Biological Services Program

FWS/OBS-78/35
MAY 1978

INSTREAM FLOW STRATEGIES FOR ARIZONA

Interagency Energy-Environment Research and Development Program
Office of Research and Development • U. S. Environmental Protection Agency

sh and Wildlife Service

.S. Department of the Interior

U. S. Department of the Interior

Fish and Wildlife Service

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues which have an impact fish and wildlife resources and their supporting ecosystems. The mission of the Program is as follows:

1. To strengthen the Fish and Wildlife Service in its role as a primary source of information on natural fish and wildlife resources, particularly with respect to environmental impact assessment.

2. To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major land and water use changes.

3. To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process, to prevent or minimize the impact of development on fish and wildlife. Biological Services research activities and technical assistance services are based on an analysis of the issues, the decisionmakers involved and their information needs, and an evaluation of the state-of-the-art to identify information gaps and determine priorities. This is a strategy to assure that the products produced and disseminated will be timely and useful.

Biological Services projects have been initiated in the following areas:

Coal extraction and conversion

Power plants

Geothermal, mineral, and oil shale development

Water resource analysis, including stream alterations and western water allocation

Coastal ecosystems and Outer Continental Shelf development.

Systems and inventory, including National Wetlands Inventory, habitat classification and analysis, and information transfer

The Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams which provide the Program's central, scientific and technical expertise, and which arrange for contracting of Biological Services studies with States, universities, consulting firms, and others; Regional staff who provide a link to problems at the operating level; and staff at certain Fish and Wildlife Service research facilities who conduct inhouse research studies.

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May 1978

INSTREAM FLOW STRATEGIES FOR ARIZONA

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Performed for

Western Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. DEPARTMENT OF THE INTERIOR

DISCLAIMER

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PREFACE

This report represents the combined efforts of several individuals and firms toward a common objective: the identification, description and preliminary evaluation of the most promising strategies (institutional methods) for reserving instream flows for fish and wildlife under existing laws.

Toward this objective, the U.S. Fish and Wildlife Service, through its Western Water Allocation Project, contracted with two firms. Richard Dewsnup and Dallin Jensen received a contract to identify available strategies under state laws, federal laws, interstate compacts, and water quality laws. From a large number of strategies identified by this contract effort, the most promising ones were selected for further evaluation. A second firm, Enviro Control, Inc., was contracted to evaluate the most promising strategies in depth.

The combined efforts of the two firms were published in several reports which are identified below. Following this initial effort, a separate report for each state was published. This was done in the belief that most persons who are involved in instream flow work are primarily oriented to a single state. The several western states are at different levels in terms of their laws supporting instream flows, their water rights traditions, and their past experiences regarding the reservation of instream flows for fish and wildlife. This is one of the individual state reports.

The report is organized into three sections. These are the information matrix, the evalation matrix, and the narrative description of each strategy. The information matrix is intended to be a guide to help the reader select the strategy or stategies most applicable to any particular situation. This matrix contains a general description of the strategy, the most applicable situations for its use, the party or parties who can initiate the strategy, and the party or parties who must implement the strategy.

The evaluation matrix provides a subjective analysis of whether each strategy has been used to advantage, disadvantage, or not at all in each state. A unique feature of the evaluation matrix is that a blank matrix is provided for the reader. This is done because an evaluation of this kind is necessarily a product of a given time frame and a particular point of view. The blank evaluation matrix will allow the reader to evaluate the strategies as times, laws, experiences, and traditions change in the state.

The narrative section of the report contains an expanded description of each strategy, notes its application possibilities, illustrates the usage of the strategy within the state, and evaluates its general utility. All of the narrative materials are oriented to the particular state for which the report is written.

In the use of this report, the reader should be aware of its purposes and limitations. First, only a few of the many possible strategies are described herein. The user should exercise initiative, judgement, and creativity in dealing with any specific situation. Second, this report should be used as a starting point. In any situation related to the acquisition of instream water rights, legal advice should be sought. This report should in no way be construed as a substitute for the opinion of a private attorney, attorney general, or agency solicitor. Third, this report is neither a policy nor decision document. It is simply a collection of strategies which appear to have utility in a variety of situations.

Further questions about these and other strategies may be addressed to the Cooperative Instream Flow Service Group, U.S. Fish and Wildlife Service, Western Energy and Land Use Team, Drake Creekside Building, 2625 Redwing Road, Fort Collins, Colorado 80526. This Group is an interagency, intergovernmental, interdisciplinary service organization under sponsorship of the U.S. Fish and Wildlife Service, Western Energy and Land Use Team. The Group provides a focal point for the increasing activity of instream flow assessments.

For more detail on the strategies, the user of this report should be aware of supportive documentation contained in several related reports:

1. FWS/OBS-77/26. Strategies for Reserving Flows for Fish and Wildlife: Identifcation, Description and Preliminary Evaluation. By Richard L. Dewsnup and Dallin W. Jensen, February 1977. 706 pages.

   This is the full completion report prepared by Dewsnup and Jensen under the FWS contract. It contains chapters on regulatory authority and property rights in water resources, strategies for reserving instream flows under Federal statutes, strategies for protecting instream flows under State statutes, and interstate compacts as they relate to the protection of instream flows. This report is only available from the National Technical Information Service (NTIS Accession No. PB 276 243).

2. FWS/OBS-77/27. State Laws and Instream Flows. By Richard L. Dewsnup and Dallin W. Jensen, March 1977. 76 pages.

   This report is a slightly modified version of the State law chapter taken from the above report. It contains a summary matrix in which the legal basis (e.g., statute in the State code) for each strategy in each State will be identified. This report is also available from the National Technical Information Service (NTIS Accession No. PB 272974).

3. FWS/OBS-77/29. Promising Strategies for Reserving Instream Flows. By Richard L. Dewsnup and Dallin W. Jensen, Edward Hoban, Gerald Horak, Martin Lewis, and Wayne Nelson, August 1977. 63 pages.

This report contains descriptions of 26 strategies for reserving instream flows under existing laws. The descriptions provide guidance on the level of action required, legal bases for each strategy, and advantages, disadvantages, and costs involved in strategy implementation. This report is also available from the National Technical Information Service (NTIS Accession No. PB 276 046).

LIST OF ABBREVIATIONS

BLM	Bureau of Land Management
BR	Bureau of Reclamation
CE	Corps of Engineers
DOE	Department of Energy
FERC	Federal Energy Regulatory Commission
FWS	Fish and Wildlife Service
FS	Forest Service
HCRS	Heritage Conservation and Recreation Service
SCS	Soil Conservation Service

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INFORMATION MATRIX

INFORMATION MATRIX

Strategies for Reserving Instream Flows in Arizona

Title	IDENTIFICATION		APPLICATION				
			Initiation		Implementation		
	General Description	Applicable Situations	Parties	Actions	Parties	Actions	Expenditures
APPROPRIATIVE WATER RIGHTS							
State Condemnation and Reallocation of Water Rights	Not applicable in this State	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
State Appropriation of Instream Flows	Obtaining an administrative appropriation of streamflow from the State water rights agency for fish and wildlife purposes	Primarily along streams not fully appropriated; secondarily along over-appropriated streams	Arizona Game and Fish Department; public interest groups	Determine quantity of flow required; request appropriation of instream flow from the Arizona Land Commissioner	Arizona Land Commissioner	Grant an appropriation	Study cost
State Moratoria on New Appropriations	Not applicable in this State	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
State Discretionary Water Permit Authority	Utilizing discretionary opportunities by the permit authority for the benefit of instream flows	Granting new water permits or exchanges or transfers of existing rights	Arizona Game and Fish Department; public interest groups	Petition Arizona Land Commissioner to deny or amend permit application	Arizona Land Commissioner	Deny or amend permit application	Bargaining cost; study cost
LEGISLATIVE AND ADMINISTRATIVE CONTROLS							
Federal Reauthorization of Projects	Reauthorizing existing Federal water resource projects to provide for instream flow reservations	At existing Federal dams or stream diversions	Construction agency; public interest groups; FWS Area Office (Phoenix); Arizona Game and Fish Department	Lobby to have construction agency conduct feasibility study; seek Congressional reauthorization	U.S. Congress	Enact legislation reauthorizing the project (approved by Committee, passed by both houses)	Feasibility study cost; bargaining cost; legislative cost

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Title	IDENTIFICATION		APPLICATION				
	General Description	Applicable Situations	Initiation		Implementation		
			Parties	Actions	Parties	Actions	Expenditures
State-Federal Wild and Scenic Rivers System	Designating stream segments for inclusion within a wild and scenic rivers system to promote instream flow reservations	Along free-flowing stream segments, bordered by visually appealing landscape	Local citizens; Member of Congress	Organize and demonstrate local support to convince elected representatives to introduce a Bill	U.S. Congress; Forest Service; Heritage Conservation and Recreation Service; FWS Region 2 Office; Arizona Game and Fish Department	Pass a Bill authorizing study of the segment(s); conduct study to inventory resource and solicit local views; after agency review, consider study report in Congressional Committee and pass a Bill approving designation	Study cost; legislative cost
State Definition of Navigable Waters	Not applicable in this State	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
State-Federal Interagency Consultation	Adopting interagency agreements, regulations, and formal procedures to implement the Fish and Wildlife Coordination Act toward promoting instream flow reservations	Planning new or expanded Federal water resource projects	FWS Region 2 Office; Arizona Game and Fish Department; public interest groups	Seek interagency agreements based on adopted regulations or procedures; promote strengthening procedures or see that they are enforced	FWS Region 2 Office; Arizona Game and Fish Department; construction or permit agency	Draw up agreements or make existing procedures more stringent	Bargaining cost

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Strategies for Reserving Instream Flows in Arizona

Title	IDENTIFICATION		APPLICATION				
			Initiation		Implementation		
	General Description	Applicable Situations	Parties	Actions	Parties	Actions	Expenditures
Federal License and Permit Stipulations	Incorporating stipulations in new and renewed Federal licenses and permits to reserve instream flows	Authorizing planned or existing Federal dams and reservoir projects	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups; private citizens	Determine quantity of flow required; make specific instream flow recommendation to permit or license agency	Permit or license agency (FERC, BLM, FS etc.)	Stipulate flow reservation in permit or license	Study cost; bargaining cost
State Allocation of Reservoir Space	Not applicable in this State	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
State Purchase and Lease of Water Rights	Obtaining contractual arrangements which include direct purchase of flow rights, the leasing of water rights, and the purchase of shares in a mutual water company to enhance instream flows	Particularly along over-appropriated streams	Arizona Game and Fish Department; private citizens; public interest groups	Identify stream where the purchase of only a few cfs can make a significant difference to the fishery; locate willing seller, lessor, or mutual shares company	Arizona Game and Fish Department; private citizens; public interest groups	Purchase or lease water right or purchase shares in a mutual shares company	Acquisition cost; negotiation cost
WATER RESOURCE PLANNING							
Federal Water Resources Council Planning Programs	Considering instream flow needs in Water Resources Council planning programs toward promoting flow reservations	Planning river basin and energy development	Arizona Game and Fish Department; Cooperative Instream Flow Group; FWS Region 2 Office; public interest groups	Lobby to have instream flows considered in Level B study or Section 13(a) assessment	Arizona Land Department	Include instream flow requirements in Level B study or Section 13(a) assessment	Study cost

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Strategies for Reserving Instream Flows in Arizona

Title	IDENTIFICATION		APPLICATION				
	General Description	Applicable Situations	Initiation		Implementation		
			Parties	Actions	Parties	Actions	Expenditures
Federal Aid Funding to Purchase Storage	Expending Federal Aid funding to purchase reservoir storage as a means of reserving instream flows	Along overappropriated streams at privately owned reservoirs	Arizona Game and Fish Department	Identify stream and reservoir; file required documents requesting funds from Region 2 Federal Aid Office	FWS Region 2 Federal Aid Office; Arizona Game and Fish Department	Grant funds; purchase the water rights	Administrative cost; acquisition cost
Federal Reservoir Construction and Enlargement	Constructing larger new reservoirs or enlarging existing reservoirs to provide for instream flow reservations	At existing or planned Federal reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Conduct stream investigation; recommend a larger dam and reservoir; allocate additional costs to fish and wildlife benefits	Construction agency; U.S. Congress	After possible Congressional authorization, constructs additional storage for instream flows	Study cost; bargaining cost; construction cost; legislative cost
WATER RESOURCE MANAGEMENT							
State Water Rights Records Analyzed	Analyzing water rights records as an aid to reserving flows	Bargaining for an instream flow	Arizona Game and Fish Department; FWS Area Office (Phoenix); public interest groups	Determine the extent, location and ownership of water rights from the Arizona Land Department	Arizona Game and Fish Department; FWS Area Office (Phoenix); public interest group	Select the best course of action to reserve an instream flow	Water data cost; study cost
State-Federal Flow Requests Made Early	Presenting recommendations early in the decision process to achieve reservation of instream flows	At planned Federal dams and reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Conduct a timely investigation; recommend an instream flow to the construction agency	Construction agency	Include instream flow in project plans	Study cost; gaging, installation and maintenance cost; bargaining cost

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Title	IDENTIFICATION		APPLICATION				
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	General Description	Applicable Situations	Parties	Actions	Parties	Actions	Expenditures
State-Federal Flow Requests Made Specific	Specifying and monitoring instream flow reservations to protect downstream fish and wildlife resources	Along stream reaches below existing or planned Federal dams and reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Conduct detailed instream flow study; recommend flow to the construction and/or permit agency, specifying flow releases and flow quantities required at downstream sites	Construction agency/permit agency	Include flow releases in reservoir's operating criteria; install gaging stations to determine the sufficiency of the actual releases	Study cost; gaging, installation and maintenance cost; bargaining cost
State-Federal Combined Storage and Flow Requests	Negotiating for reservoir storage to facilitate instream flow reservations	Planning new reservoirs or reallocating storage space in existing Federal reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Request information regarding reservoir storage allocations and projected sales from the construction agency; determine the amount of storage available to ensure minimum instream flows; recommend storage and flow requirements	Construction agency	Allocate storage to fish and wildlife; include flow releases in the reservoir operating criteria	Bargaining costs; study cost

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Strategies for Reserving Instream Flows in Arizona

Title	IDENTIFICATION		APPLICATION				
	General Description	Applicable Situations	Initiation		Implementation		
			Parties	Actions	Parties	Actions	Expenditures
ENGINEERING ALTERNATIVES							
Coordinated Multi-Reservoir Operations	Coordinating operations of multi-reservoir systems to facilitate instream flow reservations	At Federal dams and reservoirs in multi-reservoir system	FWS Area Office (Phoenix); Arizona Game and Fish Department; FWS Region 2 Office	Conduct system-wide flow study to establish the flow required; propose to alter the operations manual and memorandum of agreement to ensure the recommended flows	Agency or agencies operating the system; U.S. Congress	After possible Congressional reauthorization or relicensing, revise the system operations manual to include instream flows	Study cost; bargaining cost; legislative cost
Reservoir Sediment Storage Releases	Releasing reservoir sediment storage reserves to promote instream flow reservations	At existing Federal dams and reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Determine the quantity of available yield from the sediment reserve; recommend that the construction or administering agency reassign a portion of this yield to benefit fish and wildlife resources	Construction or administering agency	Modify project operation; release yield from the sediment reserve for instream flows	Study cost; bargaining cost

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Title	IDENTIFICATION		APPLICATION				
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	General Description	Applicable Situations	Parties	Actions	Parties	Actions	Expenditures
Stream Channels to Convey Stored Water	Conveying stored water to downstream users via the stream channel to aid in securing instream flow reservations	At planned Federal dams and reservoirs	FWS Area Office (Phoenix); Arizona Game and Fish Department; public interest groups	Obtain information regarding proposed conveyance systems; determine system's effect on fish and wildlife resources; recommend system modification to the construction agency	Construction agency	Modify conveyance system to preserve fish and wildlife resources	Study cost; re-design cost; bargaining cost

EVALUATION MATRIX

EVALUATION MATRIX Strategies for Reserving Instream Flows in Arizona

yes = Advantage ●
no = Disadvantage ○
blank - Inapplicable (in this State)

