allocation agencies in hybrid states is determining how much water is available for new appropriations, given existing riparian claims, interstate water compacts, public trust obligations, and previously established appropriative claims.

Elements of a Water Right

Regardless of whether a water right is established in a riparian, prior appropriation, or hybrid system, it will possess the elements described below. Some of these elements are not precisely defined until the water right is “adjudicated,” a process explained in the next section.

- Quantity – expressed as a flow rate and/or a specific water volume.
- Water Source – surface water (stream, lake, spring, etc.) or groundwater (a specific aquifer).
- Priority – specifies when the water may be diverted from the water source, relative to other water rights. In some states, certain types of beneficial uses, described below, may have priority over other beneficial during times of shortage.
- Beneficial use – specifies the types of uses to which water may be applied, such as domestic, irrigation, industrial, wildlife, or recreation.
- Point of Diversion – location where water is removed from the source, typically expressed as a legal description and/or with GPS coordinates.
- Place of Use – location where the water is applied, typically expressed as a legal description and/or with GPS coordinates.
- Period of Use – portion of the year when water can be applied to the specified use.

It is important to note that there is substantial variation among state laws concerning what uses of water are considered “beneficial uses,” especially concerning environmental uses of water that might be important for designated rivers. Some states do not recognize instream flows, recreation uses, or maintenance of wildlife, riparian, or fish habitat as beneficial uses of water, so it is not possible under state law procedures to obtain an enforceable water right for those uses. This dynamic is why the assertion of a “federal reserved water right,” which operates under different legal principles and is described in a section below, is important for designated rivers.

Permitting

Water usage on private lands commenced long before states passed statutes that set forth specific procedures for obtaining a water right. Acknowledging this reality, state governments have created water right permitting systems that allow these historical uses of water to continue but require that historical users obtain permits or decrees confirming their historical use. In prior appropriation states, most new water uses must obtain permits, unless a proposed use is specifically exempted from permitting requirements by state law. In states using a riparian water allocation system, it is typically only larger uses of water that must obtain permits.

While there is substantial variation in process from state to state, the general permitting steps used by state water allocation agencies include: file an application with the agency, publicly notice the application, provide an opportunity for parties to protest, hold hearings, issue a preliminary decision, and provide a process for the applicant or protesters to appeal the decision through administrative or court venues. After the permit is approved, and the water is placed to use as specified in the permit, the applicant is required to submit proof of construction and proof of beneficial use of water to the state agency. After that proof is confirmed, the state agency issues what is typically called a “certificate” or “license.”

Adjudication

States have also set up judicial or quasi-judicial procedures called “adjudications” designed to confirm and define previously established water rights that were not obtained or confirmed through the state’s permitting system. An adjudication can be initiated by a state’s water allocation agency, or it can be initiated by water rights owners who seek legal confirmation of priorities and allocations. During an adjudication, a designated court or the state water allocation agency sends official notices to all water users within a defined area, typically within a defined surface watershed or a defined aquifer system, telling them water rights claims must be submitted by a deadline. Once claims are submitted, the court or state water allocation agency reviews all claims for factual accuracy, and then publishes a proposed determination of water rights. All parties who submitted claims may submit objections to the characterization of their claims or claims submitted by other parties. Hearings are held on the objections to gather further facts, and then the court issues a final decree that specifies each element of the confirmed water rights. Because adjudication processes vary substantially from state to state, it is important to confer with legal counsel when participating in these processes.

If the state desires the adjudication to include the water rights of the United States, including Federally Recognized Indian Tribes, the adjudication statute must qualify as a “McCarran Amendment” adjudication, 43 U.S.C. 666, which waives the sovereign immunity of the United States and allows the United States’ water rights to be adjudicated in state court. In addition, federal agencies have the option of asking the U.S. Department of Justice to seek adjudication of federal water rights in the federal court system.

The Public Trust Doctrine

The Wild and Scenic Rivers Act is a federal statute and its implementation does not rely upon and is not controlled by state law. If a legal question arises as to whether a river manager is complying with the obligations of the statute, the court with jurisdiction will be a federal court and the court will apply legal standards found in the Wild and Scenic Rivers Act and related federal law. In addition, designation of a river segment creates a federal reserved water right (which also may be described as an “allocation of water to federal purposes” in riparian doctrine states that do not use water rights terminology).

However, river managers, sometimes work to protect stream flows in a context where state governments and stakeholders are attempting to use the “Public Trust Doctrine,” which is based on common law and state law, to advance their flow protection objectives. It is important for these river managers to understand the Public Trust Doctrine and be able to differentiate between flow protection available under that doctrine, and the flow protection requirements and tools under the federal Wild and Scenic Rivers Act described in this paper.

The Public Trust Doctrine is a body of common law (case law and custom) that originated in England and was adapted to and became part of the legal system in the United States. It specifies that rivers are not subject to private ownership and that rivers must be affirmatively managed for public benefits, such as navigation, commerce, fishing, and environmental benefits. Overall, the doctrine holds that state government plays a trustee role over riverine resources, and that generally state government decisions regarding rivers, including water allocation decisions, must consider trustee responsibilities. Private interests, which include parties who own water rights and lands adjacent to streams, are balanced with public trust interests and against each other, as determined by the state’s courts or established by state statute or rule.

A key concept to understanding the Public Trust Doctrine is that application of the doctrine alone does not result in specific allocations of water to private parties or to public purposes. Instead, when states make allocations of water under their respective water rights systems, such allocations may be subject to legal review and modification pursuant to the state’s Public Trust Doctrine. If parties feel that the balance between public and private interests has been violated by a state’s water allocation decision, they *may* have standing to litigate and seek remedies that restore the perceived imbalance.

Another key concept is that each state has widely varying provisions in state constitutions, statutes, and regulations regarding the nature and scope of the public trust. Some states have not recognized the public trust doctrine. For states that have recognized the public trust doctrine, each state has distinct law as to which types of water bodies it applies to, the types of public benefits that must be protected, how public trust responsibilities affect private property rights, and the public decision-making processes during which public trust responsibilities will be considered. For example, some states limit the application of the public trust to public trust water interests identified in federal law – navigation, commerce, and fishing, while other states have broadened their doctrines to include a broad array of recreational uses and environmental uses. Many states have very narrowly construed the public trust in a manner such that it rarely constrains water allocations, while other states have denied water right

applications or placed terms and conditions on water right allocations that are designed to protect public trust interests.

State court decisions continue to emerge that have a major impact on how the doctrine is implemented within each state. These decisions highlight how different the application of the doctrine can be from state to state. In 1983, the California Supreme Court ruled in *National Audubon Society v. Superior Court* (33 Cal 3d 419) that the State Water Resources Control Board must limit diversions made by the Los Angeles Department of Water and Power from tributaries to Mono Lake to protect public trust resources. In 2018, the California Court of Appeals heard *Environmental Law Foundation v. State Water Resources Control Board*, 237 Cal Rptr 393, and it ruled that the Public Trust Doctrine also applies to the allocation of groundwater. In contrast, in a 2020 case in neighboring Nevada, the State Supreme Court examined the long-term lowering of Walker Lake in Nevada due to diversions exercised upstream, and it reached a different conclusion pursuant to Nevada law. The court ruled that existing water right allocations cannot be altered to protect public trust interests in the lake. (See *Mineral County and Walker Lake Working Group v. Lyon County, et al*, 473 P.3d 418 (NV SCT 2020).

In addition to and separate from the public trust doctrine, which is typically enforced through litigation, most western states have “public interest” criteria set forth in statute that must be met before applications for new or changed water rights are approved by state water allocation agencies. Each state defines the “public interest” differently, and some states do not have statutory definitions. Each state has varying history in how “public interest” criteria have been implemented in water allocation processes to protect communal values, if at all. Instead of considering “public interest” values during water allocation processes, some states have allowed “public interest” concerns to be considered as part of state-based instream flow protection programs, where junior water rights are established to protect communal values.

The values protected by “public interest” statutory criteria can extend beyond those associated with the waterway. For example, “public interest” criteria may address recreation, aesthetics, and wildlife habitat values associated with the waterway. However, they can also address values outside of the waterway such as public access, health and safety, economic, anti-speculation, social justice, and cultural values.

A summary of the development of the law related to the Public Trust Doctrine is contained in: Aladjem, David. *The Public Trust Doctrine: New Frontiers for Sustainable Water Resources Management. Natural Resources & Environment, Vol. 25, No. 1 (Summer 2010) pp. 17–21*. A summary of the public trust doctrines of individual eastern states, where the public trust plays a prominent role in water allocation, is contained in *A Comparative Guide to the Eastern Public Trust Doctrine: Classifications of States, Property Rights, State Summaries* by Robin Kundis Craig. A summary of the application of “public interest” criteria can be found in Squillace, Mark. *Restoring the Public Interest in Western Water Law*, 2020 Utah Law Review 627.

Introduction to Federal Reserved Water Rights for Wild and Scenic Rivers

One of the primary goals of the WSR Act is to protect selected rivers in their free-flowing condition for the benefit of future generations. Section 13(c) of the WSR Act recognizes the importance of instream flow protection through the establishment of a federal reserved water right for each designated river to accomplish the purposes of the WSR Act. The express language included in Section 13(c) is a direct indication that Congress intended to secure a certain amount of water necessary to fulfill the purposes of the designation. The “reserved” terminology refers to the fact that Congress, the Secretary of the Department of the Interior, or the Secretary of the Department of Agriculture has “reserved” certain lands and waters for a defined purpose. In the case of WSRs, the purpose is to protect and enhance the free-flowing condition, water quality and outstandingly remarkable values of selected rivers and their immediate environments for the benefit and enjoyment of future generations.

A federal reserved water right for a river designated under the WSR Act is comprised of water right elements that are established pursuant to standards in federal law, as opposed to state law. Even though federal reserved water rights are based upon federal laws, a federal statute referred to as the McCarran Amendment provides a process for federal reserved water rights to be determined in state courts. The McCarran Amendment is a limited waiver of the United States’ sovereign immunity, the result of which is the United States may be joined as a party to comprehensive general stream adjudications in which the rights of all claimants are adjudicated.

Certain elements of state water law do not apply to federal reserved water rights. Federal reserved water rights are not subject to forfeiture or abandonment for non-use. In addition, claims for federal reserved water rights are not limited to uses of water that occur now or will occur in the immediate future. Federal reserved water rights can claim water uses that may occur in the future, if such uses are necessary to achieve the purposes of the reserved lands and waters, as set forth in executive orders or Congressional acts.

The adjudication process determines federal reserved water rights (43 USC 666(a)(1)) and allows them to be administered within the same state administrative framework (43 USC 666 (a)(2)) that applies to water rights held by other parties within a state’s jurisdiction. For example, just like privately-owned water rights, exercise of a federal reserved water right may not injure senior water rights held by other parties. During the adjudication process, state governments are required to consider unique features of federal reserved water rights, including beneficial uses of water (such as recreation, scenery, and riparian natural communities) and locations of water use (instream) that may not be recognized under state law. In some circumstances, the federal reserved water right claim can be heard by a federal court if a federal court review is necessary to ensure compliance with all federal legal standards for a federal reserved water right.

State-administered adjudication processes that recognize federal reserved water rights are not always available. State adjudication processes must meet the criteria described in the McCarran Amendment to

be able to make a binding determination of federal water rights. Not all states have a well-defined process that meets the statutory criteria of the McCarran Amendment for a basin-wide adjudication. In such instances, the river managing agency should consult with agency counsel and Department of Justice about filing in federal court to establish the WSR water right. In addition, state adjudication processes are expensive and lengthy, and states may not have prioritized an adjudication of water rights for a particular river basin. Alternatively, an adjudication may have occurred decades before the WSR was designated.

Regardless of whether the federal reserved water right has been adjudicated, or if the state has called a supplemental adjudication to address water allocation conflicts within the watershed, the river manager should identify potential steps to protect the federal reserved water right and discuss these strategies with agency leadership and legal counsel. These steps may include monitoring flows on the designated segment, monitoring water development throughout the entire watershed where the designated river is located, and initiating and/or participating in alternative flow protection strategies. All of these steps presuppose that the river manager has conducted studies to generally identify the amount and timing of water that could potentially be claimed under a federal reserved water right. If such studies have not been completed, then that may be the first step necessary toward protecting the federal reserved water right.

The federal reserved water right for Wild and Scenic Rivers establishes a priority date equal to the date of designation. The priority date for a federal reserved water right is junior (has a lesser priority) to water rights that were established prior to the date of designation but is senior (has a greater priority) to any water right that is established following the date of designation. To administer all of these water rights, western states have administrative enforcement systems, where junior users with later priority dates are required to stop diverting at certain times to ensure that senior water users receive all of the water they are entitled to during times of shortage before a junior water user is allowed to divert.

The amount of water set aside for a federal reserved water right is for a quantity no greater than the amount of water necessary to fulfill the purposes of the designation. The water right is typically not quantified by the federal government at the time of designation, so the manager must complete a quantification process before participating in any state procedures. Regardless of whether a river manager is working to file a formal claim for a federal reserved right or working to protect flows using alternative methods, the manager needs to know the amount, location, and timing of flows necessary to protect and enhance the ORVs.

The necessary quantity varies from river to river because each river reflects a unique geographic setting and has unique hydrology and ORVs. There is no universal percentage or proportion of the flow that can be applied across systems. The minimum amount necessary also varies by the specific ORV and the attributes that define each ORV. The minimum amount also varies by the relative dependency of each ORV on streamflow attributes versus other physical processes, such as soil properties and microclimates, or other water sources, such as groundwater or flow from springs. The federal reserved water right may be only a fraction of the flow in the river or may be as large as the entire flow of the river.

When quantifying the location, amount, and timing of flows necessary to fulfill the designated purposes, it is important to pay close attention to the tension between two legal principles associated with federal reserved water rights for WSRs. The first principle, mentioned above, is that the amount of water set aside for a federal reserved water right is for a quantity no greater than the amount of water necessary to fulfill the purposes of the designation. The second principle is that the Wild and Scenic Rivers Act specifies that the purpose is to “protect and enhance” the values for which the river was designated. The “enhance” purpose is atypical for areas protected under federal law and requires the river manager to think about what flows may be needed to restore degraded conditions. Simultaneously, the river manager must acknowledge that when adjudicating a claim for a federal reserved water right, judges and decision makers who work within state water allocation systems may not endorse a claim that is designed to return a river to pre-development conditions.-The key is to identify specific hydrologic attributes, such as periodic flooding or flow variability, that may act to enhance conditions without necessarily claiming pre-development flow conditions.

To date, there has been no adjudication of a federal reserved water right for a designated Wild and Scenic River in a state with an exclusively “riparian” water right system. In states with “riparian” water administration systems, alternate strategies that do not involve adjudication of water rights may need to be used to protect instream flows. Where competing uses exist, river managers should be diligent in monitoring and tracking water use, so that they can advise agency leadership and legal counsel if such usage may result in degradation of ORVs and free-flowing condition. In addition, managers may need to take concrete legal steps to react to proposed or existing water uses that could impair the flows necessary to protect the WSR values. For example, the manager may need to place a formal “call” for water with the state water right agency, file an objection in an administrative proceeding, or file an objection against a claim filed by another party in an adjudication.

Development of a Flow Protection Strategy

The development of a flow protection strategy requires an understanding of both the hydrology and ecology of a river, the existing legal framework used by the state or states in which the river is located, and the institutional and legal interests of any tribes located within the watershed. There is no one solution that will fit all situations.

Baseline Information

The steps taken to protect and enhance instream flows requires key types of information about the hydrologic conditions at the time of designation. This information includes flow measurements; information on the amount, timing, type of use, and location of water withdrawals along and upstream/upgradient of the designated segment; and the priorities associated with various water rights. The removal of water from the stream channel, whether by gravity diversion or pumped withdrawal, will be referred to as “diversions” in this paper. When this information is assembled, present and future water demands can be projected and compared against measured flow. A prediction of future water demand will inform the river manager’s prioritization and timing of flow protection efforts. If there are multiple stream reaches requiring protection, then the manager may choose to focus protection efforts on streams with highest future demand. These data also assist in analyzing other environmental variables that can affect flow, such as drought, flood, climate change, and changing land uses within the watershed.

Baseline Information on Historical and Natural Flows

The first step in establishing a baseline for protecting flow is determining what types of flow data are needed to meet flow protection objectives. If it is necessary to quantify and adjudicate an instream flow water right, a logical first step is to consult with legal counsel to determine the degree and nature of hydrologic records required for the state’s processes. If the goal is to identify the changes in flow that have occurred since designation to inform projects designed to re-establish critical portions of historic flow patterns, then research is required to identify the flow regime that existed on the date of designation and analyzing available flow data for the decades before designation.

When conducting research on flow regimes, it is important to distinguish between “natural” flows and “historic” flows. “Natural” flows refer to a flow regime that has not been modified by human developments, such as diversions and dams. “Historic” flows refer to flow regimes that incorporate any changes in flow created by human development. When a river is designated, the managing agency’s obligation is to protect and enhance the ORVs, free-flowing condition, and water quality. This obligation requires that the river manager determine whether the “historic” flow rates that existed at time of designation are sufficient to protect the ORVs. If not, the river manager may also have an obligation to work to partially or wholly restore “natural” flow regimes, especially if the CRMP identifies this as an objective. The river manager cannot automatically assume that the either the “natural” flow regime or the “historic” is equal to a claim for a federal reserved right. Instead, that information is necessary to inform the decision about what flow amounts to claim.

Where historic flow data does not exist, it may be necessary to synthesize hydrologic data using information from nearby basins to develop a picture of “natural” flow. Analyzing historical flow data, even if such data incorporates human changes to the flow regime, is critical. Flow dependent ORVs are a product of the natural variability of flows that existed over many decades, and this natural variability may have been modified by human water use. Natural hydrologic variability shaped the river channel and the biological community associated with the river. Some ORVs, such as certain riparian and fish communities, cannot persist without significant hydrologic variability over time.

The objective of baseline data collection is to build a long-term flow record. Such records are typically displayed in the form a hydrograph, which show flow rates on one axis and time periods on the other axis. Hydrographs are used to illustrate mean flows, flow variability and extremes. Initial research should be conducted to determine if flow data are available for any portion of the period before designation. A long-term record is essential for reliably calculating median flow rates and the frequency of extreme events, such as drought and flood. Adequate characterization of extreme events is essential for maintenance of some ORVs.

Historical flow data may have been collected by the U.S. Geological Survey, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, state water management agencies, units of local government, tribes, researchers and owners of water diversion and storage facilities. In many cases, these data may not have been published or may not be readily available, and direct outreach to other entities may be required to secure the data. However, for many streams, especially streams in remote locations without significant water diversions, historic data may not exist. If no historic data exists or historic data are not sufficient, data collection on flow rates should begin as soon as possible after designation. Capturing variability over long time periods is essential for producing a usable hydrograph.

Hydrology staff within the river managing agencies should be asked to recommend appropriate data collection locations. Recommendations should consider variables such as tributary and groundwater inflow, ease of access, and water use by other parties. Hydrology staff should also be asked to provide data collection options with differing cost estimates. These options can range from simple pressure transducer stations with data loggers to long-term cooperative agreements with the U.S. Geological Survey for permanent stream gages. Data collection on flows does not necessarily have to be expensive, because many alternative data collection methods exist.

