U.S. Fish and Wildlife Service

Long-Range Plan

San Juan River Basin
Recovery Implementation Program

May 2011

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INTRODUCTION

Background

The San Juan River Basin Recovery Implementation Program (Program) was initiated in October 1992 to protect and recover populations of two federally-listed endangered fish species in the San Juan River Basin (Basin) while water development proceeds in compliance with all applicable federal, state, and tribal laws. The two listed fish species are the Colorado pikeminnow (*Ptychocheilus lucius*; formerly known as Colorado squawfish) and razorback sucker (*Xyrauchen texanus*). Activities and actions within the Program serve as the "reasonable and prudent alternative" for projects in the San Juan River Basin and help to ensure that those projects will not jeopardize the continued existence of the endangered species. It is anticipated that actions taken under the Program will benefit other native fishes in the Basin and prevent them from becoming endangered.

The goals of the Program are:

1. To conserve populations of Colorado pikeminnow and razorback sucker in the Basin consistent with the recovery goals established under the Endangered Species Act of 1973, as amended, 16 U.S.C. §§ 1531 *et seq.* (ESA).
2. To proceed with water development in the Basin in compliance with federal and state laws, interstate compacts, U.S. Supreme Court decisions, and federal trust responsibilities to the Southern Ute Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation, and Navajo Nation.

The Program was initiated with the signing of a Cooperative Agreement in 1992 after the rediscovery and documentation of successful spawning by Colorado pikeminnow and the continued presence of razorback sucker in the San Juan River. Adult and young-of-year Colorado pikeminnow and adult razorback sucker were collected during 1987-1989 by biologists gathering detailed fish community data for use in potential razorback sucker reintroduction efforts (Platania et al. 1991). This discovery resulted in the reinitiation of Section 7 consultation through the Bureau of Reclamation (Reclamation) for the Animas–La Plata Project; and subsequently, the Navajo Indian Irrigation Project underwent Section 7 consultation through the Bureau of Indian Affairs.

A 7-year research program, conducted during 1991-1997, provided a baseline of information that identified and characterized factors limiting the two endangered species. The research program was incorporated into the Recovery Program when it was formed in 1992. Culmination of the research program in 1997 marked the end of the research phase and the beginning of the implementation and management phase for the Program. In 1991, a Program Document (Document) was developed to provide the framework for Program implementation. The original Document was adopted in 1992 by the Cooperative Agreement (SJRIP 2006, 1992) and updated in 2006 by the Coordination Committee (SJRIP 2006). A new version of the Document was completed in 2010. The Document outlines the Program's purposes, authorities, structure, and operating procedures including funding and budgeting. The Document details the purposes of the Program's committees and defines their composition, authorities, and duties. The Document also includes a description of the process for conducting Section 7 consultations and for reviewing sufficient progress. The Section 7 procedures specifically reference implementation of a Long Range Plan as the principal means for determination of ESA compliance for water projects in the Basin. The Program operates through committee processes that identify the actions needed to attain the Program goals. The committees include representatives of the signatories to a cooperative agreement (SJRIP 2006, 1992), including state and federal agencies and Native American Tribes. Water development and conservation interests are also Program participants.

Purpose

The purpose of this Long-Range Plan (LRP) is to identify specific actions to be implemented in the Basin that will contribute to recovery of the Colorado pikeminnow and razorback sucker in accordance with species recovery goals (U.S. Fish and Wildlife Service [Service] 2002a, 2002b). Recovery of both protected species will be accomplished within the context of conservation and management of the entire native fish assemblage and in a manner that does not compromise, impair, or diminish persistence of unprotected native fishes. The LRP uses research information from past San Juan River studies, as well as that from other regions and Program evaluation reports to identify multi-year research, monitoring, and recovery actions necessary to achieve the Program goals.

The need for a long-range plan was identified in the original Program Document (SJRIP 1992). The first LRP was developed in 1995 by the Biology Committee and was intended primarily to guide the Program through the completion of a 7-year research program to identify and characterize factors limiting the two endangered species. The research program was completed in 1997 and it became necessary to revise and update the LRP to provide guidance on the implementation and management phase of the Program. This revised LRP is a culmination of drafts that updated the 1995 plan and identifies new recovery actions based on evaluation and review of the Program's progress (Holden 2000; Miller 2006; SJRIP 2006; USFWS 2010) and on species recovery goals. The LRP is reviewed annually and updated as needed. The relationship of the LRP to the various Program components is shown in Figure 1.