	ELEMENTS OF EFFECTIVENESS																				ELEMENTS OF COST					
	Overall		Political			Legal					Administrative						Resource					Institutional			Monetary		
	Demonstrated past utility in this State?	Optimism over future effectiveness in this State?	Predominantly involves fish & wildlife interests?	Can be implemented by fish and wildlife interests?	Attracts support from public interest groups?	Clearly established statutory basis?	Avoids legislative or judicial action?	Recognized without legal challenge?	Legally recognizes fish & wildlife values?	Creates legal right to flow reservation?	Available independent of other strategies?	Fits into a funded agency program?	Involves established administrative procedure?	Uses available fish & wildlife agency expertise?	Uses quantified instream flow needs?	Influences early planning & design decisions?	Directly results in flow reservation?	Results in storage for flow augmentation?	Useful during extended low flows?	Useful for overappropriated streams?	Useful with small streams?	Avoids costly legal process?	Avoids costly bargaining process?	Avoids costly planning & design?	Avoids costly reservoir development?	Avoids costly water rights acquisition?	Avoids costly forfeiture of water revenue?
Appropriative Water Rights																											
State Condemnation/Reallocation of Water Rights																											
State Appropriation of Instream Flow	○	○	●	○	●	○	○	○	●	●	●	●	●	●	●	○	●	○	○	●	●	○	●	●	●	●	●
State Moratoria on New Appropriations																											
State Discretionary Water Permit Authority	○	○	○	○	●	○	●	○	○	○	●	●	●	●	●	○	○	○	○	○	○	○	○	●	●	●	○
Legislative/Administrative Controls																											
Federal Reauthorization of Projects	○	○	●	○	●	●	○	●	●	●	●	○	○	●	●	○	●	●	●	●	○	○	○	○	●	●	○
State-Federal Wild & Scenic River Systems	○	○	●	○	●	●	○	●	●	●	●	●	●	●	○	○	●	○	●	○	●	○	○	○	●	●	●
State Definition of Navigable Waters																											
State-Federal Interagency Consultation	○	○	●	●	●	●	●	●	●	○	○	●	●	●	○	●	○	○	○	○	○	●	○	●	●	●	○
Federal License & Permit Stipulations	○	○	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●	●	○
State Allocation of Reservoir Space																											
State Purchase & Lease of Water Rights	●	●	●	●	●	●	●	○	○	●	●	○	●	●	●	○	●	●	●	●	●	●	●	●	●	○	●
Water Resource Planning																											
Federal WRC Planning Programs	○	○	○	○	○	●	●	●	○	○	●	○	●	●	●	○	○	○	○	○	○	●	○	○	●	●	●
Federal Aid Funding to Purchase Storage	●	●	●	●	○	●	●	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○	●	●	○	●
Federal Reservoir Construction/Enlargement	○	○	●	○	●	●	○	●	○	○	●	●	●	○	●	●	●	●	●	●	○	●	○	○	○	●	●
Water Resource Management																											
State Water Rights Records Analyzed	○	●	●	●	○	●	●	●	○	○	○	○	○	○	●	●	○	○	○	●	●	●	●	●	●	●	●
State-Federal Flow Requests Made Early	○	●	●	○	○	●	●	●	○	○	●	●	●	●	●	●	●	○	●	●	○	●	○	○	●	●	●
State-Federal Flow Requests Made Specific	○	●	●	○	○	●	●	●	○	○	●	●	●	●	●	●	●	○	●	●	●	●	○	○	●	●	●
State-Federal Combined Storage/Flow Requests	○	●	●	○	○	●	●	●	○	○	●	●	●	○	●	●	●	●	●	●	○	●	○	○	●	●	●
Engineering Alternatives																											
Coordinated Multireservoir Operations	●	●	●	○	●	○	●	●	○	○	●	○	○	○	●	○	●	○	●	●	○	●	○	○	●	●	○	○
Reservoir Sediment Storage Releases	○	○	●	○	●	○	○	●	○	○	●	○	○	○	●	●	●	○	●	●	●	●	○	○	●	●	○	●
Stream Channels to Convey Stored Water	●	●	●	○	○	○	●	●	○	○	○	○	○	○	○	●	●	○	●	●	●	●	○	○	●	●	●

Answers are strictly judgmental, based on written and verbal opinion reported to the Enviro Control study team through December 1977; subject to modification by selected reviewers (empty matrix furnished for reviewers on the following page).

EVALUATION MATRIX Strategies for Reserving Instream Flows in _____

yes = Advantage ●
no = Disadvantage ○
blank - Inapplicable (in this State)

	ELEMENTS OF EFFECTIVENESS																		ELEMENTS OF COST				
	Overall		Political			Legal					Administrative						Resource					Institutional			Monetary		
	Demonstrated past utility in this State?	Optimism over future effectiveness in this State?	Predominantly involves fish & wildlife interests?	Can be implemented by fish and wildlife interests?	Attracts support from public interest groups?	Clearly established statutory basis?	Avoids legislative or judicial action?	Recognized without legal challenge?	Legally recognizes fish & wildlife values?	Creates legal right to flow reservation?	Available independent of other strategies?	Fits into a funded agency program?	Involves established administrative procedure?	Uses available fish & wildlife agency expertise?	Uses quantified instream flow needs?	Influences early planning & design decisions?	Directly results in flow reservation?	Results in storage for flow augmentation?	Useful during extended low flows?	Useful for overappropriated streams?	Useful with small streams?	Avoids costly legal process?	Avoids costly bargaining process?	Avoids costly planning & design?	Avoids costly reservoir development?	Avoids costly water rights acquisition?	Avoids costly forfeiture of water revenue?
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Coordinated Multireservoir Operations																											
Reservoir Sediment Storage Releases																											
Stream Channels to Convey Stored Water																											

APPROPRIATIVE WATER RIGHTS

STATE CONDEMNATION AND REALLOCATION OF WATER RIGHTS

In Arizona there are no statutory or administrative provisions for the condemnation of existing water rights to reserve instream flows.

Sources

1. Dewsnup, Richard L., and Dallin W. Jensen, Identification, Description, and Evaluation of Strategies for Reserving Flows for Fish and Wildlife, February 1977.

2. Curtis, Robert D., Chief of Wildlife Planning and Development Division, Arizona Game and Fish Department, Phoenix, Arizona, Private Communication, February 1978.

STATE APPROPRIATION OF INSTREAM FLOWS

I. Identification

There are no explicit statutory provisions in Arizona for the appropriation of instream flows. However, Ariz. Rev. Stat. § 45-141 may be construed to imply that the Arizona Game and Fish Department may appropriate instream flows for the purpose of protecting the aquatic habitat. The statute states that any person may appropriate unappropriated water for domestic, municipal, stock watering, water power, wildlife, including fish, mining uses for his personal use or for delivery to consume. The person first appropriating the water shall have the better right. Furthermore, an Arizona Appeals Court ruled that the legislative recognition of appropriations for fish and wildlife purposes removed the diversion requirement and allowed for the "in situ appropriation of water" (McClellan vs. Jantzen, 26 Ariz. App. 223, 547 p. 2d 494 (1976)). Appropriation of instream flows might be applied to the reservation of instream flows, thereby,meeting fish and wildlife needs through the protection of the aquatic habitat.

II. Application

The Arizona Game and Fish Department might file for water rights to instream flows through those procedures established for private parties. It is uncertain, however, whether or not the Department could receive a right without diversion of the stream flow, depending upon the interpretation of the "McClellan v. Jantzen" decision.

In order to comply with the application procedures the Game and Fish Department must determine the necessary instream flow to meet fish and wildlife needs. Data derived from instream flow study methodologies such as the Water Surface Profile, Montana Method, Sag Tape Method, and so forth, could be employed for meeting this procedural requirement. The findings of these studies are not always conclusive; therefore, either the State Land Commissioner may deny the application for inconclusive documentation of the required quantity of water to meet fish and wildlife needs or another potential user may challenge the Department request on the same basis. Such challenges have been made in other western states.

However, the state-of-the-art of instream flow studies is being improved, enhancing the accuracy of the study data. Instream flow studies may incur substantial costs depending upon such factors as stream channel variability, length of the stream segment to be studied, diversions and tributaries affecting the stream flow and so forth. The benefits, however, may be greater than the costs, thereby justifying the strategy's application.

III. Illustration

The Arizona Game and Fish Department has appropriated instream flows for fish hatcheries by diverting water, but has not made an in situ appropriation.

IV. Evaluation

In situ appropriation of instream flows to meet fish and wildlife needs has not been utilized in Arizona for two major factors. Water from mountain streams have to a great extent been appropriated by irrigation districts in

the valleys and this apparently, effectively preserves the instream flows in the mountains because the water is not diverted until the streams flow out of the mountains. Although, at a future date the water in the mountains may be diverted, it is unlikely that major developments will occur in the mountains. Furthermore, until the court case of "McClelland v. Jantzen" in 1976 diversions were required for valid appropriations. Hence, little time has elapsed since this decision to apply this strategy. Due to these factors, the Arizona Game and Fish Department believes that the future application of this strategy is limited.

If Arizona Game and Fish Department applies the strategy, it has a number of advantages and disadvantages associated with its use. Along heavily appropriated streams whcih face the greatest threat of being dewatered, the State would have only a very junior water right and, therefore, it would probably be satisfied only during high-stream flow years. Even though most of the streams in Arizona are already over appropriated, under the general provisions of the appropriation doctrine as it is applied in the west, a junior user is entitled to have the flow of a stream remain substantially as it was found when appropriated. If the stream conditions are altered by other users, even those senior to him, the junior user has standing to sue to restore the stream to its earlier condition. Specifically, the State as a holder of a junior water right for instream uses could take defensive measures such as blocking transfers of water rights or changes in use, etc. if the State's right is affected adversely. For example, Arizona could file for water rights for instream uses on the high mountain streams, thus blocking transfers of water rights, changes in use, etc., if major developments occurred in the mountains which would adversely affect Arizona's right.

Sources

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STATE MORATORIA ON NEW APPROPRIATIONS

In Arizona there are no provisions for either statutory or administrative moratoria on new appropriations; thus this strategy is unavailable in Arizona.

Sources

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STATE DISCRETIONARY WATER PERMIT AUTHORITY

I. Identification

This strategy is available to the Arizona State Land Commissioner for exercising discretionary authority in granting applications for water permits (Ariz. Rev. Stat. § 45-143) and the transfer of water rights between place and use (Ariz. Rev. Stat. § 45-172). Exercising discretionary authority, the Commissioner may deny or include stipulations in an application for appropriation, thereby ensuring that future appropriations do not threaten minimum instream flows. The State Land Commissioner may, also, issue a conditional permit for less than the amount of water requested (Ariz. Rev. Stat. § 45-143). Furthermore, the statute states that when the application or the proposed use conflicts with vested rights, is a menace to public safety, or is against the interests and welfare of the public, the application shall be objected.

II. Application

This strategy is designed so that fish and wildlife interests petition the Arizona Land Commissioner to recognize instream flow needs on granting permit applications with administrative discretion. The Arizona Game and Fish Department, and any interested party, especially those parties with prior appropriations which may be affected by granting the application, may be an objecting party. If an objecting party, having legal standing, demonstrates to the State Land Commissioner that either granting a permit jeopardizes a prior appropriation, because of an insufficient amount of unappropriated water, or that such action would be contrary to the public interest, then the Commissioner may deny the application or include stipulations in the application.

Objections presented by the Game and Fish Department to the Commissioner in granting an appropriation permit would be based either upon the public interest or in recognition of the potential threat to a prior water right granted to the Department. The Department must prove that granting a permit would diminish the instream flow to the extent that the aquatic habitat would be affected adversely. Such proof is totally dependent upon detailed instream flow studies, which will accurately document the effect on the aquatic habitat if further diversions occur. Depending upon the level of analysis conducted, these studies may incur considerable costs.

Acting upon such studies, the Commissioner may deny the application or include stipulations limiting the amount and period of use of the appropriation. Stipulations could be made if it is determined that only during low flow periods the pertinent appropriation would adversely affect the fish and wildlife habitat. During these periods the permit may contain stipulations limiting or prohibiting the diversion of water by the respective user.

III. Illustration

The Game and Fish Department has not raised objections to the granting of a permit for the purpose of reserving an instream flow. The Department has objected, however, when the granting of a permit threatened the Department's prior right for diverting a portion of the streamflow to maintain a fish hatchery.

IV. Evaluation

The State Land Commissioner is empowered by law to deny or modify a permit for appropriation if it infringes upon a prior appropriative right or is contrary to the public interest. It would probably be the responsibility of the Game and Fish Department to present evidence substantiating its objections either in the public interest or in recognition of the threat to its existing water right. Such evidence would rely upon instream flow studies, which often incur considerable expense. However, the Game and Fish Department has applied this strategy for protecting its water rights for the diversion of water to support fish hatcheries.

The State Land Commissioner perceives two potential problems for denying a permit by invoking administrative discretion to reserve instream flows. Denial of a permit is tantamount to either State reservation of instream flows for which there is no statutory provision or appropriating the instream flow for the Game and Fish Department without the Department formally filing for a permit. These considerations diminish the probability that to reserve instream flows the Commissioner would deny or modify applications for the appropriation of water. It can be argued, however, that all waters within the State belong to the people; therefore a denial or modification of an application to reserve instream flows would be for the people of Arizona. Such administrative action neither implicitly nor explicitly entitles the Game and Fish Department to the affected waters.

Sources

1. Bettwy, Andrew, Arizona State Land Commissioner, Arizona State Land Department, Phoenix, Arizona, Private Communication, February 1978.

2. Curtis, Robert D., Chief -- Wildlife Planning and Development Division, Arizona Game and Fish Department, Phoenix, Arizona, Private Communication, February 1978.

LEGISLATIVE AND ADMINISTRATIVE CONTROLS

FEDERAL REAUTHORIZATION OF PROJECTS

I. Identification

Reauthorization of a Federal water resource project to provide for increased flow releases so as to reserve instream flows involves Congressional passage of legislation modifying the original authorizing legislation. After the sponsoring construction agency conducts feasibility studies, which include comments of the Fish and Wildlife Service, the appropriate Congressional Committee drafts new legislation or amends the original authorizing legislation. The legal basis of this strategy is the Congressional authorization process for water resource projects and construction agency guidelines and procedures for authorizing and modifying water resource projects.

II. Application

This strategy may be pursued when the reauthorization of a water resource project could rehabilitate or markedly improve the downstream fishery. Interest groups of fishermen or conservationists might instigate this strategy; the Fish and Wildlife Service or Arizona Game and Fish Department might also. A U. S. Senator or Representative could introduce reauthorizing legislation. Realistically, however, for this strategy to be successful, the construction agency, such as the Bureau of Reclamation or Corps of Engineers, must initiate the process by agreeing to study reauthorization and support it before Congress.

There is a number of important decision points in the formulation and implementation of this strategy. Those encouraging the strategy must decide to lobby the construction agency for action. The construction agency must decide whether to support a study of reauthorization. Once a study is completed, the construction agency may decide to modify the project and, if so, must also decide whether to seek Congressional reauthorization. If the modification is minor, the construction agency has the discretionary authority to alter project operations without Congressional approval. In instances involving instream flows, however, the construction agency would probably seek Congressional approval because of the normally controversial nature of such a modification. To secure the approval of Congress, the construction agency would conduct and submit a feasibility study justifying the proposed change.

Legislation reauthorizing a Bureau of Reclamation project must be approved by the Subcommittee on Water and Power Resources of the House Committee on Interior and Insular Affairs and by the Subcommittee on Public Lands and Resources of the Senate Committee on Energy and Natural Resources. Corps of Engineers projects must be approved by the Subcommittee on Water Resources of the House Public Works Committee and by the Subcommittee on Water Resources of the Senate Committed on Environment and Public Works. After reviewing the feasibility report of the construction agency, these committees must decide whether to reauthorize. According to Congressional staff members, as long as there is no significant political opposition, the committees will approve the reauthorizing legislation. The legislation must then be approved by both houses of Congress and signed by the President.

This strategy is costly in terms of money and time. The construction agency and fish and wildlife agencies must fund and conduct a feasibility

study to justify the modification and reauthorization of a project already planned and constructed. The reauthorization process takes almost as long -- 5 to 10 years -- as the original authorizing process.