For streams without historic hydrology data, the river managing agency may need to develop synthetic hydrology information to help define baseline flow regimes. Synthetic data is typically developed by analyzing nearby gaged streams with similar watershed characteristics. The nearby gage data is then adjusted to account for different watershed size, elevation, aspect, and other basin characteristics. Alternatively, synthetic data may be obtained by using flow estimation equations developed by the U.S. Geologic Survey. These regression equations consider watershed size, location, elevation, slope, and other variables. A decision on whether to develop and use synthetic hydrology should involve consultation with legal counsel. Any data must be sufficiently robust and defensible for use in legal processes, such as state-based water administration processes.

When establishing a plan for data collection, it is important to consider other objectives that can be achieved with the data. For example, after flow protection strategies are implemented, the objective of data collection may expand to include monitoring to ensure flows meet the desired targets. The data may also be used as a foundation to support management objectives for water-dependent values in the context of a CRMP. Finally, any flow data collection should be coordinated with needs for water quality data. Water quality data can often be collected at a very low additional cost once a flow monitoring station is established.

Baseline Information on Flow Depletions

Existing alterations to natural flow regimes, and their impacts to ORVs, can be addressed in a flow protection strategy and in a CRMP. Where flows have been significantly altered, the entire flow regime may not be available to protect the ORVs. In those cases, quantification studies may be required to identify the flow rates and flow duration that trigger and protect biological and ecological processes.

Research should be conducted soon after designation to identify the amount, timing and location of diversions and storage associated with existing water rights, including water rights upstream, upgradient and within the designated reach. For water rights that divert directly from streams, water right diversion and usage records are sometimes maintained by state governments, local governments, and water user entities. Well users may or may not be required to report quantities diverted, depending upon state and local government requirements.

Documenting the effects of storage facilities on stream flow is particularly important because storage facilities can dramatically change the flow regime for a stream. Many designated rivers are located immediately downstream from water storage facilities, or they are in watersheds where the aggregate volume of water stored is large relative to total annual runoff. In some cases, owners of water storage facilities who operate under federal permits, such as Federal Energy Regulatory Commission (FERC) permits, may be required to modify the operation of water storage facilities to address instream flow needs when permits come up for renewal. For water storage facilities, detailed water storage records are typically maintained by the entities that operate the facility, and these records are typically provided to state government agencies that regulate water use.

Effects to flow created by direct diversions from rivers may vary depending upon the time of year and upon hydrologic conditions. The river manager may conclude that flow depletions may affect ORVs under some conditions or at certain times of year, while having little effect at other times. Analyzing actual diversion records allows the river manager to determine the average and maximum quantities of flow depletion associated with actual water right operations, rather than relying exclusively upon records of “paper” water rights. Diversion records can also be used to recreate historic hydrographs if numerous new diversions have been implemented since designation. The more recent diversions can be added back into stream gage data to provide an estimate of flow rates before the recent diversions were implemented.

For water rights that authorize groundwater use from aquifers, research should be conducted to identify the amount, timing, and location of groundwater pumping. This information can then be used to

estimate the location and amount of flow depletions caused by pumping. Keep in mind that flow depletions may be caused by groundwater pumping located many miles away from the stream, especially in rivers fed by discharge from regional aquifer systems. Analytical tools are available to determine the amount of flow depletion based upon well location, well depth, pumping volumes, and underlying geology. In addition, analysis of long-term changes of groundwater levels in aquifers adjacent to the river may be helpful in identifying the overall trends in groundwater levels and how existing withdrawals may be affecting the discharge to the stream.

In some states, the hydrologic relationships between surface water and groundwater are only now being recognized in the state's water law system. In those states, clear relationships between stream flows and groundwater must be demonstrated before the state is willing to control groundwater depletions that reduce streamflow. In other states, such as Arizona and California, where the state government does not take an active role in allocating groundwater, there are legal barriers to controlling groundwater use that must be considered when formulating a flow protection strategy.

Assessment of Potential Threats to Flows

Many designated rivers are located within watersheds where significant land and water development has already occurred. In addition, as populations expand and settle in the urban-wildland interface, many rivers in less developed watersheds are likely to experience greater consumptive water demand. An effective CRMP and instream flow protection strategy should consider future changes in the watershed and incorporate measures to protect flow in the face of these changes.

The first step in a threat assessment is a qualitative analysis of the physical, legal, and institutional characteristics of the watershed. River managers should answer the following questions to complete a qualitative assessment:

- Where is the designated river within the watershed? Is it high in the watershed and upstream from developed areas, where flow depletions are unlikely to occur? Or is the designated river low in the watershed and downstream from development, where consumptive demands are likely to be stable or increase?
- What is the composition of land ownership in the watershed? Are potential threats to flow reduced by a lack of private lands where water can be diverted and used?
- Are threats to flow reduced or increased by land and water use regulations implemented by other federal agencies, state government, or local governments?
- What are the historical trends in the watershed with respect to water development? Are all surface water supplies fully appropriated (western states) or over utilized (eastern states)? Is groundwater extraction increasing as residents search for unappropriated supplies of water?
- What is the status of state water allocation within the watershed? Is the watershed open, closed, or limited to new uses of surface water and/or groundwater? What is the status of water right administration in the basin – is the basin strictly administered by a formal watermaster (or regulator) or do water user informally regulate among themselves?

- Is the state’s water administration agency undertaking a process, such as a water rights adjudication or watershed planning effort, that requires participation by the river managing agency to protect flows?
- Are there existing senior water rights downstream from the designated reaches that will assist with protecting ORVs?

This qualitative assessment will allow the river management agency to allocate limited resources to protecting flows in rivers where threats are greatest. Given the significant resources that are necessary to protect flows and the number of stream systems managed by agencies, it is not always possible to implement a comprehensive flow protection strategy for every designated river.

If flow protection is needed, the qualitative assessment will assist the agency in identifying parties who should be engaged. These parties might include state governments, local water districts, and specific water users. The qualitative assessment will also indicate where the most effort is needed, which could range from management of future demand to proactive restoration of depleted flows.

If the qualitative assessment identifies a significant threat to flows, then a quantitative analysis of the threat may be required. The river managing agency should acquire information about the location, amount, and timing of likely future water demand. This information can be obtained from state governments, local governments, water districts, and water users, who regularly engage in long-term water supply planning.

Once the river manager has assembled information on baseline flow conditions and completed an assessment of potential threats, the river manager can begin a preliminary evaluation of flow protection methods. The agency’s objective is to identify one or more flow protection tools that are most likely to be effective, given the physical, legal, institutional, and social circumstances surrounding the river.

Legal and Administrative Framework

In western states, where the prior appropriation system is employed and where water use may be strictly regulated, a strategy focused on engaging in the state’s water right system may be the most effective. In watersheds where a state-run general adjudication that meets McCarran Act requirements is underway, submission of federal claims for a federal reserved water right will be mandatory.

In contrast, in eastern states where the riparian doctrine is employed and water diversions are less directly controlled and monitored, it may be more effective to pursue a multi-pronged approach. Many eastern states have systems to monitor and regulate diversions that exceed a defined water quantity and/or timing, with the objective of maintaining “reasonable use” by all water users and protecting public interests that are recognized by the state’s public trust doctrine. These regulatory programs are often run by state-level environmental protection agencies. In addition, it may be effective to engage directly with water users and state and local governments that are responsible for a large percentage of water consumed within the watershed.

A complementary approach that should be used in all cases, even when federal reserved water right claims must be filed in an adjudication, is to identify potential partners with similar objectives. Partners

can include other federal land management agencies, tribal governments, state parks and wildlife agencies, state environmental protection agencies, local governments, watershed groups, and non-profit organizations. Partners can participate in multiple aspects of flow protection, including baseline data gathering, quantification studies, application for water rights, education about flow protection options and advocacy for flow protection measures. Overall, establishing partnerships typically increases the chances of success for any individual flow protection method.

Another consideration is the magnitude of the difference between the current flow regime and the flow regime needed to protect ORVs. If the current flow regime appears adequate for ORV protection, then the strategy may focus on methods that protect current conditions, and limit future water development. If the current flow regime is inadequate for ORV protection, river managers may elect to develop a strategy to directly engage with operators of facilities that have led to the flow deficit.

The following paragraphs provide a brief overview of some of the legal, institutional, and administrative tools available to river managers for protection of flows.

Federal Reserved Water Right Claims

Asserting a claim in a state-administered water rights adjudication requires long-term engagement with the river managing agency's legal counsel and hydrology staff. In general, the bureaus within the U.S. Department of the Interior (DOI) coordinate with the Office of the Solicitor (SOL) to seek legal counsel, while the Forest Service within the U.S. Department of Agriculture (USDA) coordinates with the USDA's Office of General Counsel (OGC). However, once a judicial proceeding is initiated, the Department of Justice must be consulted and generally takes the lead on the case for the United States.

Consultation with legal counsel should occur early in the process to identify the legal foundation and strategy for the claim. Legal counsel will assist agency personnel in identifying and developing the evidence necessary to support the claim so it can withstand legal review and objections by other parties. Later in the process, legal counsel will draft and file the claim, represent the agency in proceedings, and engage with other parties in the adjudication.

Hydrology staff should also be engaged early in the process to safeguard scientific integrity, gather baseline flow data and to initiate studies to quantify the amount, timing, and location of water needed to protect each of the ORVs. It is likely that hydrology staff will be asked to serve as expert witnesses in support of the claim, so their long-term engagement in the process is critical for success.

It is important to note that federal agencies must participate in a state-initiated comprehensive water rights adjudication pursuant to the criteria set forth in the McCarran Amendment. If the river managing agency does not assert the claim of the United States at this time, any future opportunity to assert a claim is lost. Time frames for submitting claims in an adjudication process may be short, sometimes less than one year. Accordingly, it is important for the river managing agency to carefully monitor and prepare for any potential adjudication activity as soon as it learns an adjudication is contemplated by the state. If Congress designates a new Wild and Scenic River after a general stream adjudication has

been completed, the river manager should work with legal counsel to identify which process should be initiated to adjudicate the new claim, such as requesting a supplemental adjudication and court decree.

The advantage of adjudicating a federal reserved water right claim is that the result is a formal, legal protection of flows that is recognized and administered by the state's water administration agency. This legal protection is enduring and enforceable over time, even as stakeholders and politics change. However, the river managing agency must invest resources in monitoring the water right and cooperating with state governments to administer the water right.

The primary disadvantage of adjudicating a federal reserved water right is the time and resources required. Asserting a claim can require multiple years of studies to quantify the amounts necessary to protect the ORVs, and multiple years of legal counsel engagement with the state court system. If the claim goes to a trial, then the investment of time by hydrology and legal staff grows significantly and may require reprioritization of other work to fully support the trial process. It is important for river managers to understand the gravity and significance of a court proceeding and to ensure that adequate resources are devoted to this effort. In all, an adjudication process may take more than a decade to complete.

Negotiated Settlements

Negotiated settlements may provide an opportunity for securing instream flows either within or outside of a judicial or administrative proceeding. Within a judicial proceeding, a negotiated settlement can be used to address a claim filed by a river managing agency to adjudicate a federal reserved water right. Settlements can also be used to address situations in which the river managing agency has protested a water use claim or application by another party as part of water rights adjudication or part of permit proceeding run by a state water allocation agency. Within judicial or administrative proceedings, the negotiated settlement is formally adopted by the decision-making body and is binding on all parties.

Outside of judicial and administrative proceedings, settlements can be used to address situations in which the river management agency or other stakeholders believe that a stream has been or is likely to be overallocated. The settlement process is used to avoid litigation or formal administrative proceedings between the parties who are seeking to create certainty for future water use. In this context, the negotiated settlement is a legally enforceable contract between the parties, and only the parties who sign the agreement are bound by it.

The parties involved in an instream flow settlement typically include the river managing agency, the state water administration agency, and major water users within the watershed. These parties are often eager to avoid the uncertainty associated with placing water right claims in front of a judge. In addition, they are often eager to avoid the time and expense of a formal court process, including disclosures, discovery, submission of evidence, depositions, briefs, motions, and trials. These steps and the expenses associated with them can be avoided or reduced by developing settlement agreements that focus on the aspects of water administration that are most important to each of the parties involved.

To work toward an agreement, legal counsel and experts for each party typically cooperate to develop a shared understanding of the facts. These facts include the volume of water naturally produced by the watershed, the portion of that volume already allocated, the amounts necessary to protect the ORVs on the designated river, and the amounts necessary to support future water development in the watershed. Sometimes, the combined demand for instream flows and water diversions to support human uses may exceed the volume of water available within the watershed, forcing negotiators to develop creative water administration solutions.

Some of the most common features of settlement agreements include:

- Negotiation of the flow rates necessary to protect the ORVs. The parties attempt to agree on the amount, frequency, duration, and timing that certain flows need to occur to protect the ORVs. Negotiations typically are focused on trying to resolve differing views of science and hydrology, and often take place when there is a limited amount of water available to satisfy both human and environmental uses.
- Limitations on future water development. In some cases, negotiators choose not to negotiate flow rates. Instead, the negotiators choose to focus on the volume of future water development that will be allowed. The working assumption is that if development is limited, the hydrologic system will naturally provide the flow rates and hydrologic variability needed to protect the ORVs. Many state governments, local governments and water user organizations desire certainty regarding the volume of water available for future use and development, and the river managing agency also desires certainty regarding future depletions that could impact ORVs. The result is specific limitations in an agreement concerning the type, location, and amounts of future water development that is allowed.
- If the negotiation is part of a judicial proceeding, the parties may choose to negotiate how the priority date assigned to the federal reserved water right will be administered. Since the priority date of the federal reserved water right may be significantly earlier than priority dates assigned to consumptive water rights, strict administration of priority dates may result in insufficient water supplies for existing consumptive uses. In some cases, an agreement is reached in which the federal agency agrees to subordinate the federal reserved water right claim to existing uses, but senior to any future uses. This type of agreement requires the federal agency to be able to determine that existing uses are not impairing or degrading the ORVs. This type of agreement is typically driven by a desire for certainty that existing uses will be allowed to continue and that flows available for protecting the designated river will not be further diminished.
- Simplified administration of the instream flow allocation. Real-time administration of an instream flow allocation can be resource intensive or logistically impractical or impossible. Administration can involve monitoring flow at multiple locations, and continuously responding to changing flow conditions and changing rates of diversion. Administration can be streamlined by not monitoring specific flow rates, and instead carefully tracking the overall volume of water diverted from the stream.

- Most settlement agreements to date have not included climate change considerations and the potential for long-term drought. It may be appropriate to consider a settlement framework that allows for adjustments when flow regimes change in rate, timing, and volume.

State-based Instream Flow Programs

While federal reserved water rights for WSRs are based on provisions of federal law, many state governments allow instream flow water rights to be established pursuant to provisions of state water law. The terms used to refer to these state-based instream flow water rights differs from state to state and may include “instream flow water rights,” “instream flow reservations,” and “instream flow rules.”

Before deciding to rely upon a state-based instream flow program, legal counsel should be consulted for a full discussion of the advantages and disadvantages of doing so. One advantage of using a state-based procedure is that the process can often be completed significantly faster than adjudication of a federal reserved water right. In addition, the data required to support the instream flow protection request may be less extensive than the data required to support an adjudication. State-level partners, such as state wildlife, recreation, and environmental protection agencies, may be able to provide legal, logistical, and political support to the request. Finally, some states have instream flow programs that allow a quantity of water to be claimed that is beyond the “minimum” necessary for water-dependent values to persist. For example, Alaska allows claims for a “sufficient” amount of water to support the claimed instream use, while Arizona allows claims for the amount of stream “required” for the claimed instream use. These state-based programs may be useful in fulfilling the legislated purpose to “enhance” the values for which the river was designated.

The disadvantage of state instream flow programs is that they typically protect a flow quantity far below natural flows in streams. For example, many western states assign a minimum instream flow (e.g., Wyoming, Colorado, Montana). Some states, in the context of “minimum” flows, allow for variable flows from month to month, such as in Arizona, where median monthly flows may be claimed. It is important to determine whether the state’s definition of “minimum” differs significantly from the amount necessary to achieve the purposes of the Wild and Scenic River designation, because in some cases, the standard is very similar.

If a decision is made to rely upon a state-based instream flow program for protection of flows, it is important to understand that doing so does not relieve the river manager of the responsibility for filing a claim for a federal reserved water right if a state initiates a general stream adjudication in the watershed where the designated river is located. Federal reserved water rights for WSRs are claimed in adjudications it is the sole opportunity to assert a federal reserved water right, and because it may become necessary to rely on the federal reserved water right if the state instream flow program is modified or abolished in the future.

Instream flow protection programs in eastern states typically focus on regulating diversion of water rather than establishing instream flow water rights. This approach is used because, in states with water allocation systems based on the riparian doctrine, day-to-day administration of water rights typically does not occur. Under this approach, the state’s environmental protection agency, or other agency

charged with protecting the state's public trust interests, will define the public interests in streams that are to be protected under the agency's program. These agencies then grant permits that place limits on diversion location, timing, and amount. In addition, these agencies may place limits on diversions pursuant to Section 401 water quality certifications that are required for projects that must obtain permits under the federal Clean Water Act. If permit conditions are violated, enforcement make take place.

Even with the advantage of having state government support for flow protection, there are numerous limitations to state-based instream flow programs in each state where they operate:

- In eastern states that operate under the riparian doctrine, the instream flow program may not establish an instream flow water right that can be administered on a daily schedule. If a diverter is violating the provisions of a permit that are designed to protect flow, obtaining compliance may be a long process involving filing complaints with a state agency or potentially initiating a court action to enforce compliance.
- Some state governments limit who may apply for an instream flow water right to specific state agencies. This means that the river managing agency may not be able to acquire an instream flow water right and may not be able to control the magnitude and nature of the application that is filed. The river managing agency is also not directly responsible for maintaining and protecting the instream flow water right.
- Most instream flow water rights established pursuant to state law procedures hold priority dates equal to the date of application, instead of when the river was designated as a wild and scenic river. This means that the instream flow water right will be junior to all established water uses. However, even a junior instream flow water right can have significant value, because it allows the holder to object to changes of existing water rights that could reduce existing instream flows and provides a means for participating in a state water right administrative process.
- Many states limit the types of water uses that can be protected by an instream flow water right. For example, some states do not allow instream flow rights to be established to protect recreational uses, while others do not allow protection of riparian values. If the ORVs on a river do not match the state's authorized uses for instream flow water rights, it may be difficult to obtain the desired protection. In some cases, protection for an authorized use, such as fish habitat, may provide flows sufficient to protect a use that is not recognized under state law, such as riparian habitat.
- Many states periodically review instream flow water rights to determine if they should be adjusted or terminated, based upon new information. This means that the protection is not permanent, and that resources may have to be expended to continue the protection over time. This kind of restriction is not consistent with the requirements of the WSR Act, which requires permanent protection.

Strategies For Streams with No Federal Land Ownership and For States with “Riparian” Water Allocation Systems

Designated rivers that include no federal land ownership and/or are located in states with “riparian” water allocation system have no readily available procedure for asserting and protecting a federal reserved water right. In those cases, the most effective instream flow protection strategies are likely to be cooperative agreements, acquisition of properties that contain water diversion and storage facilities, and reliance on other federal legal authorities, strategies that are described in the following three sections of this paper.