This LRP identifies actions and tasks to be accomplished and the time frame for carrying out these tasks and activities consistent with species recovery and appropriate for evaluating Program progress. This LRP identifies and describes the progression and priority of implementing identified recovery actions that are expected to result in recovery and delisting of the Colorado pikeminnow and razorback sucker. Because actions identified in this LRP are linked to recovery goals and plans adopted by the Service (USFWS 2002a, 2002b), accomplishing the actions and tasks described in this LRP constitutes the milestones toward achieving recovery of the endangered fish species. As long as these actions and tasks are satisfactorily met and demonstrably contribute to recovery of the listed fishes, it is the mutual expectation of the participants that the Program serves as the foundation for a reasonable and prudent alternative for Section 7 consultations, but shall not preclude the development of reasonable and prudent alternatives independent of the Program.

In order to define and describe specific program activities and projects for upcoming years, the Program develops an Annual Work Plan (AWP). The AWP identifies and describes activities to be conducted by the Program in a given year for conservation of the endangered species. The LRP guides the Program in the development of AWP's and helps link Program activities for continuity and consistency. Approval of AWP's and budgets by the Coordination Committee is based, in part, on consistency and compliance with the LRP and available funds.

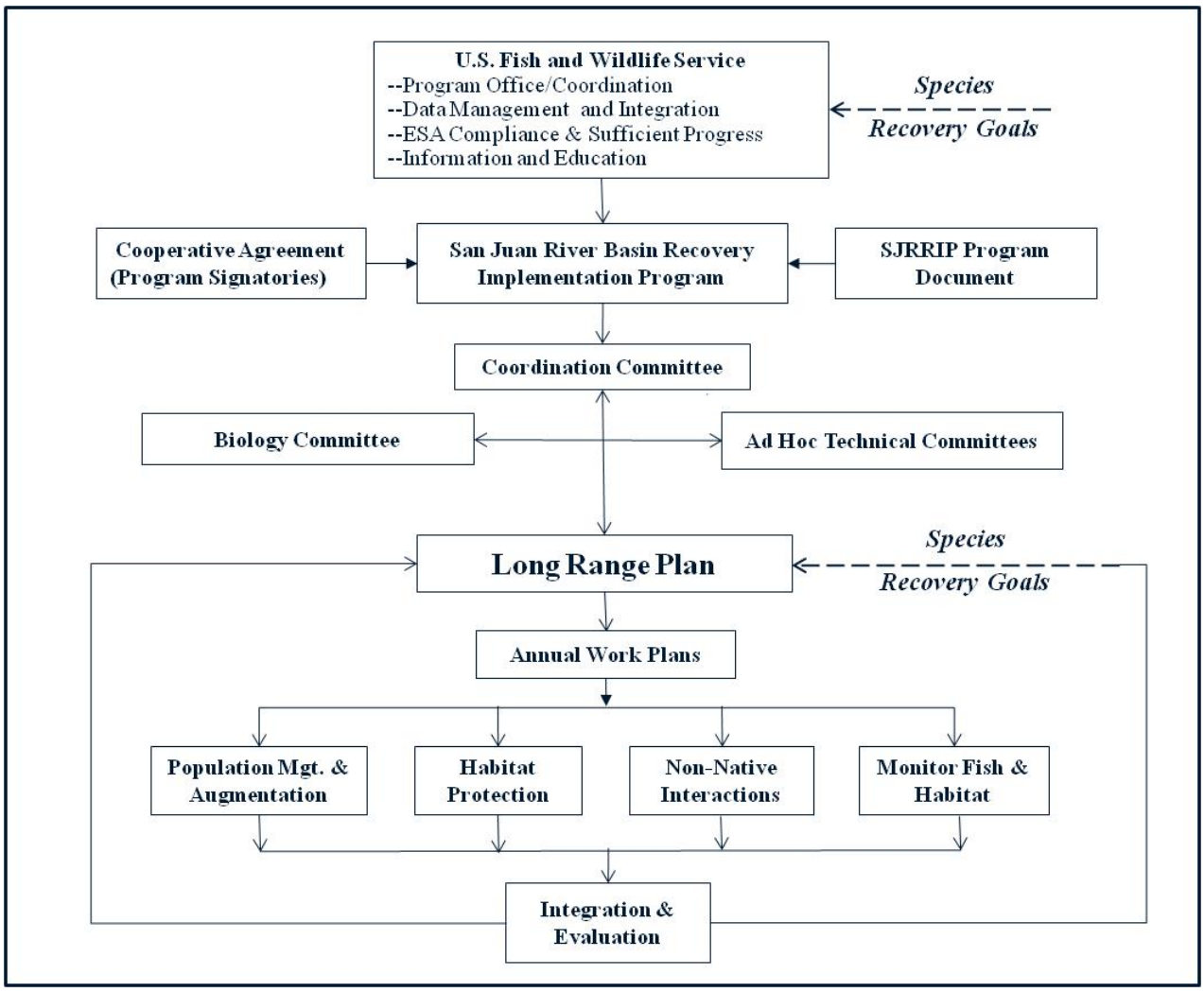

Figure 1. Components and relationships of the San Juan River Basin Recovery Implementation Program including the Long-Range Plan.