III. Illustration

This strategy has not been implemented in Arizona, therefore, an illustration from Wyoming demonstrates the utility of this strategy. Kortes Unit, a component of the Missouri River Basin Project in Wyoming, was reauthorized for fishery conservation in 1971 by the passage of P.L. 92-146. Specifically, the Secretary of the Interior was instructed to maintain a minimum streamflow of 500 cfs in the reach of the North Platte River between Kortes Dam and the normal headwaters of Pathfinder Reservoir. However, when water sufficient to operate the unit in this manner is not available, water must be reserved for hydroelectric power peaking operations, and any remaining water will be released for conservation of the fishery resources.

Before construction and operation of Kortes Unit, the stream reach below the dam site contained an excellent trout fishery. However, once Kortes Unit was built, this resource began to deteriorate. Fish kills would frequently occur due to shut-downs of the Kortes hydroelectric plant. Fishermen and area residents were concerned about the destruction of this valuable fishery. Acting upon this concern, the Fish and Wildlife Service and Wyoming Game and Fish Department convinced the Bureau of Reclamation in 1963 that field studies of various flow regimes should be made. The result of these studies, which were partially funded by the Bureau of Reclamation, was a recommendation to the Bureau that the operation of Kortes power plant be modified to assure a continuous flow of at least 500 cfs between Kortes Dam and Pathfinder Reservoir. In 1964, the Bureau of Reclamation began releasing 500 cfs pending Congressional reauthorization.

In September 1966, the BR completed a special report for the purpose of securing Congressional approval to change the operation of the Kortes Unit from a single-purpose hydroelectric power development to a dual-purpose development with fish and wildlife enhancement as a secondary purpose. The report analyzed the benefits, costs, revenues, and cost allocation with and without the fishery flow. For economic justification, it concluded that the adverse effects at Kortes would be more than offset by the benefits of fishery enhancement. In fact, the benefit-cost ratio increased from 1.31 to 1.36.

In this illustrative situation, important decisions were made by the Fish and Wildlife Service and the Wyoming Game and Fish Department in seeking reauthorization; the Bureau of Reclamation in agreeing to conduct field studies and prepare a report to secure Congressional approval; and the Congressional Committees in supporting the Bureau's position. The fish and game agencies' action was greatly influenced by the valuable fishery at stake while the Bureau's decision was primarily influenced by the great demand for, and little opposition to reauthorization. No economic interest, such as an irrigation district or a municipality, was opposed to re uthorization. The increased benefit-cost ratio from the proposed modification was less important since the project prior to reauthorization was already cost-effective. Although the maintenance of instream flows could result in decreased power production from Kortes Unit, the Bureau of Reclamation could recoup these losses from other hydroelectric projects in the same system. Finally, a positive decision by Congress was

assured because of the lack of opposition to reauthorization.

The reauthorization of Kortes Unit took approximately 8 years and incurred substantial cost in time and money among all parties involved. For instance, the Wyoming Game and Fish Department expended between 2 and 3 person-years of effort to conduct its part of the flow studies. These commitments drained some of the limited resources of construction and fish and wildlife agencies. On the positive side, increased flow releases were provided almost immediatley after the fish and game agencies completed their study and continued for seven years while project reauthorization was in process. These increased reservoir releases have usually sustained the prescribed minimum flows downstream and restored the downstream fishery.

IV. Evaluation

As shown by the illustration, the strategy of project reauthorization can successfully provide for increased flow releases. For several reasons, however, reauthorization is an unusual occurrence, particularly for fish and wildlife purposes. Once a water resource project is constructed and operating, the fishery interests and the construction agencies have little incentive to incur the expense and time needed to reassess project operations unless a combination of distinctive factors is present. As illustrated by the Kortes Unit reauthorization, the most important factors are the threat to a valuable resource, great demand for project modification, and absence of organized opposition.

Other factors in the successful outcome included increased benefits from reauthorization and the ability to recover the losses caused by changing the use of some water stored in the Kortes reservoir. Because this combination of factors is required for the successful implementation of this strategy, both Arizona Game and Fish Department and FWS personnel believe it probably will have limited application in the future. Still, if the right combination of factors does occur, this strategy offers two noteworthy advantages. It provides a long-term solution with a firm legal basis. The reauthorizing legislation legally guarantees the necessary flows in perpetuity or until the legislation is again amended.

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STATE-FEDERAL WILD AND SCENIC RIVERS SYSTEM

I. Identification

The addition of a stream segment to the Federal Wild and Scenic Rivers System, which provides for reservation of flows sufficient to accomplish the purposes of the Act, involves administrative and/or legislative action provided by the National Wild and Scenic River Act (P.L. 94-486). Designation as a wild or scenic river has the effect of reserving historical instream flows since new stream diversions and impoundments are prohibited, and may be restricted below or above the designated river segment. If a river is to be managed entirely or partly by a Federal agency, or if it lies wholly or partly within a National Park, Forest, Wildlife Refuge or other Federal land, an act of Congress is required. The Secretary of Interior can grant a Federal designation if the river is part of a State river protection program. Arizona does not have a statute providing for State wild and scenic river designation.

II. Application

This strategy can be applied where a free-flowing river or stream segment is at least 25 miles long and bordered by a visually appealing landscape. The Wild and Scenic Rivers Act defines river segments as wild, scenic, and recreational:

> Wild river areas are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. Scenic river areas are free of impoundments, with shorelines largely undeveloped, but accessible in places by roads. Recreational river areas are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

The Forest Service and Heritage and Conservation and Recreation Service have published clarifying guidelines for determining river segment classifications.

Although the Arizona Game and Fish Department, the Fish and Wildlife Service, and the HCRS may be able to initiate action by local interests, the local citizens themselves must organize and demonstrate local support to convince their Members of Congress to introduce a bill. Also, the HCRS is conducting a national inventory to determine suitable river segments to recommend to Congress for detailed study.

Congress must pass a bill authorizing a study of the river in question. Such bills must go through the legislative process, including hearings before the House Interior and Insular Affairs Committee and the Senate Energy and Natural Resources Committee. If a study bill passes and is signed by the President, the Forest Service--if the river flows through a National forest, or the HCRS in all other cases--will work with state and local officials to inventory the river's resources and solicit views of the local landowners

and citizens. The study may cost approximately $200,000. If the river proposed meets the criteria, the study team will recommend:

- Classification of various river segments
- Acreage to be included in the river corridor
- Acquisition of land and easements
- Development of recreational facilities
- Assignment of a managing agency

The study report, along with a Draft Environmental Impact Statement and a Draft Management Plan, is reviewed by agencies including the FWS and the state fish and game agency, by the public, and then submitted to Congress and the President. After clearance by the Office of Management and Budget, the President makes a recommendation to Congress. Given sufficient interest, Congress will schedule hearings to discuss the study report. Congress is free to accept all, some or none of the reocmmendations. If Congress passes a bill which approves the designation(s) and the President signs it, the agency to administer the river segment will prepare detailed boundaries for the river corridor and prepare a Comprehensive Management and Development Plan. Congress must then appropriate money for acquisition of land and easements, construction of visitor facilities, and operating expenses such as salaries of river administrators.

The Congressional designation of a river segment takes several years from the time that Congress authorizes a study. Once a river is declared a study river, it must be designated within 10 years or dropped from consideration. However, the Federal Act protects the river segment under study from the authorization, funding and construction of water resource development projects, as well as restricts development above and below the study segment which would have an adverse effect. The Secretary (Interior or Agriculture) charged with the administration of the river segment would determine if the values for which the river was designated would be adversely affected by development. The Act also protects these rivers for up to three years after the study report is submitted to Congress and the President, regardless of whether or not the river is to be included in the system. All minerals located on Federal lands within one-quarter mile of a study river are withdrawn from prospecting or leasing during the study period.

III. Illustration

This strategy has not been applied in Arizona; so an illustration from Montana demonstrates the utility of this strategy. A 149-mile segment of the Missouri River in north-central Montana from Fort Benton downstream to Robinson Bridge has recently been added to the National Wild and Scenic River System. Seventy-two miles have been designated as a wild river, 28 miles as a scenic river, and 59 miles as a recreational river. This 149-mile segment which provides habitats for bass and catfish is the last major free-flowing reach of the Missouri River.

Dams have been proposed for this segment of the Missouri River since the Corps of Engineers and Bureau of Reclamation formed the Pick-Sloan Plan thirty-five years ago. Proposed projects such as the High Cow Creek Dam and Fort Benton Dam would alter the remaining 149 miles of free-flowing river. Landowners, mainly ranchers, generally have opposed the dams, except for a few who stood to receive irrigation benefits. The ranchers testifying at hearings on the proposed projects indicated that they wanted the area to remain undeveloped.

In 1960, the National Park Service studied the river between Fort Benton and the Fork Peck Reservoir to determine its potential as a National Park. Concurrently, the Corps of Engineers studied the feasibility of constructing dams above Fort Peck. In 1962, the Secretaries of the Interior and Army merged their agencies' efforts and conducted a comprehensive study. The study was completed in June, 1963, and a report was issued which included comments by the FWS and the Montana Department of Fish and Game.

In the mid-1960's the HCRS studied the Missouri from Coal Banks Landing to Charles M. Russell National Wildlife Refuge. In 1968, the HCRS issued a report recommending establishing that river segment as a "national river" under a pre-existing Federal program which afforded limited protection. That same year, Congress enacted the National Wild and Scenic Rivers Act, which specified the Missouri River from Fort Benton to Ryan Island, Montana as one of the segments to be studied for inclusion in the system. The HCRS conducted additional studies to determine the feasibility of including the Missouri River segment in the National System and published an Environmental Impact Statement in 1975 which the FWS and the Montana Department of Fish and Game reviewed.

At this point, Senator Lee Metcalf of Montana began working for inclusion of the Missouri segment in the National Wild and Scenic Rivers System because of his personal interest in conservation and strong local support from individuals and organizations in central Montana. In the 92nd, 93rd and 94th Congresses, Senator Metcalf introduced bills to include this river segment. At hearings on the bills, overwhelming support for preservation came from 36 national,state and local organizations.

By 1976, the Wild Missouri bill provided for a mazimum of 180,000 acres, protecting the canyon rim to rim for all but the first 40 miles, where protection was established from riverbank to riverbank in order to exclude considerable private land from the system. At the request of local landowners, the entire river segment was to be admininstered by the BLM to allow for existing uses such as grazing and water diversion for irrigation. In 1976, the bill was bogged down in the House. After it was amended to provide for water pumping facilities on the river for future agricultural and recreational purposes, it was finally passed by both houses and signed by the President on October 13, 1976.

A detailed Management Plan is currently being developed by the BLM in cooperation with State and other Federal agencies. The plan will be available in early 1978. To date, the designated segment of the Missouri has been preserved as a free flowing river.

Study costs for this segment of the Missouri have been several hundred thousand dollars. The personnel time expended in this effort has been enormous although the benefits of designation are great as well. The lengthy process to include the Missouri River segment under the National Wild and Scenic Rivers Act accounts for this extraordinary effort.

IV. Evaluation

This strategy had not been utilized in Arizona as no river in Arizona had yet been designated as wild, scenic, or recreational. However, the designation of a river or stream segment under the National Wild and Scenic Rivers Act (section 13, part c) tends to reserve flows in quantities sufficient to accomplish the purposes of the Act. The Act prohibits new water resource development in the designated segment and restricts water resource development upstream and downstream which would adversely affect the designated river segment. It is a serious shortcoming, however, to take this approach to reserving flows without actually quantifying the streamflow regime that underlies the wild or scenic river designation, and monitoring the flows to ensure their maintenance, possibly by augmenting deficient flow with reservoir releases upstream from designated segments. The Act does not prohibit existing water users along a designated river segment from continuing their use; it only prohibits new appropriations. In fact, the Act states that any taking by the United States of a water right which is vested under either State or Federal law at the time a river is included in the national System shall entitle the owner to just compensation.

Inclusion in the System also protects the river segment from Federally funded water resource development. Therefore, no Federally funded dams and reservoirs will be built on designated river segments. However, this in no way guarantees that sufficient flows will occur to preserve the developed fish and wildlife resources. Some means of linking instream flow needs of fish and wildlife to this process for streamflow protection will be necessary. In 1977 the FWS, in conjunction with western state fish and game agencies, conducted a study which identified and mapped stream segments having substantial fish and wildlife value. The results from this study may be used by the HCRS when it expands its own study in 1978 to identify additional stream segments for inclusion in the Wild and Scenic Rivers System.

Future effectiveness of this strategy will depend on developing and maintaining local support and be constrained by the substantial costs involved in its implementation. The Congressional approval required to study a river segment and include it in the national system may take several years. Nevertheless, the strategy does provide for a permanent maintenance of historical flows and prohibits future Federal development. Its future effectiveness will hinge most of all on relating streamflow maintenance to quantifiable fish and wildlife values. This quantitative link is not inherent in the National Wild and Scenic River Act, but it may be possible to bridge the gap administratively.

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STATE DEFINITION OF NAVIGABLE WATERS

The nature and extent of the public trust in the navigable waters of this State has not been judicially or legislatively defined in Arizona, and therefore this strategy for utilizing the public trust doctrine to reserve instream flows is not available.

Sources

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STATE-FEDERAL INTERAGENCY CONSULTATION

I. Identification

Whenever a Federal agency constructs, modifies, or licenses a reservoir project, it must consult with the Fish and Wildlife Service and the Arizona Game and Fish Department to obtain and consider their recommendations concerning fish and wildlife resource preservation and development, including the provision of instream flow. Refining and formalizing this consultative process is the goal of this strategy. The formulation and adoption of interagency agreements, construction or permit agency regulations or formal procedures, and strict enforcement of these requirements are tactics available to implement this strategy.

The legal or administrative basis for this strategy is the Fish and Wildlife Coordination Act (FWCA) and the regulations or procedures the Federal construction and permit agencies have developed to implement the Act. The FWCA (P.L. 85-264) passed in 1958, expanded upon the Act that created the FWS in 1946 (P.L. 79-232). The FWCA requires that full consideration be given to the recommendations of the FWS; the 1946 Act only required consultation between the construction agency and the Federal and state fish and game agencies.

II. Application

The FWS, the Arizona Game and Fish Department and a private interest group are the parties who would instigate this strategy. At the present time, neither the Bureau of Reclamation, Soil Conservation Service, Forest Service nor Bureau of Land Management has an interagency agreement with the FWS at either the regional or headquarters level to implement the FWCA. The Corps of Engineers has a cooperative agreement with the FWS, enacted in 1954. This agreement will be discussed as an illustration of this strategy. All of these agencies, though, do have formalized procedures to implement the FWCA. In addition, the Corps will soon be issuing regulations concerning their implementation of the FWCA. A review of these procedures and proposed regulations is necessary to assess the decision-making and costs involved in implementing this strategy.

According to the Bureau of Reclamation policy, coordination in all phases of planning should include:

- Early notification by the BR of the initiation of planning studies
- Opportunity for the FWS to participate in the formulation and evaluation of project plans
- Opportunity for the FWS to provide reports to the BR, including recommendations relating to fish and wildlife aspects of plans or proposals.

FWS reports on BR projects are funded by the Bureau. Congress allocates funds to the FWS through the BR's Washington office which disburses funds to the FWS through the Regional Offices. Beginning in 1978, such funds will not be ear-

marked in the appropriation act and disbursed from Washington, but rather will be transferred at the field level.

Although not referring explicitly to the FWCA, the SCS procedures do specify that Federal and state fish and wildlife agencies be encouraged to participate actively in project planning and to incorporate measures needed in each project to the maximum extent feasible. According to Forest Service procedures:

> . . . it will be the policy of the Forest Service to refer to the Fish and Wildlife Service and/or the appropriate state fish and wildlife agency, all proposed projects which have a potential for affecting fish and wildlife resources to such an extent as to warrant the investigation and recommendations of these agencies.

The BLM's regulations and procedures do not refer to the FWCA, but their new organic act, the Federal Land Policy and Management Act of 1976 (P.L. 94-579), indicates that fish and wildlife values will be considered in granting permits for rights-of-way. Conditions to guarantee these values, such as minimum releases from reservoirs to augment instream flows, can be inserted in the permits.