In addition to those strategies, river managers may also utilize the “public trust doctrine” to advance their instream flow protection objectives. When doing so, the river manager should keep in mind that working with complementary tools available under the “Public Trust Doctrine” does not supplant the requirements and tools available under the federal Wild and Scenic Rivers Act. The key for river managers is to determine to what extent WSR purposes and requirements overlap with state public trust responsibilities, and to widely communicate that overlap. This may include developing relationships with state water allocation agencies and clearly articulating the amount, frequency, duration, and timing of flows that are needed to protect WSR values. In the context of this relationship, a river manager may send a letter to the state water allocation agency regarding a pending permit application. The letter could note that approval of the application may interfere with the flow regime needed to protect the ORVs, which could potentially be in violation of the state’s public trust duties. Such a letter should be accompanied by copies of studies that document the rate, volume, and timing of water needed to protect the ORVs.

River managers and river management partners can interact with state-level decision makers to discuss public trust responsibilities in a variety of forums, such as hearings for water right applications, setting water quality standards, and authorizations for facilities, such as upstream dams and hydropower facilities. However, it is important to remember that reliance on the public trust doctrine has distinct limitations. Unlike an adjudicated federal reserved water right that can be administered and protected over time, protection under the public trust doctrine involves continued vigilance and investment of resources, because implementation of trust responsibilities is on a case-by-case, decision-by-decision basis. Outcomes from these ongoing decisions are typically subject to political concerns, and the only method to enforce accountability, if direct engagement fails, may be to initiate affirmative litigation. The river manager must also acknowledge that state agencies and courts often have the latitude to decide that public benefit from increased consumption of water outweighs public benefits from protection of flows.

Cooperative Agreements

Under the National Environmental Policy Act (NEPA), federal operators of water storage, diversion, and conveyance facilities have certain responsibilities to citizens, shareholders, and customers to identify terms, conditions, and mitigation measures that could avoid and minimize the impacts associated with operation of their facilities. NEPA does not require implementation of mitigation measures and instead focuses on developing an adequate range of alternatives. However, applicant-initiated mitigation measures are often proposed to increase the likelihood of project approval. In addition, water user entities often have an interest in improving their relationships with the broader public by displaying environmentally and socially beneficial practices. Many operators of facilities prefer to proactively negotiate flow protections directly with stakeholders in the watershed, rather than being forced to react to legal or regulatory processes that may have uncertain outcomes.

Arriving at a flow management agreement with facility operators typically involves a process in which stakeholders arrive at a shared understanding of the water supply objectives and legal requirements for the operator, along with the degree of flexibility possible in facility operations. Stakeholders also work together to understand the amount of water necessary to protect the ORVs, often assisted by studies conducted by stakeholders and the river managing agency. The result is sometimes a written agreement that specifies the times, locations, and amounts of water that will be released, if such water management is available to the facility operator. Alternatively, the stakeholders may charter an ongoing working group that regularly consults with the facility operator as daily operational decisions are made.

River managers can also cooperate with watershed groups who seek to restore and protect flows. Actions implemented by these groups may include restoration of degraded watersheds to enable the watershed to better store and release water, purchase of key water rights that can be changed to instream flow uses and applying for grants to modify existing facilities to incorporate features that conserve or enhance flows. However, caution is warranted when relying exclusively upon these strategies. Certain stakeholders in a watershed may believe that removal of vegetation will result in higher water yield and that restoration of stream functions will result in significant water losses due to water detainment and increased evapotranspiration. In addition, some state governments require water right actions that are designed to offset perceived losses of flow when restoration projects are implemented.

Land and Property Acquisition

On smaller streams, operation of a single diversion or storage facility can have enormous impact on water-dependent values, because the existing facility controls a very high percentage of flows. By acquiring the land where the facility is located it may be possible to modify, curtail, or extinguish the use and partially or fully restore natural instream flows. Before an acquisition is completed, the requirements of state law regarding the modification of existing water uses must be reviewed to ensure that the acquisition can accomplish the desired benefit. In addition, in states using the prior appropriation water allocation system, acquisition of land does not always automatically incorporate acquisition of water rights, and specific provisions must be made to acquire both types of property interests.

The WSR Act limits the amount of land that can be acquired within and adjacent to a designated river. However, where land acquisition is allowed, a willing seller exists, and a CRMP has publicly vetted the concept, purchase of such a facility can provide significant benefit to the flows of the river. Sometimes, the cost for the acquisition can be exceeded by the value of the river benefits downstream.

River managing agencies have nationwide staffing and budget for property acquisition. However, the properties that can be acquired to benefit flows are often incongruous with current federal land ownership patterns. As such, these properties may not receive high priority for acquisition in competitive federal funding processes. In those cases, partners can assist with securing the necessary funding and finding a suitable entity to own and manage the acquired land and water rights. Potential partners include The Trust for Public Land, river conservancy organizations and local land trusts.

Other Federal Legal Authorities

Certain provisions of the WSR Act can be used directly or indirectly to protect instream flows. However, each river administering agency has its own statutory authorities that can be used to advance flow protection objectives.

- The U.S. Forest Service and Bureau of Land Management (BLM) consider applications for land use authorizations pursuant to procedures set forth in the Federal Land Policy and Management Act (FPLMA). These provisions are described in more detail the section below.
- All WSRs located on BLM-managed lands are part of the National Landscape Conservation System, established through Public Law 111-11. This system was established to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations. These lands are managed according to applicable law (including regulations) and in a manner that protects the values for which the components of the system were designated.
- All WSRs administered by the National Park Service (NPS) are considered units of the national park system with the exception of “partnership” rivers flowing mostly through private lands where the enabling legislation specifies that the river is not an NPS unit. For all rivers that are considered to be units of the National Park System, their associated lands are subject to the provisions of the WSR Act, the NPS Organic Act of 1916, and the NPS General Authorities Act of 1970, including amendments to the latter law enacted in 1978. The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, is to conserve the scenery, natural and historic objects, and wildlife, and to provide for the enjoyment of these resources in a way that will leave them unimpaired for future generations. In case of conflict between the provisions of these various Acts, the more restrictive provisions apply.
- All WSRs administered by the U.S. Fish and Wildlife Service are considered units of the national wildlife refuge system and are subject to the National Wildlife Refuge System Improvement Act of 1997. The primary purpose of the refuge system is the protection and conservation of wildlife resources.

Federal laws that may be used to protect flows include:

- *The Federal Power Act*. The original purpose of the Federal Power Act was to coordinate the development of [hydroelectric](#) projects in the United States. The act created the [Federal Power Commission](#), now the [Federal Energy Regulatory Commission](#) (FERC). FERC has a major role in implementing this legislation but must also comply with other federal statutes covering environmental reviews and protection, financial reporting, information technology reporting, and historic preservation. FERC also has authority to regulate flow rates released from hydropower facilities and to regulate diversions at energy production facilities (such as cooling water for thermal power plants). The following sections of the Act can be used by river managers for flow protection and enhancement:
 - Section 4(e) of the Act authorizes agencies who manage reservations of federal lands to request terms and conditions in licenses to ensure that the agency can effectively manage river-related values. Federal agencies can make study requests, request terms and conditions on facility management, and request specific release rates from facilities. Participating in these processes, which sometimes include extended negotiations, can require substantial personnel and financial resources.
 - Section 10(a) provides that hydropower licenses must be best adapted to a comprehensive plan for the affected waterways that supports all beneficial public uses of the stream. The license must include provisions for the protection of fish and wildlife and other beneficial public uses, and FERC must give environmental values, including fish and wildlife and recreation, equal consideration with hydropower development.
 - Section 18 provides licenses must include fishways if they are timely prescribed by the Departments of Commerce or Interior.
- *The National Environmental Policy Act (NEPA)*. If a river-related project requires federal permitting, funding, or assistance, the National Environmental Policy Act (NEPA) requires that all potential impacts associated with a proposed project must be fully analyzed and disclosed. Regardless of the federal agency that is providing authorization for a new project, the river managing agency should request that the NEPA analysis fully analyze and disclose any potential impacts to flow in both designated and study rivers. The NEPA process can also be used to proactively identify alternative approaches that could reduce potential impacts to flows or identify mitigation measures that would reduce impacts to flows.
- *The Clean Water Act (CWA)*. The overall objective of the CWA is to "restore and maintain the chemical, physical and biological integrity of the Nation's waters" (Section 101(a)). Although discharge of contaminants has been the primary focus of the CWA, hydrologic alteration can be a primary contributor to the impairment of water bodies that are designated to support aquatic life and other important values. Addressing flow conditions on designated wild and scenic rivers may contribute to a comprehensive approach to maintaining the state determined designated uses of a river, including aquatic life, cold-water or warm-water fisheries, and economically or recreationally important aquatic species. Water quality certifications issued by states under Section 401 of the CWA often establish operational conditions for instream flow protection.

- *The Federal Land Policy and Management Act (FLPMA)*. Section 505 provides that federal land use authorizations are discretionary and shall include terms and conditions which will minimize damage to scenic and esthetic values, fish and wildlife habitat, and otherwise protect the environment. Numerous water-related facilities are authorized by the U.S. Forest Service under Special Use Permits and by the Bureau of Land Management under Right-of-Way Grants. In addition, both agencies authorize water-related facilities under their range, minerals, and forestry programs. These authorizations can include terms and conditions that limit the location, rate, timing, and volume of water diversion and storage. When proposed facilities are located upstream from a stream reach designated under the Wild and Scenic Rivers Act, the Wild and Scenic Rivers act requires federal agencies to ensure that such land use authorizations do not degrade the ORVs or water quality of a designated stream reach. In addition, when existing land use authorizations for dams and diversions come up for reauthorization, the Wild and Scenic Rivers Act requires the managing agency is to consider terms and conditions to protect and enhance WSR values. These terms and conditions have the potential to impact a facility's storage or diversion of water notwithstanding the parameters of state-based water rights and may raise questions about the limits of federal authority.

Development of a Flow Prescription

Before selecting a flow protection strategy, the river managing agency needs a scientifically defensible quantification of the location, timing, and amount of flow necessary to protect the WSR values of the river. Engagement with other stakeholders in the watershed is difficult unless the river managing agency can communicate a certain amount of water necessary to fulfill the purposes of the designation. In addition, any effort to adjudicate the federal reserved water right associated with a designated river will require a formal quantification effort. The amount necessary is not always exclusively a minimum flow rate. Instead, it may, dependent on the ORVs identified for a segment, incorporate, a full range of flows (peaks of various recurrence intervals, base flow, interannual variability in flow, rates of change in flow, small, medium, and large events). All these amounts must be determined by identifying a direct linkage to specific ORVs.

A flow prescription for a river defines the flow regime needed to support the fundamental hydrologic processes and unique ecosystems of a river. It includes a full range of flows that support a full range of hydrologic processes and resource values, and it includes seasonal and annual variability. A flow prescription for a WSR should be based on the range of flows necessary to protect the ORVs for which the river was designated. There are four basic steps involved in developing a flow prescription for a WSR: (Table 1):

1. Identify ORVs and key flow attributes
2. Compile data and conduct field investigations, if needed
3. Perform quantification analysis and interpretation
4. Develop flow prescription

Identify ORVs and Key Flow Attributes

The first step in the quantification process is to identify the flow dependent attributes that are necessary to protect each of the ORVs. This is best accomplished through an interdisciplinary team that includes resource specialists who are knowledgeable about each of the ORVs and hydrologists who are knowledgeable about the watershed. This team can systematically address hydrologic flow components—peak flows, base flows, floods, flow duration, flow variability—and then link those to the flow dependent attributes of the ORV (e.g., Table 2).

The ideal approach is to consider flow-dependent attributes that are necessary to protect each of the ORVs as part of the initial interdisciplinary process that identifies and defines the ORVs. Including hydrologic expertise and considerations during the initial process results in ORVs that are better defined and better linked to hydrologic processes. Clear ORV definitions that specify linkages to hydrologic processes increases the likelihood that flow protection efforts will be successful, because the hydrologic basis for flow protection has strong factual and scientific support. However, river managers often operate in contexts where ORVs were identified in planning documents long before flow protection efforts commence. In those cases, the interdisciplinary team should also include hydrologic expertise, so

that the team can further analyze historical ORV definitions and link them where possible to hydrologic flow components.

Table 1. Basic steps in the development of a flow prescription for a WSR.

Step	Actions Required To Implement This Step
1. Identify ORVs and corresponding key flow components for analysis	Identify each flow-dependent Outstandingly Remarkable Value, including: <ul style="list-style-type: none"> • Scenic • Recreational • Geologic • Fish and wildlife • Historic • Cultural
2. Compile data and conduct field studies	Data Collection, such as: <ul style="list-style-type: none"> • Streamflow cross-sectional surveys • Streamflow magnitude and velocity • Particle sizes • Fish life histories and habitat needs • Riparian plant inventory and ecology
3. Perform quantitative analysis and interpretation	Develop relationships, such as: <ul style="list-style-type: none"> • River stage and the elevation of geomorphic surfaces • Flows needed to create shallow water habitats • Sediment transport thresholds
4. Develop flow prescription	Integrate components of the flow regime into a flow prescription that includes: <ul style="list-style-type: none"> • Timing • Duration • Magnitude • Frequency • Recession rates

Appendix A provides an example of how these steps might be applied to a hypothetical river, including specific examples of studies that could be implemented to quantify the flow regimes needed to protect natural conditions and flow dependent ORVs.

Table 2. Example of a streamflow matrix for a Scenery ORV (for illustration only).

ORV	Flow dependent attribute or condition	Critical habitat, lifestage, or ecological process	Hydrologic process	Flow Component – Peak, Base, Shoulder, Seasonal				
				Magnitude	Frequency	Duration	Timing	Rate of Change
Scenery	Cottonwood forest	Channel migration	Peak flow	> 10,000 cfs	1:2 years	1–3 days	Late May to early June	Mimic historic
		Bare moist substrate at seed dispersal	Out of channel; Peak flow	> 15,000 cfs; > 10,000 cfs	1:5 years; 1:2 years	1–3 days	Late May to early June	Mimic historic
		Seedling root growth in contact with groundwater	Rate of peak flow decline	Gradual decline	Annual	4–6 weeks	Post-peak	NOT > 2.5–5 cm/day
		Summer survival	Base flow	>= 500 cfs	Annual	May 1–Oct 1	–	–
	Braided flowing river	Sediment transport, flux, entrainment	Sustained high flow; extreme high flow; peak flow	> 1200 cfs; > 1800 cfs; > 10,000 cfs	1:2 years	2–4 weeks; 1–2 weeks; 1–3 days	Mar–Oct	Mimic historic
		Woody debris transport	Out of channel; Peak flow	> 15,000 cfs; > 10,000 cfs	1:5 years; 1:2 years	1–3 days	Mar–Oct	Mimic historic
		Channel avulsion/migration	Peak flow	> 10,000 cfs	1:2 years	1–3 days	Mar–Oct	Mimic historic
		Flow in channel	Base flow	>= 500 cfs	Annual	Mar–Oct	Mar–Oct	–
		Side channel formation, maintenance	Peak flow; base flow	> 10,000 cfs; > 500 cfs	1:2 years; Annual	1–3 days; Mar–Oct	Mar–Oct	Mimic historic

Table 2 (continued). Example of a streamflow matrix for a Scenery ORV (for illustration only).

ORV	Flow dependent attribute or condition	Critical habitat, lifestage, or ecological process	Hydrologic process	Flow Component – Peak, Base, Shoulder, Seasonal				
				Magnitude	Frequency	Duration	Timing	Rate of Change
Scenery (continued)	Riparian mosaic	Diverse riparian plant assemblage (multiple age/ size classes)	Sustained high flow; extreme high flow; peak flow	> 1200 cfs; > 1800 cfs; > 10,000 cfs	1:2 years	2–4 weeks; 1–2 weeks; 1–3 days	Mar–Oct	Mimic historic
		Diverse fluvial features (side channels, levees, oxbows, bars, marshes)	Sustained high flow; extreme high flow; peak flow	> 1200 cfs; > 1800 cfs; > 10,000 cfs	1:2 years	2–4 weeks; 1–2 weeks; 1–3 days	Mar–Oct	Mimic historic

Compile Data and Conduct Field Investigations

After linking ORVs to flow dependent attributes, the next step in the quantification process is to make strategic decisions concerning which ORVs and which flow attributes warrant intensive study. Since quantification studies are resource intensive, an interdisciplinary team should not conclude that each ORV must be precisely quantified. Typically, there are one or two ORVs that require the highest flow rates or the most variability of flow. One strategy is to identify one or two ORVs for intensive study and then determine whether the flows necessary to protect the selected ORVs will protect all ORVs.

Flow Quantification Methods

In determining what additional studies are needed, the interdisciplinary team should consider studies that meet budget, timeframe, legal and political requirements. Two types of investigations that have had success in quantifying instream flows to support hydrologic and other water dependent values are studies that link biology and ecology to flows, and studies that quantify the amount of flow needed to support recreation, as described in the next section. Properly conducted, these studies have held up in court proceedings.

Before undertaking new investigations, consultation with agency water rights/water use personnel and legal counsel is recommended to ensure that any proposed studies and methodology meet the requirements of any legal forums where the quantification will be used. In addition, most studies must commence several years in advance of a pending adjudication or lawsuit to have usable data. The interdisciplinary team should also consult with agency management to ensure long term support for the duration of the study period. Most quantification studies require three to five years of data collection, a reliable budget and consistent staffing. Agency staff who conduct the quantification studies may become involved in implementing the flow protection strategy, especially if that strategy involves adjudication or negotiation of federal reserved water rights.

Biological and Ecological Values

The choice of methodology for quantifying biological and ecologic values is usually driven by a key question: How will the data be used and in what type of forums? If there is a need to identify a minimum flow rate at which one or more ORVs will be protected, then a “standard-setting” approach may be implemented. Studies based upon the standard setting approach typically have fewer variables that are studied, fewer sites that are studied, and are done on streams without high levels of controversy or competing water demands. Accordingly, standard settings studies can typically be implemented quickly and inexpensively. Standard setting approaches have been widely implemented by state-based instream flow protection programs, where there is a need to identify specific flow rates for water rights administration purposes. Standard setting approaches fall into two broad categories: (1) desk-top methods and (2) those that require river or site-specific field studies.

Some standard setting approaches, often referred to as desk-top methods, are limited to office analysis of existing historical flow gage data if such data exists. Existing data can be analyzed to determine the mean daily flow rate over a long period of record. Professionals with expertise in aquatic species management can then identify the percent of daily mean flow that is needed to provide optimum, good,

or minimum habitat requirements. An example of this approach is the Tennant Method, which has been historically used in some western states.

An example of a standard setting approach that relies on site-specific field studies is when hydrologists establish a limited number of cross sections on a stream and calculate how hydraulic parameters (water depth, velocity, and percent of the channel wetted) change at various flow rates. This data can then be used to select flow rates that meet the hydrologic needs of various species, such as minimum depths for fish spawning and passage, or minimum flow rates needed to flood terraces where targeted riparian species occur. Examples of the standard setting approach that use site-specific data include the Wetted Perimeter Method, R2Cross, and Bankfull Discharge Analysis. An evaluation and description of various standard-setting methodologies can be found in: Instream Flow Council, 2002. *Instream Flows for Riverine Resource Stewardship*.

Caution is advised in relying exclusively upon standard setting approaches. Many ORVs, such as riparian communities and many aquatic species, are highly dependent on variations in flow regimes for their continued persistence. Hydrologic variability refers to changes in flow during a day, a month, a season of the year, and from year-to-year. Since standard-setting methodologies are typically used to protect only one flow rate during a specified portion of the year, hydrologic variability is not fully protected. Some flow prescriptions address this limitation by using “additive” approaches, in which the results of standard-setting studies for individual flow-dependent values, such as separate studies for fish habitat needs and riparian habitat needs, are added to together to develop a composite annual hydrograph that would be protective of both values. Typically, the additive approach protects a greater range of flows than would be protected under a standard setting approach for a single ORV. Other flow prescriptions address the limitations of standard-setting methodologies by using a “subtractive” approach. Under this approach, the results of standard-setting studies are used to identify which portions of the annual hydrograph, including the hydrologic variability inherent during those times of year, are the most critical for performing the hydrologic functions necessary to protect the ORVs. Flows during these times of year are protected under the flow prescription, while flows at other times of year are not protected, allowing portions of the hydrograph to be made available for other uses.

While standard settings approaches using site-specific data require more effort, they are recommended over approaches using only existing flow data, such as the Tennant Method. Site-specific studies can confirm whether a proposed flow rate accomplishes the desired hydrologic and ecological processes, whereas approaches using only existing flow data rely upon broad assumptions concerning what flow characteristics adequately support hydrologic and ecological processes. However, a key limitation of standard setting approaches using site-specific data is that the recommended flow rates may not be broadly applicable outside of the portion of the stream where the data were collected. If a party wants to recommend flow protection over many stream miles or throughout a watershed, a very sizable investment in collection of site-specific data may be required. In addition, the results of site-specific studies should be reviewed from the perspective of existing flow data, if it is available. If a site-specific study recommends a flow rate that is available only during certain portions of the year, it is likely that the claim will need to reflect the water availability verified in the existing flow data.

If there is a need to identify tradeoffs between various flow rates, then an “incremental” methodology may be implemented. Studies based upon this approach typically have more variables that are studied and are done on streams where stakeholders need to engage in comprehensive negotiations to allocate limited flows. Incremental studies are more time and money intensive because they typically involve data collection in many locations and over extended periods of time, with the objective of characterizing the dynamic relationships between flow and habitat. Overall, the advantage of the incremental approach is that it can identify flow rates at which habitat is optimized and inflection points below which the amount of available habitat is dramatically reduced. This can be important for understanding the effects of seasonal flow variation on critical life cycle needs of biota.

Examples of incremental approaches include PHABSIM (which stands for Physical Habitat Simulation). In the PHABSIM methodology, hydrologists will establish multiple cross sections in multiple habitat types (pool, runs, riffles) and collect information on hydraulic parameters measured at various flow rates. That information is then placed into a model that calculates the square feet of river habitat available to various species at various flow rates, based upon the habitat preferences of those species (depth, velocity, and substrate type). The assumption is that if representative cross sections are selected, the values calculated by the model will be a good estimate for the overall amount of habitat available in the entire river at various flow rates.

Another example of incremental analysis is River2D and River3D (which stands for two-dimensional and three-dimensional habitat modeling). River2D and River3D take the habitat analysis a step further by collecting spatial data with GPS units to document the shape of the entire river channel in a selected stream reach. This data is then processed by modeling software to provide an even more precise estimate of the amount of habitat available at various flow rates.

If there is a need to identify the magnitude of change from completely natural conditions to the present-day flow regime, then a diagnostic or monitoring study approach may be most appropriate. The objective of this approach is often protecting or restoring key hydrologic attributes that protect ORVs. In these studies, long-term hydrologic records are statistically analyzed from the perspective of five fundamental characteristics of hydrologic regimes: magnitude, timing, frequency, duration, and rate of change. The direction and magnitude of change in each parameter can then be used to support discussions on the operation of reservoir facilities and stream diversions that may impair or enhance ORVs.

Examples of diagnostic approaches include Indicators of Hydrologic Alteration (IHA) and Range of Variability Approach (RVA). For a detailed description of IHA see Mathews, Ruth and Brian D Richter. *Application of the Indicators of Hydrologic Alteration Software in Environmental Flow Setting*. Journal of the American Water Resources Association, Volume 43, Issue 6, pp. 1400–1413. For a detailed description of RVA, see: Yu, Chunxue et al. *A Revised Range of Variability Approach for the Comprehensive Assessment of the Alteration of Flow Regime*. Ecological Engineering, Volume 96, November 2016, Pages 200–207.

In addition to weighing different study approaches, the interdisciplinary team should also consider all the flow components that protect each ORV, and whether any of those components need intensive study. In addition to hydrology, those components may include the biology and life history of the species under consideration, how the geomorphology of the channel supports the species, water quality impacts on the species, and maintaining connectivity of habitat. The following list provides examples of where a river-related value requires study of a range of flow components to develop an appropriate flow prescription:

- Studies designed to quantify flow rates needed to preserve channel geomorphology for aquatic and riparian species should consider study of flushing flows and channel maintenance flows (see Figure 1).
- Studies that quantify flows needed to protect water quality should consider temporal and spatial variation of temperature, dissolved gases, sediments, and concentrations of various chemical constituents.
- Studies that quantify flows needed to maintain habitat connectivity should consider the riparian zone and floodplains, not just the active river channel.
- Studies that quantify flows needed for biological or ecological ORVs should always consider whether hydrologic variability plays a role in the reproduction and maintenance of native species and communities, as well as preventing non-native species from invading habitat.

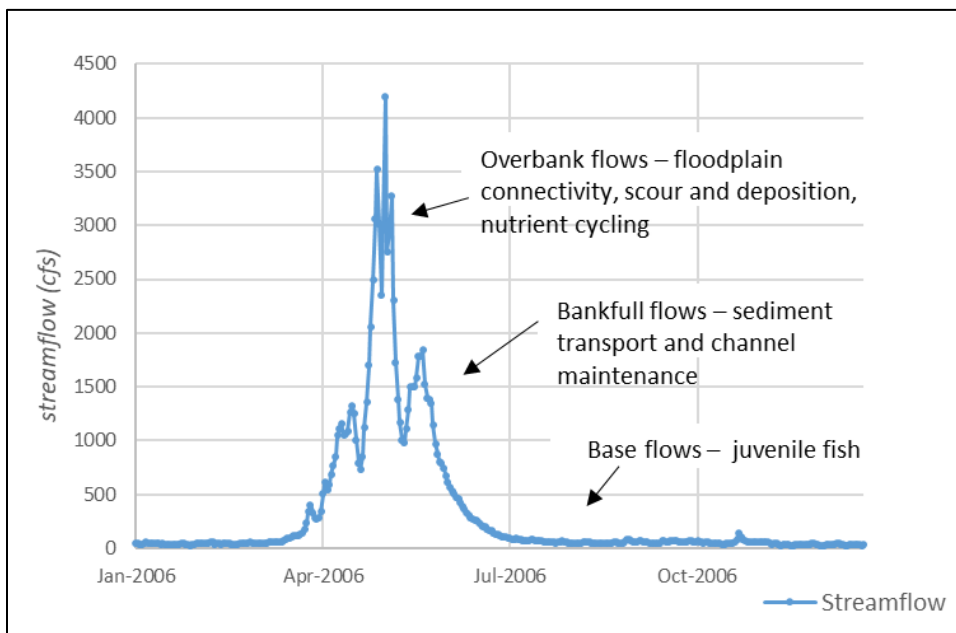


Figure 2. Example hydrograph showing representative flow components necessary to support certain values (for illustration only).

A final question that should be asked when designing instream flow studies is whether the proposed approach will capture the variability of flow necessary to protect each ORV. Natural flow regimes have substantial variability within a year and between years in terms of peak flows, low flows, flow duration,

and flow volume. A particular flow event (snowmelt flood, monsoon spate, frontal event, convective storm, flood years, drought years, etc.) may be beneficial to some species and harmful to others. However, maintenance of long-term natural flow variability is key for accommodating a range of species, communities, and populations. Although legal processes may require that a static flow regime be prescribed, the river manager should be aware that protection of flow variability should be a part of any comprehensive flow protection strategy.

The Instream Flow Council publication entitled *Instream Flows For Riverine Stewardship* provides a comprehensive list of questions to consider when designing instream flow studies (page 129). The publication also provides a comprehensive description of various instream flow assessment tools (page 171).

Recreational Values

Studies that quantify recreational values assume that river hydraulics, channel morphology and riparian vegetation, which are dynamic over time, form the resource conditions that provide recreation “habitats.” Combinations of various resource conditions and various flow rates produce recreation outputs and opportunities. Quantification studies can choose to analyze recreation opportunities, such as whether flows will support whitewater boating, wading-based fishing, swimming, or wading. Alternatively, recreation studies can choose to analyze how flows affect the biophysical resources used by recreationists, such as the quality of a sport fishery, beach size and abundance, and water depths necessary for boat passage.

The choice of study type for recreation ORV is driven by how the data will be used and in what forums. If there is a desire to quantify flow needs on river segments that have low recreational usage or are not controversial, “desktop” or “limited reconnaissance” studies may be sufficient. If the results of the study will be used in formal legal proceedings, such as a water right adjudication or a FERC relicensing process, or for high usage or controversial river segments, then “intensive studies” may be required. Overall, a coordinated recreation study plan should be developed that considers the forums in which data will be used and budget/time constraints, with an emphasis on employing study resources to river reaches where the most controversy occurs.

Desktop study options include the following procedures:

- A review and summary of existing documents to identify information about recreation opportunities and a river’s flow characteristics that make it attractive for recreation. The final product is a written summary of recreation opportunities, facilities, use, physical characteristics, and how these characteristics are affected by flow.
- A search for hydrology data from USGS, state water administration agencies, land management agencies, and water users. A report is written that summarizes hydrologic information relevant to recreational use.
- Structured interviews with experienced recreation users, outfitters, and resource experts, focused on identifying the range of recreational opportunities and the effects of various flow rates on recreational usage. A report is developed that summarizes recreational opportunities, whether

those opportunities are flow dependent, and identifies flow related issues and possible future assessments.

Limited reconnaissance study options the following procedures:

- On-land boating feasibility assessments that involve a structured reconnaissance of the river corridor by experienced boaters and agency staff familiar with the resource. At each stop, participants discuss a pre-determined list of issues such as boating feasibility, types of recreation opportunities, possible flow ranges that support opportunities, and potential effects of diversions or other projects. A report is written that summarizes participants and their opinions.
- On-water boating feasibility assessments comprised of interviews completed while participants boat the river. The types of participants and products are similar to the on-land assessment described above.
- Single flow fishability assessments comprised of interviews on land or on the river with experienced anglers. At each stop, participants discuss a pre-determined list of issues such as availability of different fishing opportunities, possible flow ranges that support opportunities, and potential effects of projects.
- Single-flow assessments for other recreation opportunities, such as swimming, tubing, riverside recreation, conducted by people considered to have expert judgment of the resource. They are typically comprised of on-site interviews with recreation consultants, and they may include interviews with recreation participants. A report summarizing participants, methodology, and findings is developed.

Intensive study options may include:

- Multiple flow reconnaissance assessments that include quantitative ratings of recreation opportunities and conditions. The assessments are made by panels of experienced recreation users or experts. Focus group discussions are completed during multiple site visits at different flow rates. A report summarizes opinions about the feasibility of and quality of different types of opportunities at different flow rates.
- Flow comparison surveys of experienced users, utilizing a formal survey instrument. The survey is designed to document the respondent's experience, knowledge, use patterns, along with their evaluation of conditions and various flow rates. A report documents methodology and findings, with emphasis on identifying distinct types of users and their flow preferences.
- Controlled flow studies for boating that ask a panel of boaters to evaluate their experiences at different flow rates. The differing flow rates are arranged by cooperating with the operator of an upstream facility, typically a reservoir. The panel participates in a focus group discussion after each run at a different flow rate. After all flows have been experienced by the panel, they complete an overall quantitative evaluation, in which various flow rates are compared against each other.

- Controlled flow studies for fishability, which employ techniques that are similar to controlled flow studies for boating. The panel of anglers fish in a number of locations at various controlled flow rates, and then they are surveyed about their flow preferences and observations.

The summary above of types of recreation flow studies was derived from *Flows and Recreation: A Guide To Studies for River Professionals* developed by the Hydropower Reform Coalition (Whitaker, D. et al., 2005). This publication contains significantly more detail on the factors an interdisciplinary team should consider before committing to a particular methodology.

Flow Prescription Considerations for Wild and Scenic Rivers

The outcome of a quantification study is an understanding of the flow needs for an individual ORV. Where there are multiple ORVs, the flows needed to protect one ORV may not protect a second ORV. For example, flows that optimize conditions to protect a native fish ORV may be insufficient to protect a recreational ORV. In that case, the role of the interdisciplinary team is to identify conditions that could protect both ORVs.

Certain tradeoffs may need to be considered including any constraints imposed by legal, institutional, or hydrologic conditions. It is important to remember that the ORVs that led to a river's designation reflect the hydrologic conditions and natural variability that have existed over a long period of time. Therefore, a variable flow regime may allow different ORVs to be optimized at different times of the year or even in different years. For example, the goal may be to optimize one ORV at certain critical times of the year, or during certain wet or dry years, or when visitor usage is typically the greatest. Then other ORVs are optimized at other times of year or in other year types when the optimization of that ORV has minimal impact on the entire suite of ORVs.

Flow prescriptions based upon quantification studies for specific ORVs may suggest preservation of the entire natural hydrograph for relatively pristine rivers. However, where flows have been significantly altered, the entire flow regime may not be available to protect ORVs. In those cases, quantification studies may be used to identify flow rates and flow duration that trigger and protect biological and ecological processes. For example, if channel maintenance processes needed to protect a riparian ORV can be provided by a three-day flood with flows at 1,000 cubic feet per second, then the river managing agency may be able to agree that flood events beyond three days in duration could be placed into water storage facilities for human use, without significantly degrading the riparian ORV. A contrasting example might be that if studies reveal that flow rates above 1,000 cubic feet per second make most habitat unusable for species that comprise a fish ORV, then the river managing agency may be able to agree that flows above 1,000 cubic feet per second can be placed into water storage facilities for human use without significantly degrading the fish ORV. Identifying these critical flow targets may enable the river managing agency to protect ORVs without claiming or negotiating for the entire natural flow regime.

The results of the quantification studies form the factual basis for negotiation of flows between multiple stakeholders in a watershed. Ideally, the studies have been designed in a manner where all stakeholders have confidence in the study methodology and results. However, it is important for all parties to recognize that the quantification studies are only part of the flow protection negotiation process. The

ultimate flow rates that are protected may be influenced by legal, social, and economic factors. In addition, all of the parties should recognize that the flow rates prescribed by the studies are the best available scientific estimate of the flows needed to protect and enhance the ORVs, that various studies may differ on the flow rates necessary to protect all ORVs, and that long-term monitoring is required to determine whether the flow prescription achieves the desired results.

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Appendix A – Case Studies and Conceptual Examples of Instream Flow Quantification Procedures

Instream Flow Protection Case Study: Negotiated Federal Reserved Water Rights Settlements on Idaho’s Wild and Scenic Rivers

A. Introduction

The comprehensive adjudication of water rights in Idaho’s Snake River Basin contains multiple examples of protecting stream flows on designated rivers. As part of the Snake River Basin Adjudication (SRBA), the State of Idaho addressed federal reserved water rights on six rivers in central Idaho that are managed by the U.S. Forest Service (USFS), and 16 stream segments in the arid Owyhee Canyonlands of southwest Idaho that are managed by the Bureau of Land Management (BLM). The rivers are good examples of how the quantification and adjudication of federal reserved water rights (FRWR) can be negotiated by stakeholders, creating certainty for both water users and the river management agencies.

The foundation for the negotiation process was an Idaho Supreme Court decision in *Potlatch v. United States* (134 Idaho 912, 2000) that affirmed the existence of a FRWR for designated rivers in Idaho. However, the decision left the quantification of the FRWR for individual rivers for lower courts to decide. To avoid a long, complex and expensive litigation process, stakeholders negotiated the quantification of the FRWRs. The result of the process were stipulated agreements for each river, negotiated among the stakeholders. The stipulations and proposed partial decrees that specifically defined quantification for each river were transmitted to the District Court For The Fifth Judicial District Of The State Idaho which had jurisdiction over the SRBA. The Court approved and entered those partial decrees in the final unified decree for the SRBA. This case study focuses on how the negotiation process unfolded for two of those rivers, the main stem of the Salmon River in central Idaho and the Bruneau River in southwest Idaho.

B. Salmon River

The main stem of the Salmon River was among the first set of FRWRs for Wild and Scenic Rivers to be negotiated in Idaho. The Salmon River established the overall framework for later Wild and Scenic River negotiations, including the 16 designated stream segments in southwest Idaho. Negotiating parties on the Salmon River included USFS, the State of Idaho, Idaho Power Company, mining companies, forest product companies, municipalities, irrigation districts, Idaho Rivers United and The Wilderness Society.

The Salmon River was designated as part of the Central Idaho Wilderness Act of 1980 (Public Law 96-312). The designated segment starts west of Salmon, Idaho, flows 125 miles through the Frank Church River of No Return Wilderness, and terminates east of Riggins, Idaho. Seventy-nine miles of the segment are classified as “wild,” while 46 miles of the segment are classified as “recreational” because of road access along the river. The USFS, as part of the Frank Church River of No Return Wilderness Management Plan, published a “Salmon River Resource Assessment” in 2000. In the assessment, the USFS determined that the outstandingly remarkable values (ORVs) for the Salmon River are Scenery, Recreation, Fish, Geology, Water Quality, Wildlife, Vegetation/Botany, History, Pre-History, and Cultural. The most recent management plan for the segment, published in 2003, emphasizes noncommercial and

commercial floatboating during the summer season, and fishing, hunting, and jetboating during the spring and fall.