The Corps draft regulations stipulate that the District Engineer, at least every six months, provide the Regional Director of the FWS with information concerning all pre- and post-authorization studies. This information will be helpful to the FWS in making decisions on personnel requirements and preparing investigative schedules. The draft regulations also require the District Engineer to notify the Regional Director of the initiation of any project investigation and coordinate with the FWS throughout the investigation. The District Engineer must consider to the fullest extent practicable the recommendations of the fish and wildlife agencies.

Beginning with FY 1978, funds for the FWCA studies will no longer be budgeted as line items and transferred at the headquarters level. Rather, the District Engineer, after consultation with the FWS Regional Director, will include in his budget the funds necessary for the FWS to comply with the FWCA. The new draft regulations state that local entities must pay for the cost of water released for intream purposes. Also, local entities must furnish assurances that appropriate action will be taken to prevent downstream withdrawals of water that could negate fishery benefits credited to such releases.

In pursuing this strategy, the FWS can seek agency regulations or interagency agreements based on unilaterally adopted procedures, attempt to strengthen present procedures, or see that they are enforced on a project by project basis. If interagency agreements or agency regulations are to be drawn up, or existing procedures made more stringent, the required decision-making would occur at the policy-making level of the FWS, not at the field level. To enforce the existing procedures, however, decision-making must be at the field level.

In terms of personnel, time and money, the costs involved in implementing this strategy could be quite high. They would vary depending on the tactic that is used. Of the several tactics available, enforcing existing procedural re-

quirements would probably incur the highest cost because it involves project by project application, yet this tactic may carry the greatest payoff.

III. Illustration

In 1954, the FWS and Corps of Engineers enacted an interagency agreement to cover the Coordination Act of August 14, 1946 which, when subsequently amended, became the Fish and Wildlife Coordination Act (FWCA) of 1958. This agreement established guidelines for CE consideration of FWS recommendations for fishery preservation in planned water resource projects.

These guidelines stipulated that the District Engineer shall incorporate in a project report all recommendations of the FWS which are satisfactory to him, including, of course, recommended instream flow reservations. The District Engineer must explain in the report his reasons for rejecting those recommendations he found unsatisfactory. Although there is no provision in this interagency agreement for pre-project coordination, the CE is supposed to include fish and wildlife conservation as a project purpose if the effects of a project on fish and wildlife resources would be significant.

This agreement has not had much impact in Arizona because few CE projects were planned or constructed from 1946 to 1958 in this State.

IV. Evaluation

It is difficult to determine the utility of this overall strategy. It is first necessary to ascertain what effect the Fish and Wildlife Coordination Act of 1958 has had on reserving instream flows. Strengthening the implementation of the Act through the application of the various tactics covered under this strategy could be expected to increase the probability of flow reservations.

A study performed by Enviro Control of instream flow recommendations made in Arizona, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington and Wyoming indicated that flows recommended after the 1958 amendments (FWCA) were accepted more often that prior to that time. The fishery was maintained or improved more often in the post-1958 projects than in the projects built before that time. However, there are no reliable statistics to gauge the success of flow recommendations in the last few years when procedures have become even more stringent.

Although the passage of the Fish and Wildlife Coordination Act of 1958 may have helped to reserve instream flows, making this Act more effective is the goal of this overall strategy. Enacting interagency agreements may be a promising tactic. On the other hand, the CE 1954 agreement is the only one presently operative. Construction and permit agencies probably would be unwilling to draw up such rigorous agreements since their own formalized procedures already contain most of the features in such an agreement. A distinct advantage of interagency agreements, in contrast to unilateral agency procedures, is that the FWS would have more of an opportunity to insert provisions it deems necessary. Also, an interagency agreement may imply more commitment on the part of the cooperating agencies. These characteristics, though, may explain why the Federal construction and permit agencies prefer merely formalizing their own procedures.

The strengthening of present procedures, even to the extent of adopting formal regulations which are more binding, may prove a promising tactic. The National Wildlife Federation has filed a petition with the Department of the Interior, Department of the Army and the Council on Environmental Quality to compel Federal construction and operating agencies to adopt formal procedures in reviewing FWS recommendations for mitigating the adverse impact of development upon fish and wildlife habitats. The petition seeks to alleviate the dependency of the FWS on the construction agencies for transfer funds by having mitigative features funded and implemented concurrently with project construction, or in advance of project construction where there may be interference with the achievement of mitigative goals.

The Wildlife Federation is optimistic that the petioned agencies will draft formal review procedures. However, the agencies are not expected to fully comply with the petition, but they are expected to take significant steps toward the desired end. For instance, the Corps has drafted new procedures and regulations, but they will not be formalized until other petitioned agencies complete their drafts. This petition relies upon existing legislation (FWCA) which avoids the pitfalls of introducing new legislation into Congress.

Another promising tactic is promoting the enforcement of existing procedures and regulations. The construction and license agencies, having issued these requirements, are officially committed to them. Issued by the agencies' main offices in Washington, D.C., these procedures or regulations are not always adhered to in the field. This may be attributed to negligence or mere unfamiliarity on the part of the construction and permit agencies. Also, some FWS Field Offices may be unaware of construction and permit agency procedures.

The major costs involved with the tactics subsumed under this general strategy would result from drafting procedures, regulations or agreements, and attempting to convince the construction or permit agencies to adopt them. The costs, to a large extent, are a function of the cooperation proffered by the agencies solicited.

A major constraint on the effectiveness of this strategy would be the difficulty the FWS would have in determining whether or not the procedural requirements are being honored. FWS knowledge of project planning and development depends on notification by the construction or permit agency. Notification may be delayed until late in the planning phase. Conceivably, the FWS would spend substantial time and effort in trying to be cognizant of project planning programs if it is not properly notified.

Even if proper notification is made, successful implementation of agency procedures for cooperation with fish and wildlife interests is dependent on the availability of funding and personnel. The FWS incurs significant cost when detailed investigations are conducted in the field and subsequent recommendations are formulated for planned projects such as dams and reservoirs. Although the construction agencies transfer funds to the FWS for this purpose, these may not be adequate. Hopefully, this situation may improve, at least as it involves the BR and CE, because of the new funding procedure that the Bureau and Corps will initiate in fiscal year 1978. Transfers of General Investigation funds will be made at the regional level following negotiations of appropriate amounts with the respective FWS Regions. These transfers will be made by memo-

randa of agreement executed by the affected agency field offices. This new communication at the field level could result in greater funding.

Another constraint upon the effectiveness of this strategy is the lack of an enforcement mechanism. If a field office of a permit or construction agency does not conform with its own procedures or an interagency agreement, the FWS can take no action other than lodging a complaint with the offending agency. The pending adoption of CE regulations is a step in the right direction because the regulations will have the force of law. Concerning the Forest Service and BLM, regulations to be issued in accordance with the Federal Land Policy and Management Act of 1976 (P.L. 94-579) may also afford further protection to fish and wildlife.

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FEDERAL LICENSE AND PERMIT STIPULATIONS

I. Identification

The inclusion of a minimum flow stipulation in a dam and reservoir project license or permit ensures that flows will be required to be released as a matter of legal right. To ensure that minimum flows are legally required as an integral part of project operations, it is essential that fish and wildlife interests take an active part in the licensing or permit process involved with an application for use of land and water under Federal ownership or control.

The legal basis for this strategy in relation to Forest Service and BLM-controlled lands derives from the Federal Land Policy and Management Act of 1976 (P.L. 94-579). Conversations with the FS and BLM have pointed out that, until pending regulations are issued pursuant to P.L. 94-579, the permit process for these agencies will continue to maintain vestiges of previous legislation which regulated acquisition of Federal lands. The legal basis with regard to the Federal Energy Regulatory Commission derives from the regulatory authority of the FERC over the non-Federal hydroelectric industry. As a quasi-judicial commission of the Department of Energy, it licenses construction, operation and maintenance of dam and reservoir projects utilizing waters and land of the United States under mandates of the Federal Power Act of 1920 and other Federal laws.

II. Application

This strategy may be utilized when it is determined that a minimum instream flow is needed downstream from a proposed reservoir project requiring a permit or license or subject to relicensing. Participating parties in this strategy would be the Federal agency in control of the affected land and water resources, the project permittee or licensee, and an interested party advocating fish and wildlife interests such as the FWS or Arizona Game and Fish Department. In the case of an FERC-regulated project, any person or group of persons whose participation may be in the public interest could participate.

The permit processes followed by the Forest Service and BLM are similar. This discussion will focus on this process as it relates to the Forest Service. Presently, the critical point at which fish and wildlife interests may exert pressure for instream flow stipulations in the project permit occurs after the applicant has submitted a plan of construction, operation, and rehabilitation of the proposed right-of-way in National Forests. At this time, an impact survey is performed by the FS which must contain the "views of the Fish and Wildlife Service. . . and State fish and game departments where fishery and wildlife values are of importance. The Forest Supervisor will ask the Fish and Wildlife Service and State fish and game departments for a report." At this point the interested fish and game agency should submit its minimum flow recommendations and any studies documenting the efficacy of the suggested flow regime in providing for fish and wildlife habitats.

Upon receiving the plans of the applicant and reviewing the completed impact survey, the FS determines whether the land in question can accommodate the proposed use. If an affirmative determination is made, a permit is granted.

Permits normally contain a list of terms and conditions. Section 505 of P.L. 94-579 states that one of the purposes of the terms and conditions is to minimize damage to scenic and aesthetic values and fish and wildlife habitats, and to otherwise protect the environment. Upon granting the permit with accompanying terms and conditions, the applicant must submit detailed plans of construction to the FS. If these plans comply with requirements of the permit, construction may then proceed.

Within this process, it is important that the interested fish and wildlife agency make a specific instream flow recommendation to the Forest Supervisor when asked to comment on potential project impact. Such action will ensure that a minimum instream flow will be considered for inclusion in the final project permit as part of the terms and conditions of project operations.

In the FERC licensing process, there are two critical points at which proponents of this strategy may exert influence. The first point occurs during the applicants' preparation of the Application for License of which Exhibit S is a component. Exhibit S, as described in 18.CFR 4.41, Rules of Practice and Procedure requires that:

> The Applicant shall prepare this exhibit on the basis of studies made after consultation and in cooperation with the U.S. Fish and Wildlife Service, Department of the Interior and appropriate state fish and wildlife agencies. . . The Exhibit shall include a statement on the nature and extent of applicants' consultation and cooperation with the above agencies.

It is thus essential that fish and wildlife interests make a concerted and organized contribution to this process involving Exhibit S at an early stage in project planning to sensitize the applicant to the importance of instream flow needs and guarantee coverage of this issue in the application review.

The second point at which fish and wildlife advocates may apply their influence occurs after the Application for License is submitted to the FERC. Upon its receipt, the FERC reviews the application to determine whether or not it fulfills the requirements of Rules of Practice and Procedure. Public notice of application is then given, specifying a final date for filing protests, notices of intervention or petitions to intervene. Concurrent with this notification, copies of the completed application are disseminated to Federal agencies and other interested parties for comment and review.

Upon review of the application and determination that instream flow needs are not adequately provided for, an interested party can petition the FERC to intervene in the applicant's licensing. It is essential that such petitions be made before the final date specified by the Commission; otherwise, the petitions may be rejected as "untimely." Section 1.8d of Rules of Practice and Procedure does state that "in extraordinary circumstances for good cause shown, the Commission (may authorize) a late filing." In the event that a petitioner's right to intervene is granted, a hearing is scheduled to resolve the difference. However, prior to the hearing, it often happens that the applicant and the petitioner meet informally and resolve the issue.

Prior to scheduling a hearing, the FERC is also empowered to authorize a Technical Session in which FERC staff meets with the interested party and the applicant in order to clarify the issue, and if possible, resolve it. If resolution is not accomplished in either an informal meeting between the applicant and the intervenor or in the Technical Session, a pre-hearing conference is arranged by the FERC's Office of General Counsel. At this time, the issue is further defined and another attempt is made at resolution. Finally, if the issue is still unresolved, a hearing is scheduled before an Administrative Law Judge of the FERC. Both parties present their case and a decision is made and transmitted to the Commission. This final hearing decision is not binding on the decision of the five-man Commission; however, the decision of the Commission is usually in agreement with hearing findings.

The term of license for most FERC projects is 50 years. The process followed for relicensing of projects is identical to the process discussed previously except that an Exhibit S is not required.

In connection with the Forest Service or BLM permit process, the costs associated with this strategy are limited to those incurred during preparation of the fish and wildlife input to the impact survey. The magnitude of the instream flow study and time associated with preparing the report submitted to the permit agency as part of this input would be the principal cost determinants.

For FERC-licensed projects, the costs linked with this strategy are directly dependent on the extent of agreement between the intervenor and the applicant. Expenditures of time and money increase as negotiations advance through the informal meeting stage to the FERC hearing stage. Occasionally, instream flow studies must be performed to provide data for a decision. The studies are authorized at an informal level or as a result of an FERC hearing. The funding for these studies is normally supplied by the utility company applicant. Most likely the studies would be performed by the Arizona Game and Fish Department with the staff biologist for the utility company.

III. Illustration

This strategy has not been implemented in Arizona, therefore, an illustration from Wyoming demonstrates the utility of this strategy. The Forest Service granted a special use permit to the Dome Lake Reservoir Company on October 7, 1970, for the construction of Sawmill Reservoir on Sawmill Creek in the Big Horn National Forest. A minimum flow of 4 cfs or the inflow, whichever was less, was stipulated in the special use permits. Apparently this stipulation has been complied with.

A 4-cfs flow or the natural streamflow, whichever is less, was recommended below the Sawmill Creek Project by the FWS in a 1969 letter report. This recommendation was developed from a joint field investigation conducted by the FWS, the FS, and the Wyoming Game and Fish Commission during June 1969. This flow was intended to protect the Eastern brook trout fishery. Since project completion, the fishing has apparently been preserved. However, because streamflow records are unavailable to document actual compliance, the effect of the flow stipulation is somewhat inconclusive. The only significant cost associated with this recommendation was the staff effort to conduct the field study and prepare the report.

IV. Evaluation

This strategy has not been applied in Arizona for several factors. First, there are no FERC projects in the State. Furthermore, at FS- or BLM-permitted projects, little or no water is available for flow releases to maintain the aquatic habitat.

Despite past success in other States, there have been some constraints on the strategy's effectiveness. Applicants were understandably wary of accepting instream flow recommendations which often were based on very cursory stream investigations, especially when the guarantee of such flows would increase project costs. Although the licensing or permit process contained requirements for consideration of instream flow needs, the inability of the interested party to develop realistic recommendations resulted in either an omission of instream flow stipulations or inclusion of a clause merely guaranteeing "adequate" or "suitable" flows.

Often a project sponsor will agree to supply minimum flows on an informal, non-contractual basis. Such "gentlemen's agreements" have sometimes been responsible for maintaining fisheries below reservoir projects; however, more often than not, the absence of a compelling legal force guaranteeing minimum reservoir releases results in a sponsor withholding flows during critical periods of competitive user needs. If the license or permit stipulates flow releases, the licensee or permittee is legally obligated to provide them. Most other instream flow strategies do not lead to as strong a legal obligation.

The future utilization of this strategy may be enhanced as a result of the current research on instream flows needs. Also, further consideration may be given to instream flows in FS and BLM projects with the implementation of the Federal Land Policy and Management Act of 1976 (P.L. 94-579).

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STATE ALLOCATION OF RESERVOIR SPACE

The strategy to obtain reservoir space for fisheries in reservoirs constructed or licensed under State law is not available in Arizona because no statutory or institutional basis exists for its implementation.

Sources

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STATE PURCHASE AND LEASE OF WATER RIGHTS

I. Identification

Contractual arrangements to reserve instream flows include the direct purchase of flow rights, the leasing of water rights, and the purchase of shares in a mutual water company. The legal basis of this strategy lies in the provisions of Ariz. Rev. Stat. § 17-241. This statute explicitly empowers the Arizona Game and Fish Commission to acquire waters by purchase and lease and implicitly empowers the Commission to purchase shares in a mutual water company. This authority may be construed to encompass only the purchase of reservoir storage. Purchase of direct flow rights to provide minimum instream flows is not provided for by Arizona Statutes. The Arizona Game and Fish Commission is the policy-making body for the Game and Fish Department. The Commission is composed of five lay persons appointed by the Governor for five-year staggered terms. The Director of the Department acts as the Secretary for the Commission.