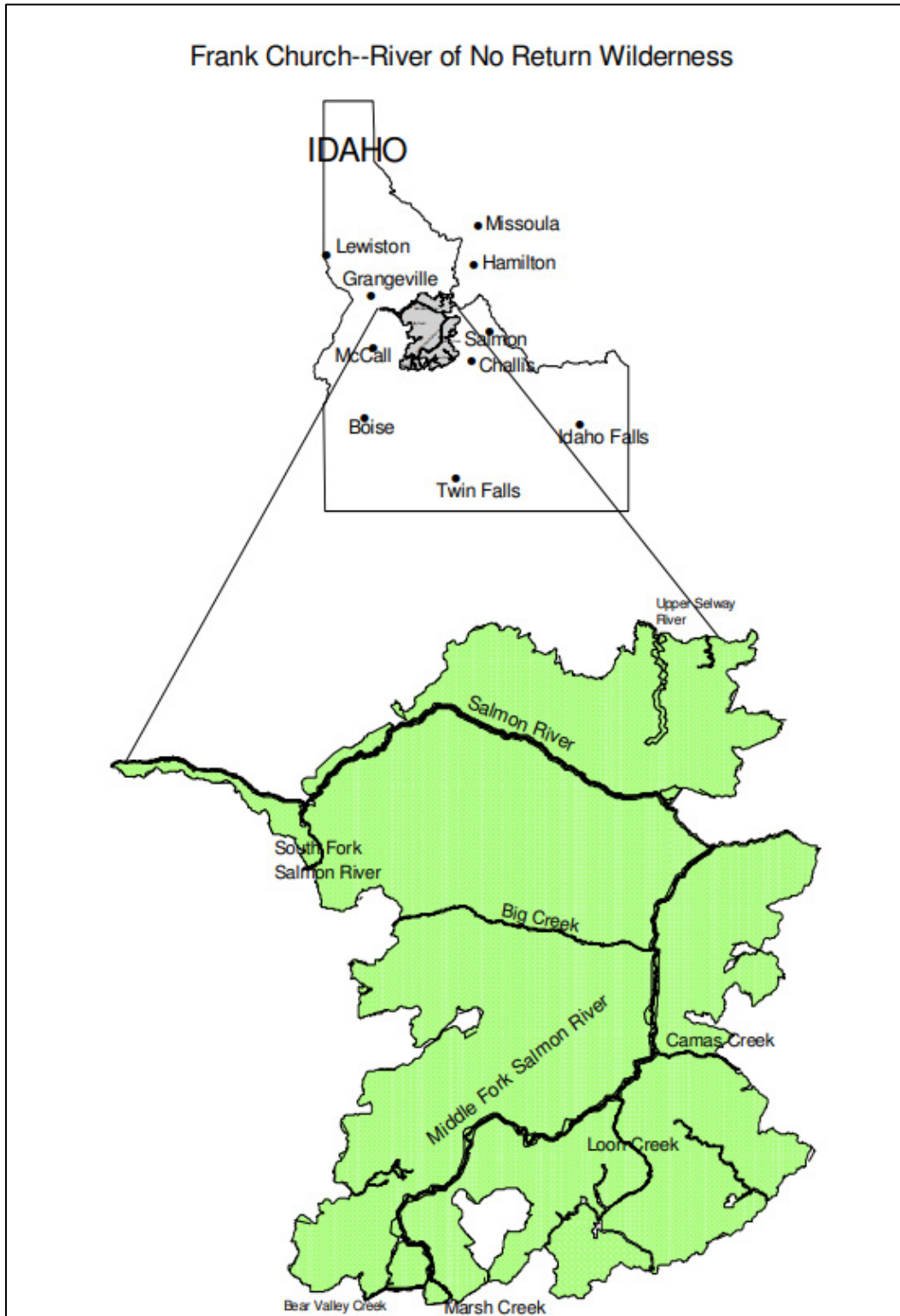


Figure A-1. Wilderness Vicinity Map. Frank Church—River of No Return Wilderness.

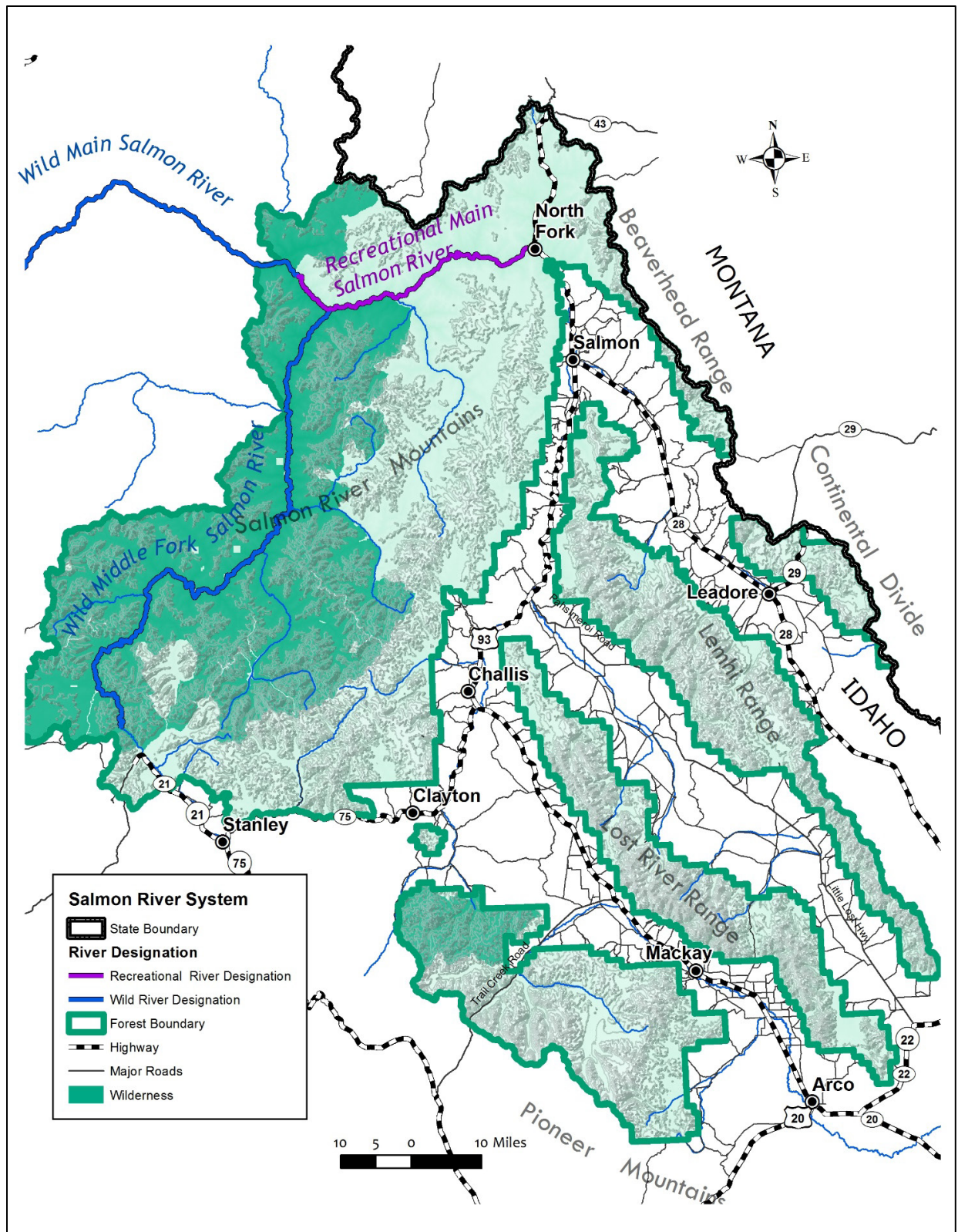


Figure A-2. Salmon River System.

Quantification of Flows Necessary to Protect and Enhance ORVs

The quantification of the flows necessary to protect fisheries incorporated two components related to protection of fisheries and aquatic resources: (1) the aquatic habitat maintenance component; and (2) the fish habitat base flow component.

The aquatic habitat maintenance component considered both aquatic habitat maintenance and riparian ecosystem maintenance. The aquatic habitat maintenance component ensures flows sufficient to transport the bedload sediment through these stream reaches, prevents long-term anthropogenic induced adjustment in the channel geometry, and maintains the ability of these river channels to transport sediment. The riparian ecosystem maintenance component ensures flows sufficient to maintain the riparian ecosystems within these rivers. Analysis of the riparian ecosystem maintenance component of the fisheries-based flows established that the flows necessary to meet the aquatic habitat maintenance, fish habitat base flow and recreation components of the claim would provide flows sufficient to protect the riparian ecosystem. Therefore, a separate quantification of riparian maintenance flows was not required.

The fish habitat base flow component is based on identifying the minimum flow necessary to provide sufficient flow velocity and depth for selected aquatic species to complete their life cycles. The fish habitat base flow component is the minimum flow necessary to provide instantaneous habitat flow protection for the aquatic resource. The investigations included intensive fish habitat base flow analyses carried out over multiple years using the Instream Flow Incremental Methodology (IFIM) as well as one of its major elements, the Physical Habitat Simulation System (PHABSIM).

The quantification of the flows necessary to protect the recreation values of the rivers incorporated two components related to protection of that resource: (1) recreational boating; and (2) maintenance of recreational beaches. The recreational boating component focused on identifying the flows necessary to protect the outstanding boating values on these rivers. Development of the recreational boating component of the claims involved identification of flow thresholds that represent specific recreation opportunities such as technical boating, standard whitewater boating, high challenge whitewater boating and jet boating. Flow evaluations focused on identifying the range of flows necessary to provide each opportunity. The beach maintenance component of the recreation-based flows ensures flows sufficient to maintain the recreational beaches on these rivers. Analyses established that the flows necessary to meet the aquatic habitat maintenance, fish habitat base flow and recreational boating components of the claim would provide flows sufficient to maintain the beaches. Therefore, it was not necessary to add a separate beach maintenance flow component to the claims.

The final claims were based on combining the habitat maintenance flows, the fisheries base flows and the recreation flows. Each claim includes: a base flow component, selected as the higher of the fish habitat base flow and the recreation flow; and a high flow component, based on the aquatic habitat maintenance flow. The high flow component for habitat maintenance applies to each claim and is expressed as a trigger, such that when the stream flow at the referenced gage is equal to or greater than the identified high flow amount, the water right is for all stream flows up to the high flow cap. The base

flow component is expressed such that when the stream flow at the referenced gage is less than the identified high flow amount, the water right is for the flows identified for each (bi-monthly) time period.

Negotiating A Settlement

A key concept that ultimately allowed the stakeholders to reach a negotiated settlement was “subordination.” In this case, subordination meant that USFS agreed that, under certain hydrologic circumstances, it would allow carefully defined human water uses to be exercised without claiming that such use would injure the FRWR. The subordination concept worked in this context because of two facts. First, it was apparent, because of the USFS Resource Assessment, that protecting and enhancing the ORVs would require a very high percentage of the overall flow of the Salmon River. Second, the Salmon River watershed is lightly populated, and satisfying current and future human uses would require only a modest percentage of the overall water volume discharged by the river.

To create the certainty desired by all parties, the stakeholders agreed that water rights in the watershed must be very carefully administered using agreed upon procedures. Idaho Department of Water Resources agreed that it would strictly and proactively enforce water rights priorities in a real-time manner, including any surface water right that was hydrologically connected to the Salmon River, even if that water right was very distant from the designated segment. IDWR’s commitment included requiring each diversion to have a measuring device, a lockable headgate, and regular reporting of water use. IDWR also agreed to create a publicly accessible database that would track water usage and calculate what percentage of the agreed upon subordination had been exercised by water users. Finally, IDWR agreed to create a new water district under its direct supervision called the “Upper Salmon Water District.” The purpose of the district would be to closely supervise water use within the watershed and manage the subordination agreement on the ground.

Another key concept that allowed stakeholders to reach agreement were minimum flow rates for the Salmon River, based upon the flow rate in the river at any given time. The minimum flow rates provided certainty to USFS that the ORVs would be protected and enhanced even as human water usage occurred under the subordination agreement. The minimum flow rates also provided assurance that the ORVs would be protected and enhanced in both dry and wet conditions. The agreement set the following minimum flow rates when flow at the Shoup stream flow gage (upper end of the designated segment) is 13,600 cfs or less, which is considered baseflow condition.

Table A-1. Minimum Flow Rates in Salmon River Wild and Scenic Rivers Settlement.

Period of Use	Discharge (cfs)
January 1–15	1440
January 16–31	1450
February 1–15	1500
February 16–28(29)	1550
March 1–15	1510
March 16–31	1540
April 1–15	1590
April 16–30	2470
May 1–15	3920
May 16–31	7310
June 1–15	9450
June 16–30	7790
July 1–15	4730
July 16–31	2700
August 1–15	1390
August 16–31	1240
September 1–15	1200
September 16–30	1400
October 1–15	1570
October 16–31	1700
November 1–15	1820
November 16–30	1730
December 1–15	1600
December 16–31	1510

When flows at the gage are between 13,600 cubic feet per second and 28,400 cubic per second, the USFS is entitled to all of the flows minus any water that is diverted by water rights that are senior the FRWR (senior to 1980) and any water right exercised under the subordination agreement. This arrangement allows the river and water users to share in the benefits of flows that exceed 13,600 cubic feet per second. The USFS agreed to subordinate to the following water uses:

- All water rights diverting from the Salmon River that were already claimed in the SRBA.
- Water rights already permitted by IDWR but for which final proof of use had not yet been submitted.
- All current and future domestic uses that occur in single family dwellings.
- All current and future livestock watering use that meets Idaho definitions of “de minimus use.”

- All current and future municipal diversions of less than 2.0 cfs.
- 150 cfs for irrigation of up to 5,000 acres when the Shoup stream flow gage reads less than 1,280 cfs.
- An additional 225 cfs for irrigation of up to 10,000 acres when the Shoup stream flow gage reads more than 1,280 cfs.

C. Bruneau River

The 325 miles of rivers in southwest Idaho's Owyhee Canyonlands were designated as part of the 2009 Omnibus Public Lands Management Act (Public Law 111-11). These rivers are distinctly different from the central Idaho designations, because they are smaller desert rivers, fed by snowmelt from the Owyhee Mountains that primarily occurs from late February through June. Base flows in the designated rivers can be extremely low during the July through February period, less than 1.0 cfs for some of the rivers. The watersheds drained by these rivers are even more sparsely populated than the Salmon River watershed, with private lands consisting primarily of ranches and some rural subdivisions.

The Bruneau River is one of the larger Owyhee Canyonlands rivers that was designated in 2009, with flows that often exceed 1,000 cfs during the snowmelt runoff period. The headwaters of the watershed are in the mountains of northern Nevada, and the river flows north to its confluence with the Snake River west of Twin Falls and southeast of Boise. The designation included 38.7 miles classified as "wild" and 0.6 miles classified as "recreational," where roads allow access to the river. The designated segment includes basalt canyons that are hundreds of feet deep, volcanic caves, and spire-like hoodoos. In its 2015 management plan, BLM determined that the ORVs for the Bruneau River include Scenic, Recreation, Fish and Aquatic Life, Wildlife, Cultural, Historic, and Botanical. The FRWR right claim for the Bruneau River was filed in the Snake River Basin Adjudication in 2012 when BLM filed claims for all 16 designated segments in the Owyhee Canyonlands. The State of Idaho was the sole objector to the claims that were filed.

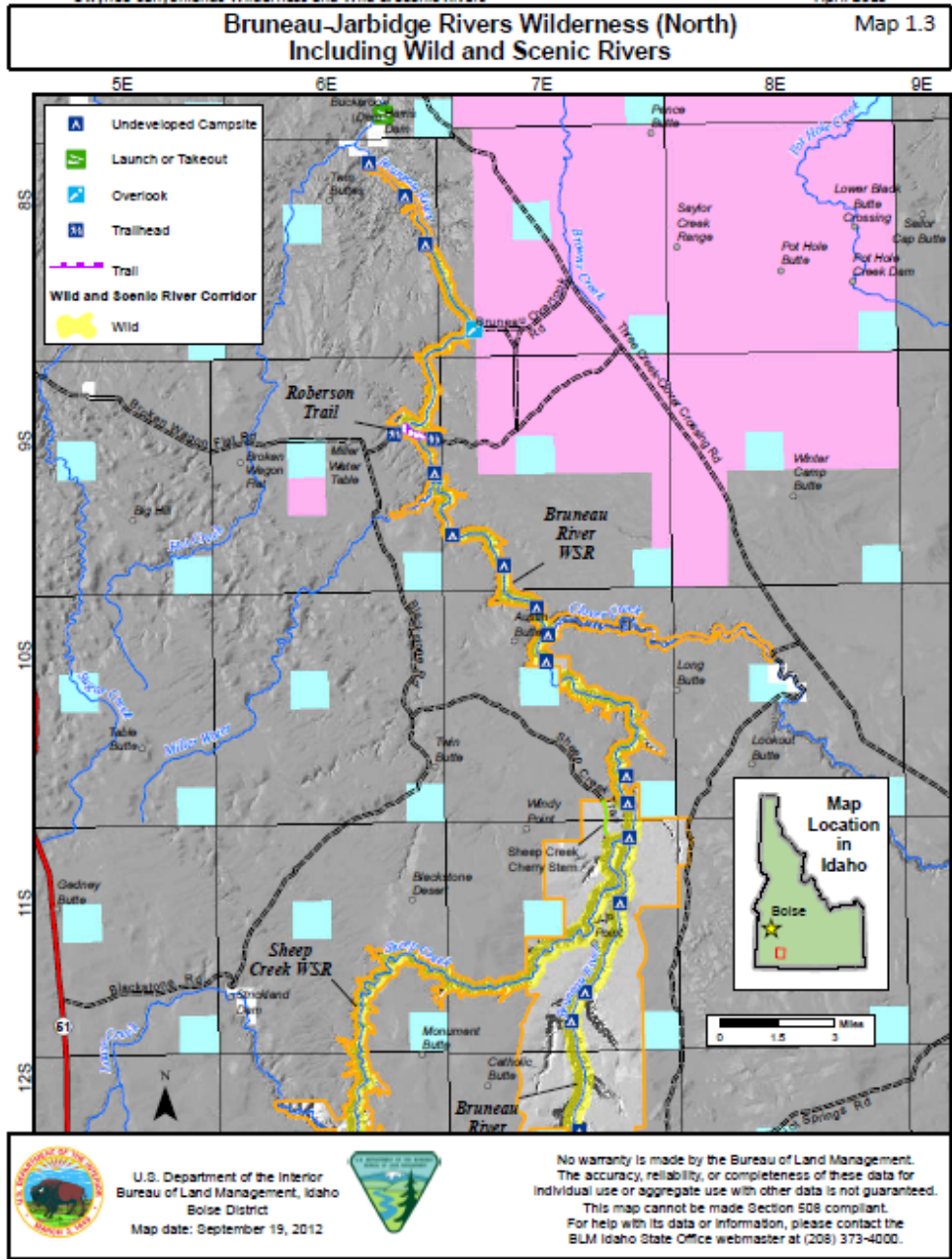


Figure A-3. Bruneau-Jarbidge Rivers Wilderness (North), including Wild and Scenic Rivers.

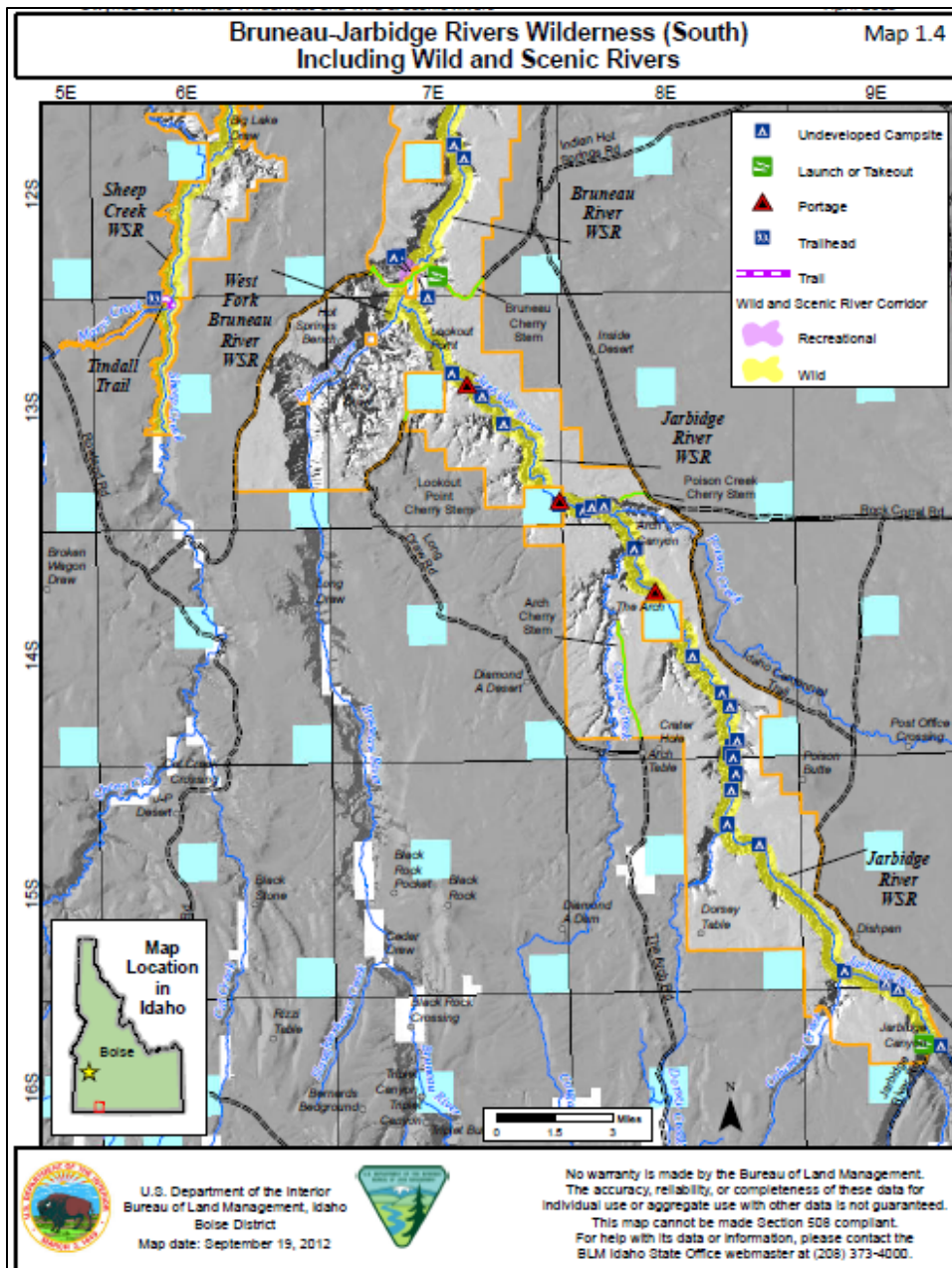


Figure A-4. Bruneau-Jarbridge Rivers Wilderness (South), including Wild and Scenic Rivers.

Quantification of Flows Necessary to Protect and Enhance ORVs

BLM faced multiple challenges in quantifying its claims. The first challenge was that stream flows were not well defined for 14 of the 16 river segments because of a lack of stream gage data. BLM entered into a cooperative agreement with the U.S. Geological Survey to collect and analyze stream flow data, which included installation and reading of multiple of temporary stream gage sites. The lack of long-term flow data forced BLM into a negotiation-based strategy because lack of long-term flow data would have been very difficult to overcome in a formal litigation setting.

The second challenge was that both very high flows and very low flows need to be protected, because those extremes provide important protection for the ORVs. High flows maintain the habitat (channel scouring and cleaning, deposition of nutrients into riparian areas, etc.) that supports the viability of fish populations. High flows also provide recreational opportunities that support public use and enjoyment, primarily through boating. Low flows are necessary to support cold water biota during the dry summer season by providing the habitat (i.e., pools, substrate, hiding cover) needed for the year-long survival of aquatic species. This is particularly important for the Bruneau River, which is designated critical habitat for the threatened bull trout.

BLM ultimately decided to use hydrologic exceedance values (percentage of the time that flows exceed a specified value) as the basis for quantifying its claims, except when specific recreation flows for boating were identified. The semi-monthly exceedance discharges estimate the flows necessary on a day-to-day basis to preserve the rivers' fisheries values (20% exceedance), as well as the recreational values for the period of the year outside the boating season on each river (80% exceedance). BLM determined that 80% exceedance flows would provide sufficient water to preserve general recreational opportunities, such as stream-side hiking, picnicking, photography, and wildlife watching, for the period of the year outside the recreational floating season.

An exceedance discharge is the flow that is exceeded the stated percentage of the time. Therefore, a low exceedance value—like the 20% exceedance selected here to preserve fisheries values—is only experienced when the river has a very high flow. Conversely, a high exceedance value—such as the 80% exceedance identified to provide recreation opportunity outside of the boating season—is commonly experienced on the river. As explained in subsection d. below, in developing the claims, the base flow component was determined by selecting the higher of the fish habitat base flow and the recreation flow for each semi-monthly period. Therefore—for the period of the year outside the recreational boating season as determined for each river—the higher (20%) fisheries flow was always selected over the lower (80%) recreation flow.

The aquatic habitat maintenance flow was initially quantified as the 1.5-year recurrence interval flow, *i.e.*, the high flow that recurs on average every year and a half. Studies have estimated that this flow level is a good surrogate for bank-full flow, *i.e.*, the flow that overtops the riverbank and inundates the adjacent flood plain. This flow level has been established to be the most efficient flow for transporting bedload sediment and maintaining channel structure.

Boating is the primary recreational value on the Owyhee Wild and Scenic Rivers, including the Bruneau River. Thus, the recreational flows estimated by BLM were designed to support various forms of boating. BLM relied on the knowledge of its river rangers to identify specific flow levels necessary to support recreational boating opportunities on each river. These BLM rangers have extensive experience floating the rivers and have documented their observations of the flow levels that provide for various boating opportunities. The recreational floating season is individually defined for each river. The recreational flows identified during these floating seasons on each of the rivers are higher than the (20% exceedance) fish habitat base flows in some semi-monthly periods.

The final claims were developed by combining the fisheries base flows, the habitat maintenance high flows, and the recreation flows. The claims include: (i) a base flow component, selected as the higher of the fish habitat base flow and the boating recreation flow for each semi-monthly period;² and (ii) a habitat maintenance high flow component to maintain physical fisheries habitat in the long term. The habitat maintenance high flow component is expressed as a “trigger,” such that when the stream flow is equal to or greater than the identified threshold high flow amount, the water right is for all stream flows. The base flow component is expressed such that when the stream flow is less than the identified high flow amount, the water right is for the flows identified for each semi-monthly period.

Negotiating A Settlement

The negotiations that had been completed for designated streams in northern Idaho provided experience and concepts that were extremely useful in developing negotiated agreements for streams in the Owyhee Canyonlands. Similar to the USFS negotiations for the Salmon River, BLM negotiated for minimum flow rates that would be protected during baseflow conditions. For the Bruneau River, the following flow rates are protected when flows at a specified quantification site are less than 895 cfs.

Table A-2. Minimum Flow Rates in Bruneau River.

Period of Use	Discharge (cfs)
January 1–15	163.0
January 16–31	196.5
February 1–15	230.0
February 16–28(29)	345.0
March 1–15	460.0
March 16–31	805.0
April 1–15	1150
April 16–30	1440
May 1–15	1730
May 16–31	1540
June 1–15	1350
June 16–30	865.0
July 1–15	380.0
July 16–31	248.0
August 1–15	116.0
August 16–31	105.0
September 1–15	94.0

² As explained above, the non-boating recreation flow was never chosen since it was always smaller than the fish flow.

Table A-2 (continued). Minimum Flow Rates in Bruneau River.

Period of Use	Discharge (cfs)
September 16–30	107.0
October 1–15	120.0
October 16–31	129.5
November 1–15	139.0
November 16–30	143.5
December 1–15	148.0
December 16–31	155.5

When flows at the quantification site are between 895 cfs and 7,640 cfs, which is typically during the late February through June snowmelt period, BLM negotiated to protect all flows, minus a subordination amount. The BLM subordinated to all “de minimus” domestic use and “de minimus” livestock watering use defined in the stipulation. BLM also subordinated to a set amount of irrigation, commercial, municipal, and industrial uses during the March through June period, as set forth below.

Table A-3. Subordination amounts March through June.

Period of Use	Subordination (cfs)
March 1–15	7.77
March 16–31	13.67
April 1–15	15.46
April 16–30	22.11
May 1–15	29.46
May 16–31	25.68
June 1–15	19.84
June 16–30	12.15

Table A-4. Base flow amounts below which subordination does not apply.

Period of Use	Base Flows (cfs)
March 1–15	148.0
March 16–31	231.7
April 1–15	315.0
April 16–30	452.7
May 1–15	590.0
May 16–31	502.9
June 1–15	416.0
June 16–30	256.9

Because of the very low base flow conditions associated with desert rivers, BLM negotiated for administrative limits on the water uses to which the FRWR would be subordinated. First, BLM negotiated for flow rates below which the subordination amounts cannot be exercised at all, and these are noted in the table above. Second, BLM negotiated to spread out the exercise of the subordination amount over multiple tributaries to the river, so that all of the subordination volume could not be exercised in one small watershed, which would potentially dry up that tributary. Third, BLM negotiated for limits on domestic use, based upon limits on subdividing land that were in place in county land use regulations at the time that the agreement was negotiated.

Finally, BLM negotiated for protection of periodic events that create bankfull flows (flows that completely fill the unvegetated channel). BLM determined that such flows are necessary to maintain the stream architecture, which in turn protects flow dependent ORVs such as Fish and Botanical. The State of Idaho agreed to protect bankfull events, provided that the protection is limited to the 100-year flood event.

D. Conclusions

The stipulated agreement for the Salmon River was signed and entered by the court that has jurisdiction over the Snake River Basin Adjudication in 2004. The Bruneau River agreement was signed in 2016. Since that time, the parties have implemented the technical aspects of the agreements, including tracking of depletions under the subordination agreement, administering water rights in real time, and installation and operation of water measurement devices. Challenges facing the parties now include reduced availability of water in response to fluctuations in climate and requests for additional diversions in locations that are close to reaching the limits of water development allowed under the subordination agreements.

E. References

Record of Decision and Final Environmental Impact Statement for the Frank Church – River of No Return Wilderness Revised Wilderness Management Plan and Amendments for Land and Resource Management Plans Bitterroot, Boise, Nez Perce, Payette, and Salmon-Challis National Forests (2003).

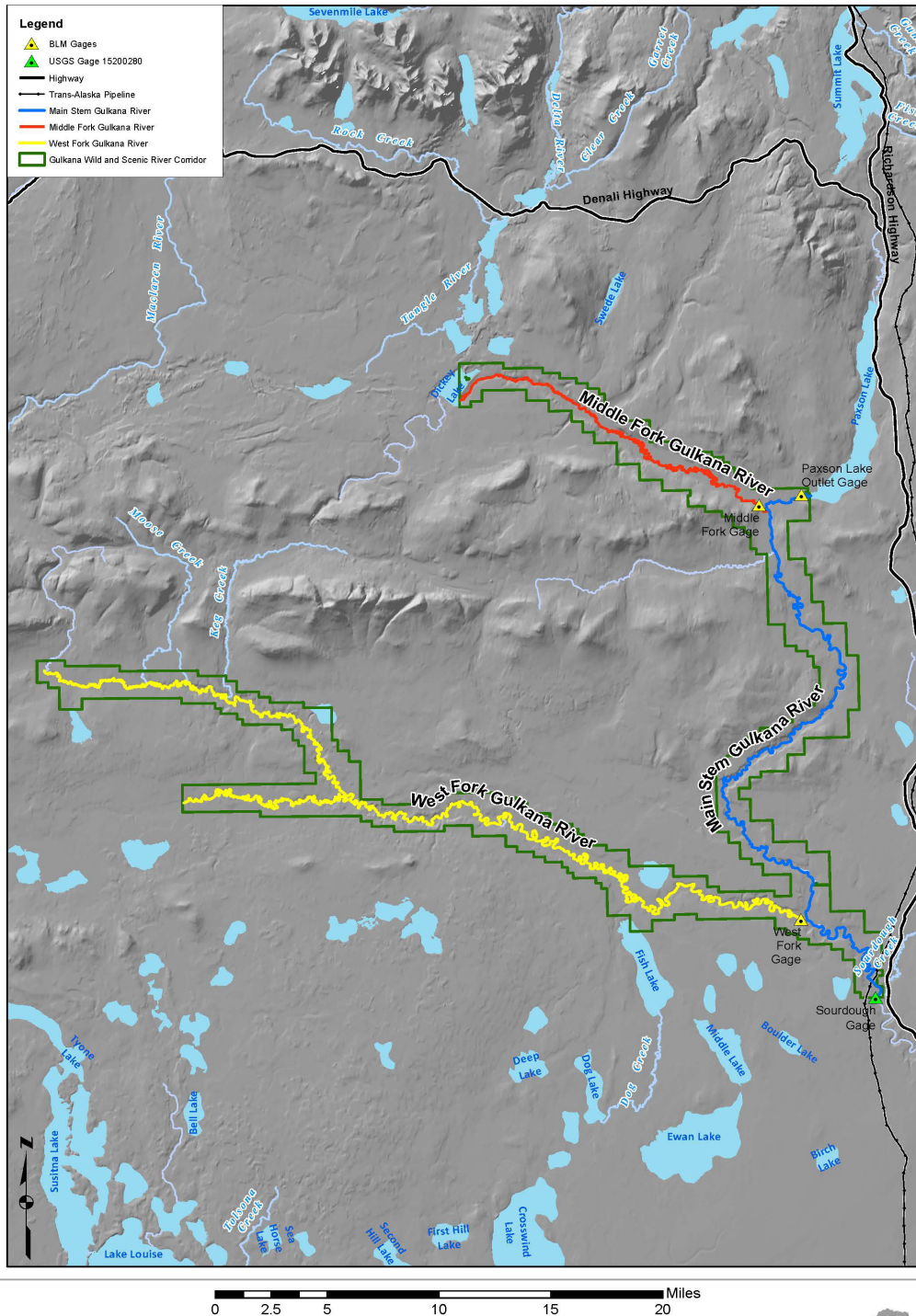
Owyhee Canyonlands Wilderness and Wild & Scenic Rivers, Final Management Plan and Environmental Assessment. Bureau of Land Management, Boise District and Twin Falls District (2015).

Instream Flow Protection Case Study: Gulkana River, Alaska

A. Introduction

The U.S. Congress added 181 stream miles into the National Wild and Scenic Rivers System within the Gulkana River watershed in 1980 as part of the Alaska National Interest Lands Conservation Act (ANILCA). The stream corridor was designated with a “wild” classification (BLM 1983, 2006) and is comprised of the Middle Fork, West Fork and portions of the Main Branch (Figure 1). The U.S. Bureau of Land Management (BLM) is the lead managing federal agency for implementation of ANILCA and the Wild and Scenic Rivers Act on this river system. BLM cooperates with other federal, state, and local agencies, non-governmental organizations, tribal interests, and other private stakeholders to achieve management goals and objectives.

The Gulkana River drains a 2,140 square mile watershed in south central Alaska. It originates in the Alaska Range, flows south to the community of Gulkana Village, and then empties into the Copper River. The river elevation drops approximately 1,250 feet over its course, running through a subarctic landscape with rolling valleys and low ridges. The watershed is dominated by spruce forests, an understory comprised of willow, alder, and berry, and hundreds of ponds and lakes. The Gulkana River is currently one of a few Wild and Scenic rivers located in Alaska that can be accessed by road. It is approximately a five-hour drive from the major populated areas in Alaska, Anchorage and Fairbanks. The Wild and Scenic River Corridor has a variety of high-quality recreational and socioeconomic values including fishing, hunting, boating (floating and power boat), and includes some Class II and Class III rapids. See the map on the following page for an overview of the designated river segments.



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Figure A-5. Original 1996 Gulkana River Reservation of Water Reaches.

B. Legal and Institutional Context in Alaska

The State of Alaska exercises its authorities to manage water allocation in all waterbodies in Alaska under the 1966 Alaska Water Use Act (AS 46.15) and subsequent amendments. The Water Use Act was amended in 1980 to add appropriation of “reservations” of water in rivers and lakes (AS 46.15.145), meaning that the amount of water in the reservation would be protected from future appropriations by other parties. The 1980 amendments enable any entity, including public and private stakeholders, to file applications to appropriate water for reservation of water purposes. The Water Use Act was further amended in 1986 (AS 46.15.165 and 166) to provide federal agencies with the option to confirm Federal Reserved Water Rights (FRWR) through judicial or administrative basin wide adjudications.

In 1983, BLM completed its first comprehensive management plan for the Gulkana River under its Wild and Scenic River designation (BLM 1983). The 1983 plan recognized the importance of needs and opportunities to protect adequate amounts of natural flows in the river, including its pristine water quality. It committed BLM to quantifying flow rates needed to protect the most flow-dependent outstandingly remarkable values (ORVs) and to assess state and federal options to achieve protection.

As part of the related actions taken to achieve the objectives identified in the plan, BLM participated in a joint State of Alaska and federal agencies *Federal Reserved Water Rights Work Group*, which was tasked with identifying the best practices for federal agencies to achieve water rights related objectives in Alaska (*Federal Reserved Water Rights Work Group, 1985–1986*). In addition, in 1990, BLM published *Resource Values and Flow Recommendations, Gulkana National Wild River, Alaska* (Shelby, et al 1990) to identify flow-dependent values and associated flow requirements.

C. BLM Flow Protection Strategy

BLM filed three water rights applications in 1996, following procedures set forth in AS 46.15.145, to reserve instream flows within the portions of the Gulkana River within the designated Wild and Scenic River Corridor. The decision to file applications in 1996 was based on a combination of the factors, publications, and assumptions discussed above. BLM’s strategy for filing the applications is further detailed below:

- The majority of water within the Gulkana River system was unappropriated when it was designated in 1980. This was the same year amendments to the State of Alaska Water Use Act were enacted to allow for any entity to apply for state reservations of water in rivers and lakes.
- Due to the limited road infrastructure in the majority of Alaska, this wild and scenic portion of the Gulkana River watershed is at least a 5-hour drive from major population centers and is relatively remote. Along with this remoteness, the river’s special status and surrounding land ownership make it less likely to be subject to natural resource developments that would negatively impact its wild and scenic river attributes. Thus, it is less likely the river corridor would be subject to appropriations of water that would significantly alter its natural flows. The federal land ownership patterns along the river also mean that significant future applications for water uses by other entities are more likely to include federal and state permitting process.

- The Gulkana River presented an opportunity for BLM to protect adequate amounts of seasonal instream flows using the State of Alaska reservation of water program under AS 46.15.145 before significant water development occurs. This protection would provide future appropriators advance notice of existing flow rates needed to protect flow-dependent values. This is an opportunity that occurs on few rivers outside of Alaska.
- A federal reserved water right is limited to the minimum flows necessary to sustain the primary purposes of the federal designation.
- In contrast, the State of Alaska reservation of water program (AS 46.15.145) allows appropriations of water for instream flows or water levels to “sufficiently” protect one or more of four river- and lake-dependent values on a reach specific basis, including:
 - Protection of fish and wildlife habitat, migration, and propagation
 - Recreation and park purposes
 - Navigation and transportation purposes
 - Sanitary and water quality purposes
- The authority to appropriate flows under Alaska statutes is independent of the federal legislation that designated the river. Using state authority would mean there is unlikely to be a need to quantify and adjudicate basin wide federal reserved water rights using procedures set forth under AS 46.165 and AS 46.15.166. These procedures for adjudicating federal reserved water rights can be costly and time intensive. The same instream flow protection benefits should be able to be achieved under AS 46.15.145 with a less resource-intensive process. The state-based process can reserve water in the river corridor segments without a need to quantify and adjudicate all water uses within the watershed.
- The State of Alaska and federal agencies *Federal Reserved Water Rights Work Group*, described previously, encouraged federal agencies to achieve their water rights objectives by using state law procedures (AS 46. 15), when doing so would be mutually beneficial to a federal agency and the state.
- BLM was interested in improving its cooperative relationships with state government, with the objective of creating a template for working on multiple designated rivers in Alaska.
- This approach, if ultimately successful, would allow BLM to be a water rights owner under Alaska state law. This ownership would allow BLM to be a party to any future state forum where water allocation decisions are made in the Gulkana River watershed that might impact BLM’s past, existing and future appropriations of water.