II. Application

The Arizona Game and Fish Commission might acquire reservoir storage by purchase, lease, and the purchase of shares in a mutual water company pursuant to Ariz. Rev. Stat. § 17-241. The Arizona Game and Fish Commission does not have any programs for the purchase or lease of reservoir storage to protect instream flows. The acquisition of reservoir storage by the Commission at the request of the Game and Fish Department might be used by the Department to provide for reservoir releases to maintain instream flows below a dam. The lease of water rights provides only an interim solution, but could be applied to protect a valuable fishery in a particular stream where no permanent supply of flows is available for purchase. A mutual water company is a corporation usually organized by landowners to acquire water for domestic and agricultural use in a designated area. Each shareholder receives a pro rata amount of water based upon the number of shares owned in the company. To employ this arrangement, Arizona Game and Fish Department, a private party or conservation organization would purchase shares in a mutual water company to acquire instream rights and leave their entitled water in the stream.

The major cost of implementing this strategy is, of course, the high price of water rights which has risen dramatically in the last few years and will probably continue to rise in the future. However, the water right might be sold to be exercised at a point downstream where few instream values worth preserving exist, thereby defraying part of the acquisition cost. Other costs include expenditures of personnel and funds for studies to identify streams where a purchase would have the greatest benefit and the substantial effort to negotiate for the purchase.

III. Illustration

This strategy has been implemented in Arizona through the purchase of reservoir storage with the use of Federal Aid funding. In July 1962 the Arizona State Land Department issued to the Arizona Game and Fish Department a water permit for the impoundment of 15,500 acre-feet in the proposed Chevelon Canyon Lake in Chevelon Canyon on Chevelon Creek within the Sitgreaves National Forest. The permit provides for the release of 1,500 acre-feet annually to establish a fishery for approximately 10 miles downstream. Chevelon Canyon Lake was impounded by the Arizona Game and Fish Department for the establish-

ment of reservoir and downstream fishery. Brown and speckled trout comprised the stream fishery. Initial total construction cost for the project was $450,000. In 1965, the Department received $150,000 in Dingell-Johnson funds and $11,500 from Accelerated Public Works Project funds for partial reimbursement of total construction costs. The Department and State provided approximately $288,000. Shortly before completion, a major storm washed out the spillway, which resulted in a total project cost of $823,537 for which the State made an emergency appropriation of $237,000.

Prior to the construction of Chevelon Canyon Lake, Chevelon Canyon Creek supported a fair coldwater fishery. Streamflows were comprised of natural runoff in the drainage area, springs, and some releases from two reservoirs owned and constructed by the Game and Fish Department upstream from the Chevelon Canyon Lake site. However, there were no provisions for releases from these upstream reservoirs included in their operating permits. The flow release provision in the Chevelon Canyon Lake water permit ensures the maintenance of an instream flow. The 2 cfs release from Chevelon Canyon Lake was intended to augment the natural flow below the dam. Faults in the area, however, result in springs approximately 3/8-mile downstream of the dam site and provide a flow of 4 cfs; these springs originate from the impounded water. Spills from the dam are made only during floods as the springs provide for adequate flows at all other times. The river channel segment between the dam and the springs is dewatered, except during floods. Since construction of Chevelon Canyon Lake Dam in 1965 the downstream fishery has benefited.

IV. Evaluation

Although the Game and Fish Department constructed Chevelon Canyon Lake Dam with the aid of Dingell-Johnson funds for both a reservoir and stream fishery, the Department has encountered significant constraints upon constructing additional reservoirs. In order to meet downstream rights, the Department has to make flow releases by either using the natural stream channel or pipelines. When using the stream channel, the Department has to make considerably greater flow releases than needed to meet downstream water rights in order to overcome the effects of seepage and evaporation. Such required releases frequently exceeded the reservoir inflow. Moreover, the cost of pipelines has been more than the benefits received from their implementation. The Department has not constructed any new reservoirs since the early 1970's for these reasons. However, given the required set of circumstances, the Department might construct more dams and reservoirs.

Purchase of reservoir storage from other reservoir operators through contractual arrangements has limited application in Arizona. The Game and Fish Department indicates that it would generally not be effective, because of unavailability of water for fish and wildlife uses. Such uses are not usually authorized project purposes. Also, it is believed that competition for available reservoir storage results in water costs too great to justify the necessary expenditure of funds. However, if the acquired water could be resold downstream, acqusition cost could be reduced. Furthermore, the Game and Fish Department is reluctant to expend considerable funds for reservoir storage to be used for flow releases, because such releases are subject to diversion by downstream appropriators. These constraints also apply to the lease and purchase of shares in a mutual water company to protect instream flows.

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WATER RESOURCE PLANNING

FEDERAL WATER RESOURCES COUNCIL PLANNING PROGRAMS

I. Identification

Section 13(a) of the Non-Nuclear Research and Development Act of 1974 requires the Water Resources Council (WRC), at the request of the Secretary of the Department of Energy, to undertake assessments of water resource requirements and water supply availability for the development of non-nuclear energy technology. The assessment is to include the environmental impact resulting from the use of water in developing the technology.

The planning process of the WRC derives from the Water Resources Planning Act of 1965 (P. L. 89-80), which was designed to encourage conservation, development, and use of the nation's water and land resources on a comprehensive and coordinated basis by Federal, State and local governments and private enterprise.

II. Application

This strategy would arise whenever the DOE Secretary requests the WRC to undertake a study of water resource requirements in Arizona for the development of a non-nuclear technology. Other parties which may become involved in the application of this strategy include a river basin commission, a State resource agency, a Federal construction agency, or the FWS. These agencies would become involved in the assessment through delegation by the WRC.

The assessment is similar to a WRC Level A Study in that its geographical scope is a river basin with a coarse level of detail. However, it is distinct because its subject matter is limited to the relationship between water use and the development of non-nuclear technology. Regarding water use, several components must be examined: an analysis of State water laws and State and Federal water rights; an evaluation of the effects of the technological development on water quality and supply; and an analysis of the environmental, social, and economic impact of any change in current use of water resources.

The 13(a) assessment does not specifically call for a study of instream flows; however, such a study can be included as part of the required environmental analysis. The crucial decision involved in implementing this strategy is the weight given to instream flow values by those conducting the assessment.

The primary cost associated with implementing this strategy is the time and personnel needed to conduct the assessment. Although there is no set time in which an assessment must be completed, it usually requires a minimum of ten months at a cost of several hundred thousands of dollars.

III. Illustration

As yet, no 13(a) assessments have been proposed for Arizona; therefore, an example from Colorado is presented to illustrate this strategy. An assessment of the water resource requirements for the development of coal and oil shale technology in the Upper Colorado River Basin will be undertaken in 1978 by the State of Colorado through its Department of Natural Resources, and by the State

of Utah under delegation by the WRC. The WRC was requested to undertake this study by the DOE Secretary under § 13(a) of the 1974 Non-Nuclear Research and Development Act.

In addition to the States of Colorado and Utah, the Bureau of Reclamation and the Instream Flow Service Group of the Fish and Wildlife Service will participate in the assessment. The latter participation resulted from aggressiveness and a good working relationship between the Instream Flow Service Group and Colorado's Department of Natural Resources. The participation of the Instream Flow organization ensures the consideration of the impacts of coal and oil shale development on instream flows, as it relates to present and future water supply availability and quality. Of course, this assessment will not result in the reservation of any flows, but it will highlight the need to consider instream flow values when planning energy development.

The Upper Colorado River Basin assessment commenced in 1978. It was to be performed in 10 months and have a budget of approximately $450,000. These funds will be dispersed in both Colorado and Utah.

IV. Evaluation

It is difficult to gauge the past utility of this strategy because it is only beginning to be implemented. However, the illustration demonstrates some of the strategy's potential advantages and disadvantages. A major disadvantage is its inability to directly affect an instream flow reservation. However, as a component of the required environmental analysis within the scope of the 13(a) assessment, it might be brought to the attention of the DOE Secretary that private energy development, subsidized by the DOE, would not be environmentally acceptable in a particular basin, because of the threat to instream flows. It can be argued that this strategy entails a substantial expenditure with a relatively small return on investment as far as instream values are concerned, although other purposes of a water resource assessment may be achieved with economy.

Also, in the above illustration the FWS participated in the § 13(a) assessment; however, these assessments are not required to include input from fish and wildlife agencies. Thus it is possible that an assessment made in another river basin will not include FWS input. The respective river basin commission is not compelled to contract with the FWS for a study of the potential environmental impacts of future energy development. The commission, at its discretion, may contract with a state agency or private organization for this work.

The primary advantage of this strategy is that it raises the issue of instream flow needs and informs the public of the conflict between instream and offstream water use, and it highlights the potential impacts on instream values resulting from energy development. Considering the building pressure to develop the West's energy resources, it is important that instream values be accounted for. This strategy's future effectiveness depends on how forcefully instream values are weighed in water resource assessments related to energy development. Until the Colorado study is completed, the FWS (Phoenix Area Office) and Game and Fish Department are withholding evaluation of this strategy.

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FEDERAL AID FUNDING TO PURCHASE STORAGE

I. Identification

The Federal Aid in Fish and Wildlife Restoration Programs are supported by a manufacturer's excise tax on certain items of fishing gear, sporting arms and ammunition. These taxes collected by the United States Treasurer are appropriated to the Fish and Wildlife Service which distributes these monies to the states and territories for carrying out the intent of the Federal Aid Programs. Under the Federal Aid in Sport Fish Restoration Act (P.L. 81-681), known as the Dingell-Johnson Act, funds may be appropriated to the states for the purchase of reservoir storage which, ultimately, could be used as a means of reserving instream flows. Other legislation, which combined with the Dingell-Johnson Act, forms the legal basis for Federal Aid Programs, includes the Federal Aid in Wildlife Restoration Act, known as the Pitman-Robertson Act (P.L. 75-415), and the Anadromous Fish Conservation Act (P.L. 89-304).

II. Application

This strategy may be utilized when the Arizona Game and Fish Department determines that the fish and wildlife resources below a reservoir might not be preserved or enhanced except by the purchase of reservoir storage. Parties participating in the implementation of this strategy would be the interested state fish and game agency and the regional FWS Federal Aid Office.

The process whereby a state applies for Federal Aid funding is described in the 1973 revision of the Federal Aid Manual. The first document submitted by the state is the Application for Federal Assistance (AFA), which outlines the basic plan for the proposed project. Information pertinent to the environmental and socio-economic impacts of the project as well as budget information and forecasted cash needs are also included in this application. The most important part of the application is the Program Narrative which must address:

- Needs or objectives of the project
- Expected benefits or results
- Approach of the project
- Project location
- Related Federal projects

The AFA in combination with any supporting documents provides the basis for any decision made by the Federal Aid Office. If the proposed project is in accordance with specifications of the Federal Aid Program, a Project Agreement is issued. The Project Agreement outlines the period of agreement between the state and the U.S. government and the respective cost share of each entity during the period of development. Care must be taken that matching funds come from state sources; a project cannot be approved if it depends upon another Federal program for the matching funds.

Costs are incurred by the state and Federal governments in the implementation of this strategy. Prior to submitting an AFA, the state must expend funds to determine which streams are in need of increased flows. Additional costs are

borne by the state in revising AFA's which the Federal Aid Office determines to be incomplete or insufficiently detailed.

III. Illustration

This strategy has been implemented in Arizona through the purchase of reservoir storage with the use of Federal Aid funding. In July 1962 the Arizona State Land Department issued to the Arizona Game and Fish Department a water permit for the impoundment of 15,500 acre-feet in the proposed Chevelon Canyon Lake in Chevelon Canyon on Chevelon Creek within the Sitgreaves National Forest. The permit provides for the release of 1,500 acre-feet annually to establish a fishery for approximately 10 miles downstream. Chevelon Canyon Lake was impounded by the Arizona Game and Fish Department for the establishment of reservoir and downstream fishery. Brown and speckled trout comprised the stream fishery. Initial total construction cost for the project was $450,000. In 1965 the Department received $150,000 in Dingell-Johnson funds and $11,500 from Accelerated Public Works Project funds for partial reimbursement of total construction costs. The Department and State provided approximately $288,000. Shortly before completion, a major storm washed out the spillway, which resulted in a total project cost of $823,537 for which the State made an emergency appropriation of $237,000.

Prior to the construction of Chevelon Canyon Lake, Chevelon Canyon Creek supported a fair coldwater fishery. Streamflows were comprised of natural runoff in the drainage area, springs, and some releases from two reservoirs owned and constructed by the Game and Fish Department upstream from the Chevelon Canyon Lake site. However, there were no provisions for releases from these upstream reservoirs included in their operating permits. The flow release provision in the Chevelon Canyon Lake water permit ensures maintenance of an instream flow. The 2-cfs release from Chevelon Canyon Lake was intended to augment the natural flow below the dam. Faults in the area, however, result in springs approximately 3/8-mile downstream of the dam site and provide a flow of 4 cfs; these springs originate from the impounded water. Spills from the dam are made only during floods as the springs provide for adequate flows at all other times. The river channel segment between the dam and the springs is dewatered, except during floods. Since construction of Chevelon Canyon Lake Dam in 1965, the downstream fishery has benefited.

IV. Evaluation

Although the Game and Fish Department constructed Chevelon Canyon Lake Dam with the aid of Dingell-Johnson funds for both a reservoir and stream fishery, the Department has encountered significant constraints upon constructing additional reservoirs. In order to meet downstream rights, the Department has to make flow releases by either using the natural stream channel or pipelines. When using the stream channel the Department has to make considerably greater flow releases than needed to meet downstream water rights in order to overcome the effects of seepage and evaporation. Such required releases frequently exceeded the reservoir inflow. Moreover, the cost of pipelines has been more than the benefits received from their implementation. The Department has not constructed any new reservoirs since the early 1970's for these reasons. However, given the required set of circumstances, the Department might construct more dams and reservoirs.

Purchase of reservoir storage from other reservoir operators with the use of Federal Aid funding has limited application in Arizona. The Game and Fish Department indicates that it would generally not be effective, because of unavailability of water for fish and wildlife uses. Such uses are not usually authorized project purposes. Also, it is believed that competition for available reservoir storage results in water costs too great to justify the necessary expenditure of funds. Furthermore, the Game and Fish Department is reluctant to expend considerable funds for reservoir storage to be used for flow releases, because such releases are subject to diversion by downstream appropriators.

However, if Arizona changes its present position it must avoid mistakes other states have made which have curtailed its effectiveness. Conversations with officials of the Federal Aid Program indicate that, in the past, delays in project funding have resulted from inadequate documentation of Project Agreements. These agreements between the state and the affected irrigation districts were often vague in delineating post-project responsibilities. Failure by the state to submit reports and vouchers for the previous year's work within the 90-day period specified by Federal Management Circular 74-7 also delayed the processing of an AFA for impending work.

Another impediment to the use of the strategy has been state violation of the Rules and Regulations of the Federal Aid Program (Section 80.5). States become ineligible for Federal Aid funding if funds or real property acquired through this source pass from control of the state fish and game agency or are used for purposes not specified in the Project Agreement. State eligibility is restored when misused funding is compensated or the appropriated property or an equivalent is restored. Adherence to the administrative guidelines of the Federal Aid Programs will improve this strategy's effectiveness.

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FEDERAL RESERVOIR CONSTRUCTION AND ENLARGEMENT

I. Identification

This strategy involves the construction of new dams and reservoirs large enough in capacity to expressly provide for instream flow reservations, or the enlargement of existing dams and reservoirs for this purpose. The legal basis for this strategy is implied in the legislation granting authority to construction agencies to construct and modify reservoir projects. The Bureau of Reclamation derives this power from the Reclamation Act of 1902 and subsequent amendments, especially the important 1939 amendments. The Corps of Engineers is granted construction authority by the various Rivers and Harbor Acts, and the Soil Conservation Service operates under the Small Watershed Protection Act. More specific statutory authority to provide reservoir storage capacity expressly for regulation of streamflow for fish and wildlife needs is contained in Section 102 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500).