The BLM 1996 reservation of water applications were accepted as “complete” by the Alaska Department of Natural Resources (ADNR), per AS 46.15.145 for the four reservation of water purposes summarized above.

D. Negotiations on Pending Instream Flow Applications

BLM's applications remained in a "pending adjudication" status for approximately 18 years until 2015. The lag time resulted from issues experienced by many western states. These issues have included limited administrative resources within ADNR to process these and other types of water use applications, as well as a large backlog of earlier water reservation applications filed by other state and federal agencies. Another factor included shifts in work priorities driven by political and budgetary considerations.

ADNR alerted BLM it was planning to initiate the adjudication process for the 1996 Gulkana River applications in 2014. ADNR began the process in 2015 by submitting a request to BLM for supplemental information and clarifications needed for moving forward with the adjudication process. The ADNR request led to a series of meetings and communications for mutually agreeing upon processes that would be used to develop amended applications.

BLM and ADNR agreed that the amended applications would be used in lieu of the original applications, and that there might be 14 or more amended applications, with the objective of breaking the appropriation requests into shorter stream reaches. Collectively, it was agreed that the amended application versions would encompass the same geographic area coverage as the original applications, retain the same 1996 priority date, and would be for the same or lesser amounts of water originally requested in 1996. ADNR also clarified that each amended application covering a specific geographic area had to be limited to one of the four primary purposes for reservations identified under AS 46.15.145. This meant that if BLM wanted to continue to apply to reserve water for all four primary purposes in the same geographic area, BLM would have to prepare one independent, amended application for each purpose. Therefore, there may be up to four amended applications required for a specific reach if all four reservation of water purposes were to be pursued for that reach.

One of the biggest supplemental information challenges identified and used as rationale by ADNR for requesting the amended applications was the sparse availability of hydrologic data specific to the large reaches covered by the original three applications. This is a common situation in Alaska. (Kiang et al 2013). As a result, the original three 1996 application reaches were divided into smaller sub-reaches covering the same geographic area. BLM then used a combination of empirical and synthetic hydrology, biological data, and other water data sources to develop water availability estimates for the revised reaches. Examples of data sources and methods included:

- Direct data from four stream gages—one installed by U.S. Geological Survey and three installed by BLM.
- Development of linear regression equations to establish flow relationships between gaged locations and locations where stream measurements were taken regularly by BLM personnel
- Estimation of unit runoff per acre for portions of the watershed that were difficult to access for direct flow measurements.
- Use of mass balance equations to ensure that the total volumes of all estimated flows did not exceed actual flows measured by downstream gages.

- Review of Alaska Department of Fish & Game Anadromous Fish Catalog data and other fish periodicity data sources.
- Review of existing information regarding other water uses such as recreation, water quality, navigation, etc.

Based on this series of deliberations with ADNR, BLM completed and submitted its initial batch of amended applications in 2018. The initial batch was based solely on fish and related reservation of water uses as the primary purpose. A more detailed description of this use (11 Alaska Administrative Code 93.141) follows:

"...the quantity or level of water necessary to maintain suitable habitat conditions for the various life stages of fish, other aquatic organisms, and wildlife, including waterfowl and mammals, and their habitat, including water quality, depth, velocity and temperature, substrate, or streamside vegetation...."

The flow requests in the 2018 amended applications for fish and related purposes were based on maintaining monthly, and during some periods, weekly flows. The requests were based on maintaining flows within the natural, long-term ranges of variability during the monthly and weekly flow periods.

ADNR will initiate the adjudication phase for the amended applications once BLM has submitted amended applications for recreational purposes. That phase will involve meeting with BLM to discuss what flow requests will be publicly noticed for public interest reviews and comments, and other procedures required by AS 46.15.080. In the interim, BLM is continuing to work on completing the remaining batch of amended applications for other non-fishery purposes allowed under Alaska's reservation of water statute. Applications for those additional purposes will also be based on maintaining natural, long-term variability in flow rates that are needed to support each of the additional uses. Regardless of the timing for completing the adjudication processes, BLM will continue to diligently review any other water right applications filed in the Gulkana River watershed that might negatively impact the maintenance of the reservations of water initially requested in 1996.

E. References

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Instream Flow Protection Case Study: West Branch of the Farmington River, Connecticut

A. Introduction

The West Branch of the Farmington River originates in Hayden Pond near Beckett, MA in the southern Berkshire Mountains and flows generally south into northwestern Connecticut. The designated portion of the West Branch of the Farmington River is located wholly within the state of Connecticut below Goodwin Reservoir. The designated segment extends 14 miles below Goodwin Dam in Hartland, CT to the Canton/New Hartford city line.

B. Outstandingly Remarkable Values (ORVs)

The ORVs include Fish and Wildlife, Recreation, History and Scenery. The most sensitive flow dependent ORVs were determined to be Fish, Recreation, and Scenery.

C. Hydrologic Context

The West Branch of the Farmington River is part of the Farmington River watershed. The watershed drains a total area of 602 square miles in Massachusetts and Connecticut. About 156 square miles, or about 25% of the watershed area, is located in Massachusetts, most of which forms the West Branch of the Farmington River sub-basin. The Massachusetts portion of the West Branch of the Farmington River is about 18 miles long before entering northwestern Connecticut. The West Branch and mainstem of the river are about 80 miles in length from its source in Massachusetts to the confluence with the Connecticut River in Connecticut.

D. Stream Flows

The USGS operates a stream gage on the West Branch of the Farmington River, CT about 2 miles downstream of Goodwin Dam. This gage has been in operation since 1955, and measures drainage from an area of about 131 square miles. The mean annual discharge is 259 cubic feet per second (cfs) for the period of record. The highest peak flow reported was a flow of 572,005 cfs in 1955 prior to the completion of the Colebrook River Dam. This stream gage is located within the designated portion of the river below Goodwin Dam. Peak flows recorded at this stream gage are affected by flood-control regulation at the Colebrook River Lake since 1969. Stream flows are also affected by regulation at Otis Reservoir, Colebrook River Lake, and West Branch Reservoir.

E. Water Usage and Facilities

The watershed for the West Branch of the Farmington River includes three dams and associated reservoirs: Otis Dam originally built in the 1880s near the river's headwaters, the Goodwin Dam, constructed in 1955 by the Hartford Metropolitan District, Connecticut (MDC), and the Colebrook River Dam, constructed in 1969 by the Army Corps of Engineers (ACOE).

The Otis Dam impounds the 1100-acre Otis Reservoir in Massachusetts. The dam and reservoir were originally constructed in 1865 to increase water storage during low flows and for downstream power generation. Today the Reservoir is owned and operated by the Massachusetts Department of Environmental Protection and used primarily for recreational purposes. An annual drawdown (release of

stored water) occurs during two weekends in October, lowering the water level to minimize potential ice damage to shoreline structures.

The Colebrook River Dam was constructed for flood control purposes (Public Law 86-645) in 1969 following severe flooding associated with Hurricane Diane in the 1950s. The Colebrook River Dam is operated by the Connecticut Department of Energy and Environmental Protection to support fisheries, and by the ACOE for flood control. At one time, the MDC operated a hydroelectric power facility at Colebrook River Dam, but the contract between the ACOE and the MDC³ was terminated in 2019, and the project was decommissioned.

Goodwin Dam was completed in 1960 to impound the West Branch Reservoir in Connecticut. The MDC owns and operates Goodwin Dam and makes releases to the West Branch of the Farmington River in accordance with Connecticut General Statutes, a riparian agreement, and an agreement with the Allied Connecticut Towns.

See Figure A-6 below for the location of West Branch of the Farmington River and major water management facilities along the river.



Figure A-6. Location of the West Branch of the Farmington Wild and Scenic River and major water management facilities along the river.

³ Contract Between the United States of America and the Metropolitan District for Water Storage Space in Colebrook River Reservoir, dated February 11, 1965 and amended October 28, 1975.

F. Farmington River Instream Flow Study

The West Branch of the Farmington River in northwestern Connecticut was studied for potential designation as a WSR under Section 5(a) of the Wild and Scenic Rivers (WSR) Act beginning in the late 1980s, leading to its designation in 1994. The study, conducted by NPS, was first initiated by local communities concerned about the effects of potential water withdrawals from the river by MDC. The MDC is the water supplier to the greater Hartford area, and in 1981 it proposed a diversion to connect reservoirs on the West Branch Farmington River with the reservoir on the Farmington's East Branch that provided the bulk of the MDC's existing supply. In authorizing the WSR study, Congress directed the NPS to address the water supply issue.

Therefore, as part of the 5(a) study, the NPS, in cooperation with a federal advisory committee appointed for the study, conducted a comprehensive instream flow study. The flow study was designed to provide information on the following questions:

- How do changes in instream flows affect the Farmington's fish, recreational and scenic resources? (These are the Farmington's flow dependent ORVs.)
- What flows are needed to maintain these resources?
- Is there sufficient water in the Farmington basin, under varying precipitation conditions, to allow for withdrawals from the West Branch while maintaining those resources?

The Farmington Instream Flow Study was performed by consulting firms selected by a technical advisory committee (TAC), with members from a federal advisory committee, the Connecticut Department of Environmental Protection, MDC and NPS. The consultants used flow data from a 20-year period of record on the main stem, West Branch, and a major tributary to create mean monthly flows for each of these three sites. Flows were calculated both for regulated conditions, based on actual dam releases for the period of record, and estimated unregulated flows that would have occurred without the dams. Monthly regulated and unregulated flow predictions at each gage were then developed for normal, dry and drought conditions using representative years from the period of record. For study sites not near the gaging stations, flows were estimated based on gaging station data corrected for the drainage area at the study site.

The consultant evaluated flows needed to protect the fish and wildlife ORV by focusing on those flows needed to support fish populations. Fish habitat was quantified by calculating weighted usable area (WUA) at 17 transect sites using the Instream Flow Incremental Method (IFIM). Habitat needs for several life stages of Atlantic salmon, brown trout, brook trout, American shad, smallmouth bass, and longnose dace were assessed. Three alternative flow scenarios to maintain and protect fisheries resources were developed: 1) the optimum habitat scenario, defined as the maximum WUA for the target species/life stage; 2) the near-optimum habitat scenario, defined as within five percent of maximum WUA; and 3) the intermediate scenario, a hybrid of the other two scenarios that compensated for deficiencies in WUA for adult brown trout during certain months under the near-optimum habitat scenario. Based on an assessment of the validity of the resulting WUA data, the TAC determined that adult brown trout and juvenile Atlantic salmon should serve as surrogates for the fish community.

Flows necessary to protect the recreation and scenery ORVs were also evaluated by conducting surveys of visitor user experiences. Recreational activities included: fishing, both bank and wading; tubing; downriver canoeing; and play boating. For each of these activities, as well as for scenic enjoyment, the evaluation identified both the minimum flow needed for an acceptable experience and the optimum range of flows that provides the highest quality experience. Data were collected through surveys of weekend users during the spring, summer and fall of 1991; during an intensive three-day field evaluation conducted by experts and local volunteers under a range of controlled releases; and, for scenery, by videotaping flows during the controlled releases. The videotapes were later viewed by impartial audiences which indicated the flows they considered to be the most scenic.

The consultant used a 30-year period of record to determine how much recreational opportunity existed historically for each recreational activity during normal, dry and drought years. For both minimum and optimum conditions, they then calculated the net annual volume of water needed to provide the historical recreational opportunity for each activity under different precipitation conditions. Allocation scenarios were developed depicting the annual volumes of water required for each of the following:

- The three alternative habitat scenarios for fisheries, including the optimum, near optimum and intermediate scenarios.
- The historical numbers of minimum and optimum days that existed during normal, dry and drought conditions for the different recreational uses.
- A fisheries enhancement pool.
- Flushing flows (during normal rainfall years only).
- Dam releases required to meet downstream power generation needs under a riparian agreement.
- Two hypothetical rates of withdrawal (10 and 20 million gallons per day) for water supply.

Based on the defined scenarios, it appeared that during dry and normal years there would be sufficient flow to support all resources and uses, including the hypothetical water supply withdrawals. However, during drought conditions, even though the MDC could exercise its right to reduce or suspend riparian releases while providing financial compensation to the riparian owner, there would still be insufficient water to provide for the optimum fisheries habitat scenario, fisheries enhancement pool, historical levels of recreation, and the water supply withdrawals.

However, all of these uses could be met during a drought under either the near-optimum or intermediate fisheries scenario. An important assumption associated with the instream flow study was that upstream reservoirs have the capacity to store all the water predicted to be available in any given year. In addition, the study was based on a number of other assumptions and simplifications, with the understanding that the results merely provided an indication as to whether future water withdrawals might be compatible with WSR designation, as opposed to a detailed assessment of a specific withdrawal proposal's impacts on the Farmington's ORVs. Despite these and other limitations, by conducting the instream flow study during the WSR study, the study team achieved several desirable objectives:

- Documentation of flows that supported the Farmington’s three flow dependent ORVs (fish and wildlife, recreation and scenery) before the date of designation. These data provide baseline conditions against which the impacts of any proposals to change the river’s flow regime could be assessed. The Upper Farmington River Management Plan, under which the designated reach is managed, incorporates these baseline data in setting resource management standards.
- Information for key decision-makers on the designation issue, including the State and regional interests who are now responsible for co-managing the river with the NPS. The flow study helped support the finding that the WSR study segment was suitable for designation, resulting in the Secretary of the Interior’s recommendation to Congress to designate the river.
- Information regarding opportunities for providing resource-enhancing flows through the reallocation of existing water by the agencies responsible for dam operation within the basin. Should a diversion ever be proposed, the impacts of reduced flows on the Farmington’s free-flowing character, water quality, and ORVs would be assessed under Section 7 before federal involvement in the diversion (either through permits or financing) would be allowed.
- For more information about the Farmington Instream Flow Study, please consult: *An Instream Flow Study of the Mainstem and West Branch of the Farmington River* (NPS, June 1992).

G. State of Connecticut Stream Flow Standards

In 2005, Connecticut passed Public Act 05-142 (CGS Section 26-141(a) and (b)), which required the Connecticut Department of Energy and Environmental Protection (Connecticut DEEP) to work with the Department of Public Health to update standards for maintaining minimum stream flows. The act required standards to balance ecology, wildlife, and recreation while providing for public health, flood control, industry, agriculture, water utilities and other lawful uses of water. As part of the requirements of the act, stream flow standards were established for all rivers and streams throughout the state based on a river classification process.

The stream flow standards incorporate the concept of balancing human and ecological needs for water by establishing different flow standards for each of four classes of waters. The flow standards for each class are based on maintaining, to various degrees, the natural variation in flow expected in Connecticut given seasonal climate and rainfall patterns and human use.

- Class 1 — free flowing, priority given to protecting ecological health
- Class 2 — minimally altered, free flowing stream system
- Class 3 — moderately altered, intermediate balance between ecological and human uses.
- Class 4 — substantially altered, priority is given to human uses.

H. State of Connecticut Regulations

Connecticut Special Act 444 of 1949⁴ authorized the MDC to build a reservoir on the West Branch of the Farmington River near the geologic feature known as the Hogback. The Act provided that only natural flows above 150 cfs could be stored at the reservoir and required maintenance of a minimum flow of 50 cfs regardless of natural flows. The Special Act states the following:

The natural flow of the water of the west branch of the Farmington River shall not be held back at the dam of the proposed Hogback reservoir, except such flow of said west branch as shall be in excess of one hundred fifty cubic feet per second above the dam site, exclusive of any water discharged from the Otis Reservoir watershed; and the minimum flow shall not be allowed to fall below fifty cubic feet per second through or over the dam regardless of the actual natural minimum flow.

The ACOE releases flows at the request of the Connecticut Department of Environmental Protection (CT DEEP) from the two fisheries storage pools behind the Colebrook River Dam between May 15 and September 30 of each year. The two agencies work together to determine whether released waters are passed over or through the dam, or some combination of these two methods, to provide water temperatures suitable for salmonid fishes.

I. Local Government Regulations

Between 1991 and 1992, while the river was being studied for designation, six of the towns along the river passed zoning regulations known as the Farmington River Overlay Protection Districts. These districts limit certain activities and construction within one hundred feet of the river's normal high-water level unless specific criteria and standards are met. Regulated activities include the impoundment of the river, new construction or additions to existing buildings, new septic tank or other waste disposal systems, dredging or sand and gravel excavation, and cutting or removal of vegetation. The publicly recognized purpose of the Farmington River Overlay Protection Districts includes the following goal:

To prevent any alterations to the natural flow of the River in order to maintain its ecological, recreational, aesthetic and other qualities such as documented in the Farmington River National Wild and Scenic River Study and other federal, state, and local documents relating to the Farmington River.

⁴ An Act Increasing the Powers of the Metropolitan District, Respecting Water [January, 1949].

J. Summary of Instream Flow Administration

Six key factors currently control the flow of the West Branch of the Farmington River:

1. A minimum release of 50 cfs from Goodwin Dam is required at all times.
2. All natural inflow to the Colebrook and West Branch Farmington reservoirs—up to 150 cfs—must be released from Goodwin Dam.
3. All upstream flows released from Otis Reservoir in Massachusetts must be released from Goodwin Dam.
4. Upon request of the Farmington River Power Company, all flows in the amount of 0 to 300 cfs, up to 400 million gallons per day and 21.7 billion gallons per year, must be released from Goodwin Dam.
5. Releases from Colebrook Reservoir when water elevation is above 708 feet.
6. Releases up to 3.26 billion gallons per year from Colebrook Reservoir as needed by the Connecticut DEEP for fisheries.

The Goodwin Dam releases required under the riparian agreement with the Farmington River Power Company historically have provided a substantial contribution to base flows in the West Branch, providing much if not all of the water for fisheries and recreation. This is particularly true during the drier summer months, when the riparian releases have often produced river flows considerably higher than what might otherwise be available.

Determining Instream Flow Requirements for a Wild and Scenic River Segment: Two Conceptual Examples

A. Introduction

The overall management goal for any designated Wild and Scenic River is to protect and enhance its water quality, free-flowing condition⁵, and outstandingly remarkable values (ORVs). Achieving these goals requires a hydrologic flow regime that reflects natural flow conditions and protects the river's ORVs to the greatest extent possible. Some designated rivers have largely unaltered hydrology, where meeting the management objective can be achieved by protecting the existing flow condition at the time of designation and working to prevent future diversions or depletions. However, some rivers have been designated in locations where flows have been modified through diversion or impoundment, and the flows available to protect and enhance free-flowing condition and a river's ORVs must also support existing human uses. The hydrologic condition that existed at the time of designation represents the baseline condition and starting point for future flow protection and enhancement activities.

Given the unique hydrologic characteristics and environmental setting of every designated river, and the range of legal constraints and opportunities that exist in different states, no one approach will work in every situation. However, some of the topics that a river manager will likely need to address, given constraints on personnel, budgets, and time, include the following:

- What is the most cost effective and reliable method available to document natural flow variability (for example: annual, seasonal, and daily variation in flows, flood and drought duration and magnitudes) that protects free-flowing condition and is key to protecting a healthy, functioning river system?
- What is the most cost effective and reliable method available to quantify the flow rates needed to the flow-related attributes of a river's ORVs (for example, if an ORV includes recreational boating, what flow rates provide the most optimal boating experiences).