The Anadromous Fish Conservation Act authorizes the Bureau, Corps, Department of Agriculture, and the states to construct dams and reservoirs solely for the purpose of conserving, protecting, and enhancing anadromous fish if the Secretary of Interior deems this action necessary. The Fish and Wildlife Coordination Act provides a mechanism through which the Fish and Wildlife Service and State fish and game agencies can implement this strategy.

II. Application

This strategy would be applied when construction agencies first begin planning to construct a new dam or enlarge an existing one. No Federal construction agency, except under the Anadromous Fish Conservation Act, is authorized to build a reservoir solely for fish and wildlife purposes; however, the protection or enhancement of fish and wildlife resources could be made a very important project purpose in a multi-purpose project. The FWS and Arizona Game and Fish Department could promote fish and wildlife conservation to the extent that additional storage capacity specifically to sustain and eserve minimum instream flows would be planned. If during initial project planning these agencies learn that planned storage volumes will be insufficient to provide adequate instream flows, they may recommend a larger dam and reservoir and have the additional costs allocated to fish and wildlife benefits.

When construction agencies enlarge existing reservoir projects, they may do so solely for fish and wildlife purposes or for a number of reasons including the preservation or development of fish and wildlife resources. The fish and game agencies would have to convince the construction agencies of the advisability of enlarging a reservoir to ensure reserving instream flows. Relating a minimum flow regime to the storage capacity necessary to its maintenance may require hydrological data and expertise that is difficult for fish and game interests to acquire. Also, fish and wildlife agencies must convince the construction agencies of the economic benefits of this action. The construction agencies are an important beneficiary of this strategy because they can claim valuable economic benefits in constructing larger dams or enlarging dams for fish and wildlife purposes, possibly improving the

the economic justification of a reservoir project. Marshalling public opinion can be an important component of this strategy. The FWS and the Arizona Game and Fish Department can cooperate with conservation organizations and sportsmen's clubs in their negotiations with the construction agencies.

In implementing this strategy, the fish and game agencies must decide which proposed or existing reservoir projects they should investigate or which instream flow and related storage recommendations are most needed. This decision is predicated on the importance of protecting a particular ecological resource and the likelihood that construction agencies will accept and implement the recommendations. The decision making involved is very related to the application of other instream flow strategies (see strategies entitled State-Federal Flow Requests Made Early, State-Federal Combined Storage and Flow Requests and State-Federal Interagency Consultations). The implementation of this strategy also depends on decision making by Congress which must authorize the construction or enlargement of dams and reservoirs.

The total costs could be substantial in implementing this strategy. Costs would be incurred as always in conducting stream investigations to justify the inclusion of flow reservations. In addition, however, developing the hydrological basis for increasing the reservoir capacity to sustain the flow reservation will impose significant study cost.

III. Illustration

This strategy has not been implemented in Arizona; therefore an illustration is used from Washington to demonstrate its utility. The proposed enlargement of Bumping Lake, a reservoir located on the Yakima River, Washington, provides an illustration of this strategy. The Yakima River had supported a major run of salmon, but with the impoundment of the river during the 1930's this run was all but destroyed. The enlargement of Bumping Lake was planned to rehabilitate the salmon run.

Consideration has been given to enlarging Bumping Lake since 1939 when the Roza Diversion was completed. Originally, the planned enlargement was primarily for increased irrigation storage, but enlarging the lake for this purpose could not be justified economically and, therefore, economic benefits had to be derived elsewhere. A complication was that in the mid-1950's the local irrigators were not enthusiastic over the proposed enlargement because they believed the stored water would be too expensive. For these reasons, the BR decided to allocate substantial storage to other purposes. Influenced by the FWS and the recent passage (in 1958) of the Fish and Wildlife Coordination Act, the Bureau proposed a 458,000 acre-foot reservoir with 324,000 acre-feet allocated to fishery enhancement and only 100,000 acre-feet for irrigation. The Washington Department of Game and the BR are presently negotiating over an optimum storage release schedule to provide for the instream flow needs of salmon.

The decision-making involved in implementing this course of action centers around the FWS decision to encourage the BR to enlarge the reservoir for fishery enhancement and the BR's favorable decision largely due to the added economic benefits it could claim to help justify the action. The costs, so far, have been those generally incurred in planning a project modification and have not been substantial. Greater costs may accrue,

though, due to delay in construction caused by local opposition. Additional time may be spent in pacifying opposition and in the Congressional authorization process.

Irrigators along the Yakima River oppose allocating a large amount of storage for instream use, and threaten to divert fishery enhancement flows. To guard against this possibility,the Washington Department of Game has suggested that streamflow gauges be installed along the river and irrigators be contractually bound to compensate losses to the ecosystem caused by illegal diversion.

IV. Evaluation

To the present, no reservoir west of the Mississippi River has been built solely for fishery purposes under the Anadromous Fish Conservation Act. Federal construction agencies, though, can include fish and wildlife conservation as a project purpose and can provide substantial reservoir storage to sustain flow releases so as to further this purpose. This approach has been more common in recent years, partially because the construction agencies can maximize their benefit claims by adding to the project purposes, and because of recent environmental legislation and increased environmental consciousness.

To successfully implement this strategy, the FWS and Arizona Game and Fish Department must participate early in the planning process with the construction agency and fully understand the allocation of projected reservoir storage. A basis for coordination with construction agencies is provided by the Fish and Wildlife Coordination Act (see strategies entitled State-Federal Combined Storage and Flow Requests, State-Federal Flow Requests Made Early, and State-Federal Interagency Consultations). Although the construction agencies are under no legal or institutional compulsion to adopt the course of action advocated by the fish and game interests, conservation agencies and their private-sector allies are sometimes convincing in bargaining for greater reservoir storage capacity to ensure reserving instream flows. Their persuasiveness depends a good deal on the scope of their knowledge of the hydrological and biological conditions surrounding a planned or existing dam and reservoir project. At present the FWS and Game and Fish Department are unaware of any reservoirs suitable for application of this strategy.

Once a construction agency commits itself to build a new dam or enlarge an existing one for purposes including the reservation of instream flows, such a commitment is embodied in authorizing legislation passed by Congress. This legislative action is a primary advantage of this strategy because it has the force of law and expresses Congressional intent to protect instream flows.

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WATER RESOURCE MANAGEMENT

STATE WATER RIGHTS RECORDS ANALYZED

I. Identification

This strategy involves locating and analyzing the water rights records for a particular stream as part of the process for securing instream flows. The strategy itself will not ensure an instream flow, but it can be used by the Fish and Wildlife Service and by the Arizona Game and Fish Department in formulating tactics when negotiating with construction or operating agencies for minimum instream flows. Any interested party could find this strategy useful in deciding what tactics or further strategy would be appropriate to obtain instream flows in a particular stream.

Negotiations between the FWS, Arizona Game and Fish Department, and the Federal construction agencies take place in accordance with the Fish and Wildlife Coordination Act. This statute is the legal basis of this strategy.

II. Application

Arizona Game and Fish Department, the FWS or any conservation organization can employ this strategy. It is applicable primarily in two situations: when a concerned party seeks to require minimum instream flows; and when the Game and Fish Department or FWS is bargaining with a Federal construction or operating agency for reservoir releases sufficient to maintain prescribed minimum flows.

Knowledge of the water rights established along a stream reach will aid in selecting the best course of action to reserve instream flows there. For example, if normal streamflows are fully appropriated, a strategy such as filing a junior water right would not be effective, but a strategy such as direct purchase of water rights would be. In contrast, if a stream is not entirely appropriated, an administrative appropriation of instream flow may be applicable.

The Game and Fish Department or the FWS can bargain more intelligently with the construction or operating agency for prescribed releases from a reservoir if the extent, location and ownership of water rights established below the dam are known. For instance, if the fishery in a certain stream reach required a minimum 15-cfs instream flow, then sufficient reservoir releases should be prescribed so that 15 cfs will remain after all water rights throughout the stream reach have been exercised. Therefore, knowledge of the existing water rights is essential. With this knowledge, a fish and game agency could tie an instream flow recommendation to an existing downstream water right. This bargaining tactic may be useful as a last resort toward reserving an instream flow where protection of fish and wildlife is not recognized legally as a beneficial use of water.

Water rights are a matter of public record in Arizona. Records are available from the State Land Department, which include a compilation of all valid water rights. After 30 June 1978 when all unrecorded rights are to be filed with the State Land Commissioner, for every stream in the State, a private individual, organization, the Game and Fish Department, or the FWS will be able to ascertain the ownership, amount, the point of diversion, and the date of pri-

ority of each water right. The cost of securing this information is not great; it is based on copying charges and staff time required to obtain the records.

III. Illustration

This strategy has not been implemented in Arizona; therefore, an illustration is used from Colorado to demonstrate its utility. Knowledge of a downstream water right enabled a useful tactic in reserving an instream flow in Clear Creek, Colorado, below Georgetown Lake. In May 1969, the FWS recommended a minimum bypass flow of 20 cfs or the inflow to the reservoir, whichever was less. In part, this recommendation was based upon the knowledge of established downstream water rights of 20 cfs. This knowledge was gained through discussions with the State Engineer. A bypass flow of 20 cfs was acceptable to the project licensee, and it was incorporated into the BLM lease for the project. This minimum low flow has usually been maintained, resulting in the preservation of the downstream fishery.

This case illustrates the strategy in a typical situation where the State and Federal fish and game agencies bargain with a Federal permit or construction agency for a minimum release from a reservoir. It does not, however, represent an optimum application of the strategy since the flow recommendation merely uses the water right as a crutch; apparently, no analysis of inflows and diversions along the affected stream reach was attempted. The important decision points in applying the strategy in this situation are already institutionalized within the bargaining process. Relatively little cost is involved to gain and apply knowledge of water rights as a tactic in the bargaining process.

IV. Evaluation

Although this strategy has displayed some utility in the past, fish and wildlife interests have only infrequently applied a knowledge of water rights to help ensure instream flows. The FWS and Game and Fish Department consider this strategy to be promising for determining water rights which are not being utilized and are subject to being forfeited by statute.

While some knowledge of downstream water rights could be applied as an instream flow bargaining tactic, it can be argued that flows would be released from a reservoir to satisfy downstream rights regardless of an agreement between the FWS and Federal construction, operating or permit agency. However, it is advantageous to obtain a formal agreement because the downstream rights eventually might be reduced or terminated. An obvious disadvantage of this tactic, though, is that the flow released to satisfy downstream rights may not be the optimum flow for fish and wildlife purposes.

After 30 June 1978, an advantage of this strategy in Arizona will be the comprehensiveness and availability of water rights records through the State Land Department. Also, the use of this strategy is not limited to a particular agency or organization; it can be applied by a concerned party to every stream in Arizona at a reasonable cost. On the other hand, this strategy is ineffective if used by itself. A knowledge of the water right situation along a certain stream will not result in an instream flow reservation unless this knowledge is used in conjunction with another strategy.

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STATE-FEDERAL FLOW REQUESTS MADE EARLY

I. Identification

To offer timely flow recommendations, the Fish and Wildlife Service and Arizona Game and Fish Department must be involved in the planning process when Federal agencies, such as the Corps of Engineers, Bureau of Reclamation, and Soil Conservation Service, plan the construction of dams and reservoirs. Recommendations that are timely, i.e., made prior to project construction, have a greater chance of acceptance and implementation than those made during or after construction. The legal basis of this strategy is the Fish and Wildlife Coordination Act of 1958 and the planning procedures adopted by the Federal construction agencies.

II. Application

This strategy is applicable when any Federal construction agency is planning a reservoir, particularly in the earlier phases of planning before design and cost options are foreclosed. Also, when the Federal Energy Regulatory Commission is considering licensing or relicensing a dam and reservoir project, or when the Bureau of Land Management or Forest Service is in the process of issuing a permit to construct a dam on Federal lands, this strategy would apply. The role of these agencies, however, is treated separately (see strategy entitled Federal License and Permit Stipulations). The Bureau of Indian Affairs manages reservoirs, but reservoirs under its management are constructed by the BR.

As provided by the Fish and Wildlife Coordination Act of 1958, the FWS and the Arizona Game and Fish Department would pursue this strategy. Although it would not be available directly to private parties or public interest organizations, they could play an important role in exerting pressure on the construction agency to accept the fish and wildlife agencies' recommendations.

To apply the strategy, the fish and game agencies must conduct a timely investigation to formulate instream flow recommendations. Application of the strategy is contingent upon prompt notification by the construction agencies of the initiation of project planning. Each construction agency has promulgated procedures to provide for early notification and cooperation with the FWS and the Arizona Game and Fish Department.

A recent letter from the Commissioner of the BR to the Bureau's Regional Directors ordered them to notify the FWS of the initiation of project planning, and provide the FWS with the opportunity to participate in the formulation and evaluation of project plans and to present reports to the BR, including recommendations relating to fish and wildlife aspects of the project plan. The Corps issued procedures dated 15 August 1973 (to be updated in 1978) which require each District Engineer to provide the Federal and state fish and game agencies with advance information on the studies underway in his planning program; notify them of the initiation of the project investigation; continue liaison, including conferences, throughout the investigation; and obtain the recommendations of the fish and wildlife agencies. The SCS has the least stringent requirements for fish and wildlife agency input. Still, their procedures do encourage the Federal and state fish and game agencies to participate actively in project formulation and to incorporate needed measures in each project to the maximum extent feasible.

Once the Federal and state fish and game agencies have been notified of a project plan and brought into the planning process, they must initiate an investigation to develop timely recommendations. Although conducting investigations and formulating instream flow recommendations are usually time-consuming and expensive tasks, an insistence on timely performance could result in additional costs because of the lack of flexibility available to the field office administrator in allocating time of personnel. Also, earlier efforts can be wasted because preliminary construction plans are often changed or abandoned later on.

III. Illustration

This strategy has not been applied successfully in Arizona; therefore, an illustration from Colorado deomonstrates the potential utility of this strategy.

The Oso and Blanco Diversion Dams are two features of the Bureau of Reclamations's San Juan-Chama Project. The Oso Diversion Dam is located on the Navajo River; the Blanco Diversion Dam on the Rio Blanco. Throughout the planning process for the San Juan-Chama Project, the FWS and the then Colorado Department of Game and Fish (CDGF) exercised their influence.

In 1950, early in project planning, the BR requested the FWS and CDGF to furnish flow requirements to sustain stream fisheries. In response, the FWS made provisional estimates based on a brief field reconnaissance of the streams and search of stream flow records. During the summer and fall of 1954, the FWS conducted in-depth aquatic habitat studies relating to flows of 20 to 42 cfs in the Navajo River and 16 to 32 cfs in the Rio Blanco. Ten transect studies were made of each channel; productive and unproductive stream portions were examined with four different flows in each stream. These studies produced the following recommendations:

Period	Navajo River below Oso Diversion Dam	Rio Blanco below Blanco Diversion Dam
October	35 cfs	20 cfs
Nov - Feb	30 cfs	15 cfs
March	35 cfs	20 cfs
April	45 cfs	25 cfs
May - July	70 cfs	40 cfs
August	55 cfs	30 cfs
September	42 cfs	20 cfs

The Federal Act of June 13, 1962, which authorized the San Juan-Chama Project, required the following bypass flows at the diversion dams, or the natural inflow, whichever was less:

Month	Navajo River	Rio Blanco
October	37 cfs	20 cfs
November	37 cfs	20 cfs
December	37 cfs	15 cfs
January	30 cfs	15 cfs
February	34 cfs	15 cfs
March	37 cfs	20 cfs

Month	Navajo River	Rio Blanco
April	37 cfs	20 cfs
May	80 cfs	40 cfs
June	55 cfs	20 cfs
July	55 cfs	20 cfs
August	55 cfs	20 cfs
September	55 cfs	20 cfs

These flow requirements resemble the final FWS recommendations but are actually closer to a flow regime the Bureau of Reclamation had adopted in 1951 subsequent to receiving the FWS provisional recommendations.

Hydrologic monitoring data indicate that the flow regime incorporated into the authorizing legislation has been complied with, resulting in the maintenance of the affect trout fisheries. An intensive 3-year study conducted between 1972 and 1975 by the FWS, the Colorado Division of Wildlife and the Bureau of Reclamation concluded that rainbow trout are widely distributed in the specified downstream reaches, with smaller populations of brook and cutthroat trout below both diversion dams.

Although the adopted minimum flows were not identical to those recommended, this illustration does demonstrate the importance of timely recommendations by fish and wildlife interests during early project planning. Partially as a result of this early influence, a detailed flow regime was included in the authorizing legislation and valuable fisheries substantially preserved.

IV. Evaluation

As illustrated by the San Juan-Chama Project, this strategy has apparently displayed significant past utility. Instream flow recommendations made prior to project construction have resulted in greater acceptance than recommendations made during or after construction. An Enviro Control study of 109 flow recommendations in Arizona, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming revealed that 51% of the recommendations made prior to construction were accepted without modification as compared to only 24% of those made during or after construction.

The rate of acceptance for timely recommendations, although higher than for untimely ones, probably was depressed because many of the recommendations examined were offered prior to the issuance in the 1970's of agency procedures concerning inputs from fish and game agencies. Also, construction agency regional offices do not always totally conform with their own procedures.

The FWS and Arizona Game and Fish Department have rarely presented flow release recommendations to Federal construction agencies. All major water resource projects in Arizona with the exception of Painted Rocks, Alamo and Davis Dam were constructed prior to the passage of the Fish and Wildlife Coordination Act of 1946. Therefore, until the Act no legal vehicle was available for fish and wildlife agencies to submit instream flow recommendations. However, in June 1976 the FWS submitted in its advance planning report on the Central Arizona Project a flow release recommendation of 50 cfs from the proposed Buttes Dam and Reservoir. This recommendation, apparently, was rejected by the BIA under whose auspices the project is to be operated by the San Carlos Irrigation District. The environmental statement for Buttes is scheduled for 1983, allowing time for further negotiations between the FWS, BIA, and BR.

In judging the future effectiveness of the strategy, a number of factors must be considered. The strategy is applicable only when a Federal construction agency is building or modifying a project. Such construction will probably decrease in the future when compared to the spate of construction in the 20 years after World War II. Users of this strategy are limited to the FWS and Arizona Game and Fish Department although private individuals or public interest groups can exert some influence with the construction agencies on behalf of the recommendations by the conservation agencies.

The effectiveness of this strategy depends, in large part, on the construction agencies' close adherence to their own adopted procedures concerning early notification of fish and wildlife agencies on project planning matters. According to FWS personnel, construction agencies have been following these procedures in Arizona, especially in recent years. Even if the Federal and state fish and game agencies are informed of a project being planned and their inputs are invited, however, they must decide which projects to investigate in depth where a considerable expenditure of limited personnel and funds would be warranted. In addition, to make timely investigations and recommendations, the state and Federal fish and game agencies would be deprived of some flexibility in budgeting and scheduling. Finally, although a timely flow recommendation enjoys a better chance of acceptance, there is no assurance that such a recommendation will not be rejected on some other basis such as the reasonableness of the flow amounts requested.

Despite these constraints, this strategy does have some definite advantages. Offering flow recommendations is already part of an institutionalized process which has been ongoing for 30 years between the fish and wildlife agencies and the Federal construction agencies. This process has a firm legal basis and should be improved in the future.

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STATE-FEDERAL FLOW REQUESTS MADE SPECIFIC

I. Identification

Specifying instream flow requirements for a particular stream reach or tributary below a dam and reservoir, and monitoring actual instream flows there to ensure that downstream resource values are protected, involves detailed on-site investigations by the fish and game agency and subsequent stream gaging. Studies such as transect surveys must be performed at downstream locations selected so as to determine the instream flow needs in specific stream reaches below the dam site. Recommendations would then be offered to the construction agency specifying needed flow releases which, if accepted, would be incorporated into the reservoir's operating criteria. Gaging stations, located within the specific downstream reaches, would determine the sufficiency of the actual releases. The legal or administrative basis of this strategy is the interagency consultative process as provided for by the Fish and Wildlife Coordination Act.

II. Application

This strategy would be applied when the fishery, rookery or other biotic resource within a reach or tributary remotely downstream from a dam and reservoir project is predicted to be, or is already, adversely affected by project flows. Often, a downstream fishery is threatened by low flows even though a required minimum flow is discharged upstream at the dam. Stream diversions and seepage from the stream channel often are responsible for the diminution of the original flow. Also, fishery flows required directly below the dam may be insufficient within a more remote reach or tributary downstream to satisfy localized fish and wildlife habitat requirements. In both cases, the specification of an instream flow requirement at a particular downstream site in addition to, or in place of a project flow release, and the installation of a streamflow gage will facilitate suitable flows in the remote stream reach or tributary. Furthermore, exact requirements supported by careful field investigations will be more persuasive in seeking any flow reservation.

Advocates of this strategy would be the Arizona Game and Fish Department and the FWS. Public interest groups aware of localized fish and wildlife needs and stream condtions could also participate in applying this strategy. Implementation of the strategy requires that instream flow recommendations be provided to the construction or permit agency during the appropriate planning stage (see strategy entitled State-Federal Flow Requests Made Early). For existing projects, reauthorization or relicensing proceedings or administrative reassignment of reservoir storage could be instituted to reserve needed flows and provide gaging stations (see strategies entitled State-Federal Combined Storage and Flow Requests, Federal License and Permit Stipulations, and Federal Reauthorization of Projects).

The principal costs of applying this strategy would result from detailed instream flow field studies performed by the involved fish and wildlife agencies at downstream sites. Installation and maintenance of streamflow gages in the designated stream reaches will account for additional costs.

III. Illustration

This strategy has not been implemented in Arizona; therefore, an example from Colorado will serve to illustrate its potential. The Fryingpan-Arkansas Project is a multi-purpose Bureau of Reclamation project involving several structures and impacting a number of streams. The operating principles of the Fryingpan-Arkansas Project, finalized in December 1960, agreed to the protection of recreational and environmental values. The principles were incorporated in the 1962 project authorization. Section 7 of the authorizing document provided for bypass flows below diversion dams and Ruedi Reservoir on the West Slope to protect more than 40 miles of important trout streams along the Fryingpan River and its tributaries and about 30 miles for Roaring Fork River and Hunter Creek. Prescribed bypass flows provided for included the following:

Fryingpan River below Ruedi Dam	Fryingpan River upstream from Ruedi Reservoir above the Confluence with the North Fork
39 cfs, Nov - April	30 cfs, Oct - March
110 cfs, remainder of year	100 cfs, April - July
	150 cfs, May
	200 cfs, May
	75 cfs, August
	65 cfs, September
Chapman Creek	Cunningham Creek
15 cfs, Oct - March	15 cfs, Oct - March
30 cfs, remainder of year	30 cfs, remainder of year

In order to monitor these flows, the BR agreed to install recording gages where needed. As of 1977, new gages have been installed in Chapman and Cunningham Creeks.

The impetus to include these flow regimes in the authorizing document came from recommendations of the FWS which performed detailed field investigations during the late 1950's and early 1960's. The principal decisions in this example are the FWS decisions to conduct a detailed study, recommend a detailed flow regime and request the installation of gages; and the BR's decisions to accept the FWS recommendations, include them as operating principles in the authorizing document, and to install gages. The primary costs incurred thorugh 1977 have been for the flow studies and gage installation.

IV. Evaluation

A major constraint on past use of this strategy has been the usual inadequacy of instream flow field studies. Historically, flow recommendations were

made for the entire reach below the project to a downstream confluence with an identifiable tributary or a main stem river without investigating the requirements of intermediate stream segments. Little attention was paid to the effects of irrigation diversions or return flows. Likewise, consideration of tributary inflows and groundwater recharge was overlooked in the evaluation of flow needs. These variables are receiving greater attention in contemporary flow studies, although the costs associated with such detailed investigations are significantly greater. They are justifiable where high-value fish and wildlife resources are at stake.

An added constraint in the future will be the costs of the installation and maintenance of streamflow gages which are necessary to fully implement this strategy. Conversations with the United States Geological Survey indicate that an assumption of gaging costs by a construction agency is determined on a case-by-case basis. In some instances, the construction agency and the fish and game agency will share these costs; otherwise, either one or the other will assume the total cost. The cost of installing a gage can range from $15,000 to $40,000; approximate annual operation and maintenance costs can be $4,000. Also, according to the FWS, the USGS may be cutting back on its gaging program.

Future effectiveness of this strategy will be enhanced by improved flow study methodologies. The ability to document seasonal instream flow needs for a specific stream reach lends authenticity and credibility to the fish and wildlife agency's bargaining position, thus increasing the likelihood of a flow reservation. On occasion, the ability to quantify the instream contributions of tributary inflows and irrigation return flows could result in a downward adjustment of project releases, thereby preserving water for other beneficial uses. Although, this strategy has not been applied in Arizona, the FWS and the Game and Fish Department consider this strategy to be promising.

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STATE-FEDERAL COMBINED STORAGE AND FLOW REQUESTS

I. Identification

When recommending flow releases from proposed or existing reservoir projects, the Fish and Wildlife Service and Arizona Game and Fish Department should base their recommendations in part on information about storage capacity and projected sales of stored water. The strategy thus embraces simultaneous negotiations for downstream flows and surplus storage capacity in the reservoir sufficient to guarantee the flows. The legal basis of this strategy is the Fish and Wildlife Coordination Act which provides for consultation between state and Federal fish and game interests and the Federal construction agencies.

II. Application

This strategy is applicable in two situations: when a project is being planned by a Federal construction agency; and when storage space becomes available in either a planned or existing reservoir. The parties to be involved in this strategy are primarily the FWS and the Arizona Game and Fish Department. They would apply this strategy in their dealings with Federal construction and operating agencies over planned and existing reservoir projects. Support for this strategy can be generated from local residents, conservancy districts, sportsmen, and environmental organizations.

Most operating reservoirs in the west contain either unobligated, unutilized or underutilized storage. "Unobligated storage" is reservoir storage which is not contractually obligated to water users although it is bound by legislative intent for particular purposes. "Unutilized storage" is contractually obligated for future or deferred use, whereas "underutilized storage" is currently not in use for a particular purpose although contractually obligated for that purpose. Knowledge of unutilized, unobligated and underutilized storage can lead to its interim or permanent allocation for minimum flow releases to satisfy instream flow needs of fish and wildlife. Even without producing an outright allocation, such knowledge can certainly strengthen the bargaining position of fish and wildlife interests seeking instream flow reservations.

Early in the project planning phase, the construction agencies should be requested to provide the FWS and State fish and game agencies with information regarding reservoir storage capacity and the projected sale or other commitment of storage. With this data, the fish and game agencies should be able to determine and negotiate for the amount of storage available to ensure minimum instream flows below the reservoir.

During project operation, some storage may become available -- i.e., unobligated, unutilized or underutilized. The FWS and the state fish and game agencies should have cultivated a cooperative arrangement with the Federal construction agencies, requiring notification when reservoir storage space becomes available. With this information, fish and game agencies may decide to recommend the allocation of reservoir storage to reinforce instream flow recommendations if the downstream fishery warrants this extra measure of protection.

The costs involved in implementing this strategy could vary dramatically, depending on the level of cooperation between the fish and game agencies and

the Federal construction and operating agencies. If cooperative agreements under the Fish and Wildlife Coordination Act are successfully implemented (see strategy entitled State-Federal Interagency Consultation), then this strategy would not involve substantial costs. If, however, the FWS and the state fish and game agencies are not routinely furnished with information on planned reservoir capacities and anticipated sale of water storage, or information on available storage in existing reservoirs, then significant costs can be incurred in gathering this information.

III. Illustration

Although this strategy has not been implemented in Arizona, an illustration from Colorado will serve to demonstrate its utility. The Bureau of Reclamation's Dolores Project (McPhee Dam) was authorized in 1968 as part of the Colorado River Storage Project. McPhee Reservoir, which will have a total capacity of about 381,000 acre-feet, will be operated primarily for irrigation, flood control, municipal and industrial water supply, and recreation. In addition, 800 acre-feet have been allocated to fish and wildlife enhancement. At present, the Dolores River is dewatered at many locations due to channelization and mining and agricultural activities. Therefore, the once excellent trout fishery in the Dolores River has been decimated.

When the project was authorized, the BR planned to release only 4 cfs from McPhee Reservoir for fishery purposes. The FWS and Colorado Division of Wildlife did not recommend additional flow releases because to significantly improve the marginal downstream fishery would require substantial releases which the BR probably would not agree to. In the early 1970's the BR decided to redesign the project, switching from a gravity surface-irrigation system to a sprinkler system. This change was made for two reasons: the sprinkler system is more water efficient, and the sprinkler system would reduce the salinity of return flows.

This change in project design released 800 acre-feet of reservoir storage for other purposes. This storage could have been used to irrigate more acreage; however, the Conservancy District sponsoring the project realized the benefits of releasing the unobligated storage to re-establish the trout fishery in the river. The BR then asked the FWS and Colorado Division of Wildlife to study the river to determine the flows needed to re-establish the fishery. Using the sag-tape method, FWS and Colorado Division of Wildlife personnel concluded that 78 cfs was an optimum flow, 50 cfs an adequate flow and 20 cfs a survival flow for trout below the proposed dam. Based on these studies the FWS and Colorado Division of Wildlife recommended that the BR release 50 cfs from McPhee Dam. The BR agreed to release 50 cfs during wet years, and 20 cfs during dry years. The terms dry, wet, and normal were not defined.

It is, of course, premature to judge the effectiveness of the prescribed releases since the project has not yet been built. Given the cooperation of the construction agency, the costs of implementing this strategy are not too great. The major cost involves the personnel time to conduct the streamflow study.

IV. Evaluation

This strategy has not been applied in Arizona. However, the Colorado example specifically illustrates how reservoir storage capacity which becomes

unobligated can be made available to provide releases for the downstream fishery with the cooperation of the construction agency, the local sponsor, and fish and wildlife interests.

According to the FWS and the Game and Fish Department, this strategy has not been applied in Arizona because of intense competition for water, precluding the availability of unobligated, unutilized, or underutilized water. However, if the opportunity arises the FWS and the Game and Fish Department might utilize this strategy.

To a great extent, the future effectiveness of this strategy for new projects depends on successfully implementing other strategies, such as achieving interagency coordination under the Fish and Wildlife Coordination Act (see strategy entitled State-Federal Interagency Consultation) and recommending instream flows early in the planning process (see strategy entitled State-Federal Flow Requests Made Early). It is essential that fish and game agencies actively participate in planning reservoir projects and are kept informed periodically about the availability of storage in already authorized and operating reservoirs.

The strategy's greatest potential exists when the local sponsoring entity and/or the construction agency sees the benefits involved in releasing available storage for fishery purposes and brings fishery agencies into the process of planning reservoir releases. In such instances, the costs of implementing this strategy are not particularly great; however, without cooperation among the agencies involved, the costs could be substantial. For example, major cost might be incurred by the fish and wildlife agencies in gathering information which could have been provided by the construction and operating agencies. On the other hand, fish and wildlife interests must justify the economics of allocating any available storage for fish and wildlife pruposes.

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ENGINEERING ALTERNATIVES

COORDINATED MULTI-RESERVOIR OPERATIONS

I. Identification

The operations of a multi-reservoir system are regulated through an operations manual which specifies the flows to be released in keeping with the stated purposes of each project. The most common purposes for which multi-reservoir systems are operated are flood control, power production, and irrigation.

Coordinated operations of a multi-reservoir system to sustain or elevate minimum flows would require modification of the operations manual. To accomplish this, authorizing or licensing documents for component projects within the the system must be modified to include the necessary releases. Modification of Federal projects may require reauthorization or relicensing proceedings (see strategies entitled Federal Reauthorization of Projects and Federal License and Permit Stipulations). At the minimum, an adjustment of flow releases would entail the preparation of a memorandum of agreement between the operators of the system and the fish and wildlife interests. The legal and administrative basis for this strategy is the agency and interagency regulations and procedures governing those agencies operating reservoir systems. The Fish and Wildlife Coordination Act is the interagency mechanism.

II. Application

This strategy would be applied where a fishery or other aquatic resource below a dam within a multi-reservoir system could be rehabilitated or enhanced by coordinated releases from the system. Parties involved in the implementation of this strategy are likely to be the FWS, the Arizona Game and Fish Department, and the agency or agencies operating the system. In many instances, the system operator will be a single entity, such as the Bureau of Reclamation operating an irrigation project. Where two or more entities such as the Bureau and the Corps would be responsible for project operations, regulation of the system is often mediated using a memorandum of agreement among the agencies involved. Attempts to secure minimum instream flows by balancing system operations would call for drafting a revised memorandum of agreement.