The following two fictional examples provide the river manager with a mix of possible approaches that can be used to answer these questions in a range of river environments. Both rivers in the fictional examples have similar flow characteristics and the same set of ORVs but different levels of complexity. The first example reflects a complex river that has been modified by multiple existing water users with concerns about federal reserved water rights, and where an instream flow claim is likely to be contested in court. The second example is a low complexity river, where there is very little existing water use and an instream flow claim is unlikely to be contested. Most rivers today have some existing upstream uses, but rivers located within wilderness areas, national parks or other remote area may have very little or no existing water uses. Many rivers will fall between these two examples, in terms of complexity. The river manager, in consultation with legal counsel and agency staff with expertise in various disciplines, will

⁵ Free-flowing condition is defined as flowing in natural condition without modification, diversion or impoundment.

need to determine which types of studies will best satisfy the legal and administrative processes that are driving the instream flow quantification.

B. The Common ORVs and Flow Characteristics of Two Fictional Rivers

ORVs: Fish and Wildlife, Scenery, Recreation, and Cultural Values

The following is a list of flow-related attributes of free-flowing condition and flow-related attributes of the ORVs on both fictional rivers:

- Free-Flowing Condition: A range of geomorphic landforms in the channel (sand bars, cut banks, and islands); healthy native riparian vegetation communities line the river corridor: sediment regime is maintained (sediment is transported through the designated reach with sediment deposition and aggradation balanced over the long term); channel substrates support an abundant community of macroinvertebrates that provide food for diverse fish species and sensitive bird species.
- Fish and Wildlife Values: A cold water fishery found nowhere else in the region of comparison; habitat supporting sensitive and threatened bird species; a variety of birds that represent an ecological crossroads in the landscape.
- Scenic Values: A mosaic of riparian vegetation with different plant varieties, sizes and age classes along the river corridor provide visually pleasing scenery; changing fall colors provide a stunning and colorful display against the backdrop of an arid landscape: dramatic canyons; braided stream channel with clearly running water flowing in the foreground against a backdrop of snow-covered mountains.
- Recreational Values: Exceptional whitewater boating opportunities at certain times of year, with more mellow floating and canoeing opportunities at other times of year.
- Cultural Values: Riparian and aquatic plants used for religious ceremonies, food, medicinal purposes, basket weaving and fiber; historically occupied camps on bluffs overlooking the river; traditional hunting and fishing practices in the river corridor.

C. Fictional Example: Consternation Wild and Scenic River

Management Context: Large and complex river system with many existing diversions and upstream impoundments; the instream flow protection claim will likely to be contested in court.

Examples of detailed studies that could be used to quantify flow related attributes of the Consternation Wild and Scenic River:

- Studies related to natural flow characteristics:
 - Analyze of U.S. Geological Survey (USGS) streamflow data that represent historic flows and reflect the flows at the time of WSR designation.
 - Install water level data recorders (and barometers if recorders are not vented) at the upstream and downstream extent of study reaches to measure river stage.
 - Complete cross-sectional and longitudinal surveys to measure channel width, depth, and slope.
 - Complete two-dimensional hydraulic modeling of selected reaches to develop rating curves that provide flow rates for various water surface elevations; map water depths and velocities associated with different flow rates; determine flow rates associated with inundation of important channel landforms (for example, what flow rates inundate the adjacent floodplain; what flow rates inundate in-channel sandbars).
 - Conduct literature review of hydrologic and hydrogeologic reports focused on the watershed, including reports prepared by USGS, National Resource Conservation Service (NRCS), irrigation districts, etc.
 - Install cased wells and water-level recording devices across the floodplain to understand surface water – alluvial groundwater interactions.
- Studies related to fish:
 - Inventory aquatic invertebrates in representative macrohabitats (pools, riffles and runs) at each of the study reaches.
 - Characterize flows that support substrate composition (gravels, sands, cobbles) important to aquatic invertebrates.
 - Shock fish in selected areas to inventory fish species and calculate fish density and biomass.
 - Compile literature review of fish life histories that describe when fish species spawn and describe flow-related conditions that drive fish spawning, such as water temperature and passage over channel obstacles.
 - Develop habitat suitability curves to identify the needs of various species in terms of water depths and velocities.
 - Use two-dimensional hydraulic models to evaluate habitat characteristics (flow rate and depth) and abundance (quantity of habitat) at certain flow rates.

- Studies related to wildlife (in this example, birds):
 - Compile literature that documents which bird species use the river corridor.
 - Conduct bird inventories at sites where data gaps exist.
 - Compile life histories of bird species that relate habitat needs (for example, sand bar nesting) to flow conditions, if such life histories exist.
 - Identify primary food/forage sources for birds and determine flows needed to support those food/forage sources.
 - Use two-dimensional hydraulic models to evaluate habitat characteristics (e.g. exposed sand bars, shallow water depths inside channels) and quantity at certain flow rates.
- Studies related to scenery and/or habitat (riparian vegetation):
 - Inventory and map plant community composition in the river corridor.
 - Search literature for studies that relate plant species to flow regime (for example, the flow frequency, magnitude, and extent of channel disturbance, and groundwater depth necessary for seed dispersal, germination, and establishment of individual plant species)
 - Use two-dimensional hydraulic models to evaluate habitat characteristics (e.g. exposed sand bars, depth of flooding in riparian areas) and quantity at various flow rates.
- Studies related to recreation (boating):
 - Document flows needed to float a canoe or raft without dragging or paddle hitting the channel bottom.
 - Install motion-detecting cameras (that are sensitive to personal privacy) that can relate types of recreational uses to flow rates that are present at the time of use.
 - Survey recreational users (online and on site) to get opinions about the quality of the recreational experience at different flow rates and times of year.
- Cultural:
 - Identify river-related plant species used in certain cultural practices (basket weaving, music, medicine, food and food preparation, etc.)
 - Relate plant species that are important to cultural practices to the flow regime.
 - Identify traditional river-related hunting, trapping and fishing practices, along with flow rates or duration of flows at certain times of year important to those practices.

D. Fictional Example: Contentment Wild and Scenic River

Management Context: Located within a designated wilderness area; no existing water uses; strong local support for instream flow protection; flow protection claim is unlikely to be contested in court.

This example relies upon existing data and studies to quantify the flow regime need to protect free-flowing condition and ORVs. The following are examples of descriptive narratives that could be used to characterize flow conditions and flow related attributes of the Contentment Wild and Scenic River:

- Descriptive narratives that link ORVs to flow regime:
 - Develop a narrative that identifies components of the flow regime that protect specific ORVs (from the Comprehensive Management Plan, or from the Act designating the river if it references key flow characteristics).
 - Support the narrative with a literature review or with existing data obtained from monitoring or studies on the river.
- Characterize natural flow conditions and current hydrology:
 - Use USGS gage data or other long-term flow records to summarize important flow components (annual average flow, peak flow, base flow level, range of interannual variability). Be certain to differentiate between flow rates that existed at time of designation versus flow rates that exist today.
 - In ungaged locations, use USGS (or similar) regional regression equations that allow for prediction of important flow components from basin attributes (watershed area, precipitation, snowpack, elevation, and location)
 - Install water level recorders and develop a time series of river stage.
 - Use hydraulic models and field measurements to develop rating curves that illustrate the relationship between river stage and flow rates.
- Provide a narrative that illustrates how the ORVs are protected by the recommended flow regime and the likely consequences of deviations from specific components of these flows (frequency, duration, magnitude, timing, variability in low flows, high flows, etc.)

Appendix B – Federal Agency Policy Direction

The federal agencies that manage designated rivers have similar guidance, but the guidance varies in phrasing and level of detail.

Bureau of Land Management River-Related Management Policies

The BLM Water Rights Manual (BLM 7250 Manual) provides policy and guidance for BLM in locating, acquiring, perfecting, documenting and protecting BLM-administered water rights, with the goal of managing and conserving economic and resource values of the public lands. Specific sections include:

BLM 7250 Manual Section 1.5.A.1

Review and secure water rights for BLM programs and projects by affirmation of a Federal reserved water right, if one is available and the water is necessary to preserve the primary purpose of the reservation. Assertions of federal reserved water right may include, but are not limited to, water for the sustainability of a resource such as fish populations or riparian habitat, for wild and scenic rivers values, for recreational use, for interpretation of archaeological values, for livestock values, or BLM facilities location on a reservation, such as campgrounds and visitor facilities.

BLM 7250 Manual Section 1.5.A.2

Secure necessary water rights pursuant to state law if the water is required for a secondary purpose of the reservation or if the language creating the reservation specifically excluded the create of a federal reserved water right.

BLM 7250 Manual Section 1.5.A.7.d

In many instances, federal reserved water rights are created long before or after a comprehensive McCarran Amendment adjudication is completed within the basin where the federal reserved water right is located. In those instances, the BLM shall collect hydrologic and water use data to determine if the federal reserved water right is being injured. If evidence suggests a federal reserved water right is being injured water uses by other parties, the BLM shall consult with the state water engineer, Office of the Solicitor and Department of Justice to determine how the federal reserved water right claim can be asserted and protected.

BLM 7250 Manual Section 1.5.B.1

Collect site-specific information to submit claims and applications for water right within adjudication and administrative processes. Information collected will include spatially referenced inventories of BLM water uses at point water sources, such as springs, wells, and reservoirs, the diversion point, the distribution system, the application locality, and studies to quantify the rate, timing, and location of water needed to support water-dependent values on rivers and streams.

BLM 7250 Manual Section 1.5.B.5

Identify opportunities to cooperate with state, local, and tribal governments, water users, and other stakeholders on water right and water use issues when such cooperation can serve to maintain and enhance water-dependent values and uses managed by the BLM, for example, protecting instream flows.

The BLM Wild and Scenic Rivers Manual (BLM 6400) provides broad direction on protecting instream flow within the overall context of managing designated and study rivers, as follows:

BLM 6400 Section 7.6

The CRMP should include a detailed description of outstandingly remarkable values, including the importance of instream flow in maintaining these values, and should identify appropriate actions to protect and manage the timing, location, and quantity of water necessary to support the identified outstandingly remarkable values.

USFS River-Related Management Policies

The Forest Service's National Forest System Water Rights Manual (FSM 2541) provides the Authority, Objective, Policy and Designation of Responsibility for the USFS acquisition and management of water rights. Federal law (Acts of July 26, 1866, and July 9, 1870) protects possessors and owners of rights to water for mining, agriculture, manufacturing or other purposes. The water rights protected are those vested and accrued by priority of possession, and recognized and acknowledged by local customs, laws and court decisions. Subsequent laws and legal decisions specifically affecting National Forest System water rights and uses include: The Desert Land Act, The Organic Administration Act, General Exchange Act, Organic Act of 1944, and McCarran Amendment.

Other sections of the manual specific to Wild and Scenic Rivers include:

FSM 2354 – Wild and Scenic River Management

This manual section provides general direction on Wild and Scenic River Management. FSM 2354.03 (8) states:

Acquire water rights needed to ensure sufficient water to achieve management objectives.

FSM 2541.1 – Determining Water Rights and Needs

The right to use the amount of water needed to manage the National Forest System is provided under authority of Federal laws (sec. 2541.01), or under State law. Determine specific amounts required when claiming water rights under the reservation doctrine, applying for water under State laws or purchasing water rights. Identify specific uses, sources and quantities of water needed. Water rights asserted under the Federal reserved rights doctrine may provide for present and foreseeable future uses.

Forest Service Manual 2541.12 – Instream and Standing Water Requirements

Determine the amount of water needed for instream and standing water purposes, particularly for the following:

1. *Adjudications. To be certain of meeting public obligations, establish Forest Service claims for instream flows and standing water during State or Federal court proceedings to adjudicate claims.*
2. *Land Management Planning. Many management objectives are dependent upon certain water flow and lake-level conditions. Determine the amount and location of water needed to meet management objectives.*
3. *Water Development Projects. Examine instream flow and standing water level needs and establish requirements whenever a diversion or impoundment threatens to alter existing flows or levels.*

Determine quantities of water needed to maintain instream flows for recreation, fish and wildlife and other uses, as well as activities and uses associated with timber production and securing favorable conditions of water flow.

Forest Service Manual 2541.21 – Claims Under the Reservation Doctrine

- 1. Use the Organic Administration Act of 1897 authority to claim reserved water rights for consumptive or non-consumptive needs on reserved lands directly related to securing favorable conditions of water flow or to furnish a continuous supply of timber.*
- 2. Other reservation authorities. Claims for reserved rights may be based on purposes authorized by legislation such as the Multiple-Use Sustained-Yield Act of 1960, the Wild and Scenic Rivers Act (82 Stat. 917, 16 U.S.C. 12771 et seq.) or the Wilderness Act (P.L. 88-577, as amended, 16 U.S.C. 1131 et seq.).*

Forest Service Manual 2541.22a – Quantifying Water Needs Under State Law

Quantify total water requirements for rights to be acquired. Take into account any seepage, evaporation, and transmission needs and losses associated with the water use.

Forest Service Manual 2541.31 – Protecting Instream Flows

Notify States of Instream flow needs by: (a) filing protests of application for water rights if the exercise of such rights would adversely affect National Forest resources or water rights of the United States, (b) asserting claims to water rights under Federal law insofar as applicable, and (c) filing for water rights under State law where these uses are recognized. In those States that recognize instream flows but require that related water rights be held in the name of the State (or some State agency), work with the appropriate agency to obtain and protect the needed water flows.

Notify the Chief or the Office of General Counsel if the appropriate procedure for protecting needed instream flows is difficult to determine.

Where water rights for instream flows cannot be established, use other methods and authorities to ensure the necessary level of protection. Such methods include: (1) special use permits or easements and (2) agreements and memorandums of understanding.

NPS River-Related Management Policies

The NPS mission is to preserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of current and future generations. NPS policy guidance is described in the NPS Management Policies (2006) and in several Director's Orders. Chapter 4.6 of the NPS Management Policies on Water Resource Management states that NPS will perpetuate both surface water and groundwater as integral components of park aquatic and terrestrial ecosystems. Water rights protection is described in the following guidance documents:

NPS Management Policies (2006) Section 4.6.2

Water for the preservation and management of the national park system will be obtained and used in accordance with legal authorities. The Park Service will consider all available authorities on a case-by-case basis and will pursue those that are the most appropriate to protect water-related resources in parks. While preserving its legal remedies, the Service will work with state water administrators to protect park resources and participate in negotiations to seek the resolution of conflicts among multiple water claimants.

Water essential for NPS needs will be purchased if it is not otherwise available. NPS consumptive use of water will be efficient and frugal, especially in water-scarce areas. All rights to the use of water diverted from or used on federal lands within the national park system by the United States or its concessioners, lessors, or permittees will be perfected in the name of the United States. Park surface waters or groundwater will be withdrawn for consumptive use only when such withdrawal is absolutely necessary for the use and management of the park. All park water withdrawn for domestic or administrative uses will be returned to the park watershed system once it has been treated to a degree that ensures that there will be no impairment of park resources.

The Service may enter into contracts for the sale or lease of water to persons, states, or their political subdivisions that provide public accommodations or services for park visitors outside and near the park that have no reasonable alternative sources of water. The Service will authorize such contracts only if:

- *the transfer does not jeopardize or unduly interfere with the natural or cultural resources of the park, and*
- *the government's costs are fully recovered, and*
- *the contract is for a short term, true emergency.*

The Service will follow the requirements and procedures of Director's Orders #35A and #35B when considering the sale or lease of park water.

Director's Order 35A: Sale or Lease of Park Services, Resources, or Water in Support of Activities Outside the Boundaries of National Park Areas

With specific regard to water resources, water is considered a vital part of the park environment. While this Director's Order conditionally allows the NPS to authorize the sale or lease of water, the NPS's primary responsibility under the Organic Act is the preservation and protection of park resources—including water resources and the water dependent environment—for the enjoyment of future generations. Meeting this commitment in the future may require NPS use of water presently considered available for sale or lease. Therefore, when a park's future resource protection or visitor needs dictate, the NPS will terminate the sale or lease of park waters.

U.S. Fish and Wildlife Service River-Related Management Policies

F&WS Manual Section 403 FW 1:

1.2 Objectives. Objectives are to obtain water supplies of adequate quantity and quality, and the legal rights to use that water, for development, use, and management of Service lands and facilities, and for other congressionally authorized objectives such as protection of endangered species and maintenance of instream flows. These objectives can be achieved by:

- A. Reviewing and documenting the need for and use of water at field stations and research laboratories.*
- B. Identifying and evaluating water rights appurtenant to, or which may be applied to beneficial use on, lands proposed for protection, restoration, enhancement, development, or acquisition.*
- C. Asserting appropriative, riparian, vested, and reserved water rights in proper administrative and judicial forums.*
- D. Submitting applications for new State appropriative water rights and changes to existing State appropriative water rights according to State law.*
- E. Providing technical and evaluation data to the Solicitor and Department of Justice to resolve water rights controversies through negotiation and litigation.*
- F. Identifying and pursuing opportunities to acquire water through mitigation, settlement of litigation, legislation, or other means to satisfy Service objectives.*
- G. Communicating water rights technical and policy guidance to project leaders and Service managers.*

1.3 Policy. It is the Service's policy to comply with State laws, regulations, and procedures in obtaining and protecting water rights, both for Service facilities and for trust fish and wildlife resources on lands not owned by the United States, except where application of State statutes and regulations does not permit Federal purposes to be achieved. Federal reserved water rights will be quantified and asserted when necessary to accomplish the primary purpose of the reservation. Water rights shall be purchased if essential to Service activities and not otherwise available. Water rights appurtenant to lands proposed for protection, restoration, enhancement, development, or acquisition will be identified and evaluated early in the planning process, and proposed actions will not proceed until water rights have been acquired. All water rights associated with water uses by permittees will be secured in the name of the United States, Fish and Wildlife Service, and permittees may be issued special use permits allowing the use. Service water rights shall be managed to ensure that they are not lost and water use/distribution systems will be designed and operated for efficient use of water. The Service shall cooperate with the States on all matters related to water use and water rights and will seek to resolve conflicts through negotiation, in coordination with the Solicitor's Office, as appropriate. However, if negotiations prove unproductive, other courses of action, including litigation, will be pursued.

F&WS Manual Section 403 FW 3:

3.1 Acquisition of Water Rights. The Service acquires water rights in the Western States in several different ways. If the lands were withdrawn from the public domain, the associated Federal reserved water rights must be quantified and asserted when the watershed or basin is included in a general stream (McCarran Amendment) adjudication. (See [403 FW 2.1A\(a5\)](#).) Water rights for acquired lands are usually obtained under State law. In Eastern States, regulation of water use, except for water quality purposes, has not been common or extensive, although a number of these States have implemented permit systems.

3.1.D. Instream Flow. Increasing demands for water have been accompanied by greater concern for maintaining streamflows for fish and wildlife, water quality, and recreational purposes, as well as for aesthetic reasons. These flows are being protected through a variety of mechanisms, such as granting water permits for an identified flow rate, imposing minimum streamflow conditions on new permits, and closing stream systems to new appropriations. Many Western States now provide mechanisms by which existing consumptive water rights may be changed, either temporarily or permanently, to instream water rights.