Upon determining stream flows to be insufficient to sustain the fishery below a dam within the reservoir system, the interested fish and wildlife agency must examine the operating characteristics of the system, especially its flow regimes and its storage capacities (see strategy entitled State-Federal Combined Storage and Flow Requests). Field studies would be performed to establish the flow needs for the affected stream reach. Given the system characteristics and the instream flow needs, the fish and wildlife interests could propose to alter the operations manual and memorandum of agreement to ensure the recommended flows.

Conducting system-wide flow studies will incur the principal costs during the implementation of the strategy. Additional costs will result from presenting a convincing case to the operating agency toward revising the system operations manual and in reauthorization or relicensing proceedings if these become necessary.

III. Illustration

In Arizona this strategy is most applicable to the reservoir and dam system on the lower Colorado River operated by the BR. This system is composed of Glen Canyon Dam, Hoover Dam, Davis Dam, Parker Dam, Imperial Dam, Laguna Dam and Morelos Dam. Maintenance of minimum instream flows is generally not a problem within this sytem; however, water quality and drastic flow fluctuations are a concern. BR development and operations plans for the system are reviewed by the "Lower Colorado Work Group" which meets approximately every other month. The Lower Colorado Work Group is an interagency committee representing the BR, CE, BIA, BLM, FWS, irrigation districts, state fish and game agencies from California, Arizona, and Nevada, and others having interest in Colorado River water. Issues which cannot be resolved by the Work Group are presented to the Lower Colorado Management Program Coordinating Committee, which is comprised of Federal agency regional directors and directors of state water departments. However, the BR is not compelled to adopt the recommendations of these committees.

Fish and wildlife are not authorized purposes of the reservoir system; hence, BR is not obligated to operate the reservoir system for such purposes. Dam and reservoir operations priorities are flood control, irrigation, and hydroelectric power, respectively. BR has an informal agreement with the FWS and State fish and game agencies to maintain a minimum flow of 1,000 cfs between Glen Canyon Dam and Lake Meade (Hoover Dam) where an excellent trout fishery is maintained, and a minimum flow of 2,000 cfs throughout the remainder of the system to sustain a coldwater fishery in the free flowing river segments between Hoover, Davis and Parker Dams and a warmwater fishery to the Mexican border. These flow releases were agreed upon by the BR and the FWS during the 1960's, apparently on the basis of field observation. BR emphasizes that it is not obligated to this agreement. On rare occasions in the past, flow releases have apparently fallen below 2,000 cfs resulting in fish kills.

State-federal fish and game agency negotiations with the BR for fish and wildlife mitigation and enhancement activities are restricted by Congressional authorization, a March 1974 U.S. Supreme Court case Arizona vs. California, and a recent decision by a Department of Interior Solicitor. The decision states that reservoir levels at Hoover Dam are to be managed for maximization of hydropower after other authorized project purposes are met. This greatly reduces the flexibility of dam and reservoir operations.

The solicitor's decision was in response to FWS, Nevada Department of Fish and Game, and Arizona Game and Fish Department negotiations with the BR for managing Lake Meade Reservoir levels in a manner consistent with black bass spawning needs. BR is contracting with the Arizona Game and Fish Department and the Nevada Department of Fish and Game to study alternatives to managing reservoir levels on Lake Meade for supporting a black bass fishery. The study is being funded at a cost of $500,000 for five years (1977-81). The BR contracted with these agencies, because of the effect of reduced inflows into Lake Meade after the completion of Glen Canyon Dam. After the construction of Glen Canyon Dam, during the irrigation season reservoir releases from Hoover Dam exceeded the inflow into Lake Meade. This drops the reservoir levels and destroys the black bass spawning habitat.

IV. Evaluation

In Arizona this strategy is being utilized primarily to improve water quality, manage water levels on Lake Meade, and minimize flow release fluctuations.

A major constraint upon the applicability of this strategy for the system of dams and reservoirs on the Colorado River is that fish and wildlife are not authorized project purposes. The flexibility of reservoir operations are further reduced by court decrees, and a U.S. Department of Interior Solicitor's decision requiring maximization of hydroelectric power at Hoover Dam. For these reasons, the FWS and State fish and game agencies have not always been able to convince the BR to modify operations dam and reservoir for the fish and wildlife purposes.

In addition there are a number of cost constraints which will continue to limit the use of this strategy. The fish and game agencies will incur increasing costs for flow studies which increase in complexity and sophistication as entire multi-reservoir systems are analyzed in greater depth. Hydrologic data requirements and required engineering expertise will demand that fish and wildlife interests acquire the analytical skills of the construction agencies in addition to their established biological expertise. These constraints, though do not actually preclude the use of the strategy.

If in the future fish and wildlife become an authorized purpose, the effectiveness of this strategy can be expected to increase. Future utilization of this strategy, however, probably will increase proportionally as the interest in in fish and wildlife habitats increases vis-a-vis project purposes such as flood control, irrigation, and power production. Although legal constraints greatly reduce flexibility in the system operations, both the FWS and BR believe modifications of system operations are possible.

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RESERVOIR SEDIMENT STORAGE RELEASES

I. Identification

Releases of yield from sediment reserve storage for augmenting instream flows involve storage space reassignment by the construction or administering agency. Sediment reserve storage space is the portion of reservoir capacity assigned to sedimentation during the economic life of the project. After a project is constructed, the total amount of storage capacity assigned to sediment reserve will not be needed for many years. This storage, then, can be made available on a long-term interim basis for fish and wildlife protection and other beneficial uses. Such a reassignment is an administrative decision and does not necessitate Congressional reauthorization of the project. The legal and administrative basis of this strategy is the construction or operating agency's statutory authority and administrative regulations authorizing discretionary modifications of operating projects.

II. Application

This strategy will be discussed only as it applies to existing reservoirs. Applying it to proposed projects involves interagency coordination in the planning process (see strategies entitled State-Federal Flow Requests Made Early, State-Federal Combined Storage and Flow Requests, and State-Federal Interagency Consultations). The strategy may be formulated when a proposed or existing reservoir contains unused sediment reserve storage in the active reservoir space lying above the elevation of the lowest dam outlet. Such storage is normally preserved or else drawn down for beneficial uses such as recreation, irrigation or water supply in compliance with operating restrictions. Either the Arizona Game and Fish Department, Fish and Wildlife Service, or a conservation group could instigate this strategy if it determines that an available yield from the sediment reserve can rehabilitate or improve the fish and wildlife resources downstream from the existing reservoir. Ultimately, the concerned party must convince the construction or administering agency, such as the Bureau of Reclamation or the Corps of Engineers, to reassign a portion of the unused sediment reserve storage space to fish and wildlife purposes.

Implementation of this strategy involves two basic decision points. After reaching a favorable preliminary determination, the concerned party must decide to solicit the construction or administering agency for action to modify project operation and release some yield from the sediment reserve. Then the agency must decide if the desired modification is feasible and agreeable. Because of the controversy that is often associated with preserving instream flows, the construction or administering agency might seek formal Congressional approval.

The costs of this strategy to fish and wildlife interests are dependent on the detail and availability of information concerning the sediment reserve storage and the fish and wildlife resources downstream from the reservoir. The concerned party will need to know the amount, depletion rate, and current interim uses of the sediment reserve. In addition, the probable effects that increased instream flows, due to a certain yield of the reserve, would have on the fish and wildlife resources would have to be ascertained.

III. Illustration

Although no actual illustration in Arizona could be identified, an example of a reservoir in Colorado presently suitable to this strategy can be discussed. Completed in 1963, the Bureau of Reclamation's Paonia Project is located on Muddy Creek in west-central Colorado. The stream below Paonia dam supports trout habitat which would improve significantly if added reservoir releases of relatively clear water could be made.

Because of a projected severe sedimentation problem, a substantial portion (44%) of the active storage capacity of Paonia Reservoir was reserved for sediment accumulation. By the end of 50 and 100 years of reservoir operation, the deposition of sediment is estimated to reduce the active reservoir capacity from 18,150 acre-feet to 14,650 and 10,150 acre-feet, respectively. The Upper Colorado Regional Office of the Bureau has stated verbally that the 8,000 acre-feet of sediment reserve storage might be available for interim use.

In fact, the Bureau, in a project planning report, stated that surplus sediment reserve storage space in Paonia Reservoir would be available for flood control and incidental releases to maintain fish life in the stream below the dam. However, it was also stated that the North Fork Conservancy District could use the 8,000 acre-feet of reserved capacity for irrigation or other beneficial uses until it is required by the United States for one or more of the specified purposes. The BR's Upper Colorado Office confirmed that the conservancy district is utilizing this storage.

Neither the FWS nor Colorado Division of Wildlife has attempted to secure increased releases from Paonia Reservoir. However, the proposed Grand Mesa Project, which would require the construction of Electric Mountain Reservoir immediately upstream from Paonia Reservoir, will probably enable both organizations to review the Paonia storage situation. Furthermore, Electric Mountain Reservoir should diminish the sediment deposited in Paonia Reservoir, thus freeing some storage capacity for long-term obligation.

IV. Evaluation

Although this strategy apparently has not been implemented in the past, it does appear to have broad application because most reservoirs, especially the newer ones, contain substantial sediment reserve storage capacity in the active storage space. The strategy's future effectiveness is primarily limited by the ability of Federal, State or private fishery interests to:

- Determine that the available interim yield from sediment reserve storage can significantly improve the associated fish and wildlife resources;

- Convince the construction or administering agency to reassign and release the surplus water storage for fish and wildlife benefits.

The Corps and Bureau frequently apply the surplus sediment reserve on an ad hoc basis to purposes such as irrigation and municipal-industrial water supply. The user for these purposes is not charged for this water. Thus, it is likely that users of this supplemental water would lobby against its reassignment to fish and wildlife protection.

Probably the yield from sediment reserve storage space would be reassigned to fish and wildlife purposes only where it is currently unutilized and would significantly improve the downstream resources.

Attempting to ensure releases of sediment reserves requires an examination of existing project records and operations. Because FWS and State fish and game agencies' field offices direct their efforts towards proposed projects, implementing this strategy would involve an expenditure of personnel time normally not provided for from funds transferred by construction agencies. The FWS and the Game and Fish Department consider this strategy to be of limited utility in Arizona because of the intense demand for water. They believe that releases from sediment reserve for instream flows are unlikely. There are major constraints upon the future effectiveness of this strategy. However, the best opportunity to implement the strategy probably would arise when an existing project is modified or a planned project, such as the Grand Mesa Project, would have an impact upon existing reservoir operations.

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STREAM CHANNELS TO CONVEY STORED WATER

I. Identification

In operating dam and reservoir projects to convey stored water to downstream users, water is either released into the stream and diverted at a point downstream or conveyed directly from the reservoir via a canal or conduit. This strategy is an attempt to have proposed reservoir projects designed without direct conveyance systems at the reservoir so that water can be released into the stream to benefit fish and wildlife, then diverted as far downstream as may be feasible. This strategy can be effectuated through the consultative process stipulated by the Fish and Wildlife Coordination Act (FWCA).

II. Application

As provided by the Fish and Wildlife Coordination Act, the Fish and Wildlife Service and the Arizona Game and Fish Department conduct investigations of sites proposed for reservoir projects, then formulate and present recommendations to the construction agencies concerning fish and wildlife preservation or enhancement. If, as part of their investigations, the FWS and State agencies determine that a reservoir conveyance system may damage the downstream fishery or other biotic resources, they might recommend that such a system be modified. They could draw support from local interest groups and users of the resource to give greater force to such a recommendation.

In conducting their project investigations, the FWS and Game and Fish Department are provided with information by the sponsoring agencies. Any information regarding proposed conveyance systems should be sought at the outset because a recommendation to modify or not build a conveyance system must be made early in the planning process. Because detailed engineering and planning are involved, construction agencies and permit applicants would resist a change of plans after spending time and money to develop them. Once the construction begins, a sponsoring agency almost assuredly would not stop construction solely on the recommendation of fish and wildlife interests.

III. Illustration

The proposed Buttes Dam and Reservoir on the Gila River serves as an illustration of this strategy's potential. Initially proposed in the early 1950's, Buttes Dam and Reservoir will provide irrigation water to the San Carlos Irrigation Project. Buttes Dam and Reservoir will be constructed by the BR and operated by the San Carlos Irrigation District under the auspices of the BIA. Presently four river miles below the proposed dam site the,Gila River flows are diverted to the Irrigation Project by Ashurst-Hayden Dam, a low earthen diversion dam. Several alternatives have been proposed to convey future Butte Reservoir water to the Irrigation Project:

- convey water from Buttes to the Irrigation District via a pipeline;
- release water from Buttes into the Gila River in order to convey it to the proposed Salt-Gila Aqueduct, a Central Arizona Project (CAP) approximately 8.5 linear miles downstream of Buttes, which will closely bypass the Irrigation District;

- convey water from Buttes via a lined canal to the proposed Salt-Gila Aqueduct and then delivered to the Irrigation District
- release water from the Buttes down to Ashurst-Hayden for diversion to the Irrigation Project.

In June 1976 the FWS submitted a fish and wildlife mitigation report on the Central Arizona Project as requested by the BR. The FWS recommended that the natural stream channel be used and that a flow release of 50 cfs be provided from Buttes downstream to the Ashurst-Hayden Dam. This flow release is expected to establish a fair warm water fishery below the dam. This recommendation was formulated on the basis of an analysis of USGS flow records. This analysis did not incur any significant costs.

Four miles of riparian vegetation between Buttes and Ashurst-Hayden Dams would be degraded or destroyed if all but the very infrequent spills are diverted from the natural river channel at Buttes Dam. The release of San Carlos Project waters into the channel, even though there will be some months of no release, may be adequate to maintain the downstream vegetation. Buttes dam will virtually cut off flood flows beyond Ashurst-Hayden Dam throughout most of the project life. This could reduce the vigor of vegetation downstream of Ashurst-Hayden Dam. However, agricultural irrigation along the river bank may keep the water table at a level sufficient to maintain this growth.

Presently, construction of Buttes Dam is uncertain. The environmental statement for the project is scheduled for completion in June 1982. A 1976 BIA memorandum to the FWS indicated that the project plan probably will not incorporate the 50-cfs flow. A water conveyance alternative have not been selected, so further negotiations may possibly achieve a compromise acceptable to all parties.

IV. Evaluation

As illustrated by the Buttes Project, this strategy is being considered for use in Arizona and it does offer potential for protection of aquatic and riparian habitat directly downstream from reservoirs. Presently, construction of Buttes Dam is uncertain. The Buttes Environmental Statement is scheduled for completion in June 1982. A 1976 BIA memorandum to the FWS indicated that the project plan will not incorporate the 50-cfs flow. However, the persuasiveness of the FWS recommendations is enhanced because of the importance of preserving riparian habitat in the southwest. If the Irrigation District utilizes the BR's Salt-Gila Aqueduct, conceivably the BR might convince the BIA to accept or modify the FWS recommendations in recognition of the critical importance of the riparian habitat to wildlife.

In judging the future effectiveness of this strategy, several severe constraints must be weighed. Reservoir conveyance systems usually occur as a function of project purpose or engineering necessity. Single-purpose power and municipal supply projects most frequently divert water directly from the reservoir. Most offstream appropriators seek gravity flow delivery by conduit or canal to minimize pumping costs; sound engineering judgment and ordinary cost saving considerations may demand direct conveyance from the reservoir. Since conveyance structures are costly, construction agencies and permit applicants normally would maximize the use of the stream channel, subject to trade-off

cost factors such as high energy use to deliver water by pumping instead of gravity. As evidenced in the Buttes Dam and Reservoir case, the burden will be on the FWS and the Game and Fish Department to justify their recommendation from a cost and engineering standpoint, taking the value of the threatened resource into account in a cost/benefit analysis.

Investigating a proposed project and formulating recommendations, pursuant to the FWCA, usually requires substantial time and money. To implement this particular strategy may incur significant additional costs in performing detailed studies to defend a recommendation to modify the reservoir conveyance system.

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