Authority

The Program became operational in October 1992 upon execution of a Cooperative Agreement signed by representatives of the Department of the Interior; the States of Colorado and New Mexico, and the Ute Mountain Ute and Southern Ute tribes; and the Jicarilla Apache Nation. The Bureau of Land Management became a participant in the Program in October 1993 as a condition of a Biological Opinion regarding oil and gas development in the Basin, and the Navajo Nation joined the Program in November 1996. In 2006, the 1992 Cooperative Agreement was extended through 2023.

Funding reliability is critical to the success of the Program to ensure that the Program is conducted on a continuous basis and that high priority recovery elements are funded every year. Prior to 2001, funding of the Program was provided by Reclamation, the BIA, and the Service. On January 24, 2000, Congress enacted Public Law 106-392 that authorized and directed Reclamation to fund this Program and the Upper Colorado River Endangered Fish Recovery Program. Public Law 106-392 authorizes the Secretary of the Interior to use Colorado River Storage Project power revenues to fund annual base costs of both programs and to provide a cost-share, to be matched by state cost-shares,

towards the costs of implementing capital recovery projects under both recovery programs. The legislation also authorizes federal appropriations to be made to contribute a federal cost-share towards implementation of the capital recovery projects. If the availability of power revenues proves insufficient to meet the annual base funding and capital project needs of the recovery programs, the Western Area Power Administration and Reclamation will request federal appropriations to meet these needs.

DEMOGRAPHIC AND RECOVERY FACTOR CRITERIA

Recovery goals for Colorado pikeminnow and razorback sucker identify demographic and recovery factor criteria needed to achieve recovery of the species in the Colorado River System (Service 2002a, 2002b). The Service is currently conducting five-year status reviews for both species and will incorporate revised recovery goals into updated recovery plans. All stakeholders will have the opportunity to comment when these documents are published in the Federal Register. The Upper Colorado River Endangered Fish Recovery Program implements and coordinates these management actions in the Upper Colorado River Basin in Colorado, Utah, and Wyoming, exclusive of the San Juan River Basin. This Program implements and coordinates these management actions in the San Juan River and its tributaries in Colorado, New Mexico, and Utah. The recovery goals provide site-specific management actions; objective, measurable criteria; and estimates of time and costs as guidance for each of the recovery programs.

Demographic criteria and recovery factor criteria for the San Juan River Basin identified in the recovery goals are summarized below. The demographic criteria identify the number of populations, numbers of individuals in each population, and the recruitment rates necessary for downlisting and delisting each species. The recovery factor criteria identify actions that should be taken to minimize or remove threats to each of the endangered fish species as identified for each of the five listing factors in Section 4(a)(1) of the ESA. As described in the species recovery goals, implementation of actions and achievement of criteria for downlisting and delisting of the Colorado pikeminnow and razorback sucker are the responsibility of each of the conservation programs in charge of management of these species for their region of the Colorado River System. Hence, achievement of demographic and listing factor criteria in the San Juan River Basin is the responsibility of this Program. The demographic criteria and recovery factor criteria for each of the two endangered fish species are provided in this LRP to help identify specific actions and tasks that are considered necessary for downlisting and delisting these species.

Razorback Sucker

Demographic Criteria

Objective, measurable criteria for recovery of razorback sucker in the Colorado River Basin were developed for each of two recovery units, the Upper Basin and the Lower Basin[1] (Service 2002b). Recovery of the species is considered necessary in both the upper and lower basins. In order for the species to be considered for downlisting, each population must consist of fish that are spawned and hatched in the wild; hatchery fish cannot be included in recovery demographic criteria. Without viable

[1] The Upper Basin includes the Green River, Upper Colorado River, and San Juan River subbasins, and the Lower Basin includes the Colorado River mainstem and its tributaries from Glen Canyon Dam downstream to the southerly International Boundary with Mexico.

wild populations, self-sustaining populations need to be established through augmentation with hatchery-produced fish. Once each self-sustaining population is established, the downlist monitoring period is five years and the delist period is an additional three years.

Downlisting

Downlisting can occur if, over a five-year period:

1. genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and EITHER in the Upper Colorado River subbasin or the San Juan River subbasin such that: (a) the trend in adult (age 4+;>400mm TL) point estimates for each of the two populations does not decline significantly; (b) the mean estimated recruitment of age-3 (300-399 mm TL) naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations; and (c) each point estimate for each of the two populations exceeds 5,800 adults (5,800 is the estimated minimum viable population [MVP] needed to ensure long-term genetic and demographic viability);

2. a genetic refuge is maintained in Lake Mojave in the lower basin recovery unit;

3. two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit (e.g., Colorado River mainstream and/or tributaries) such that: (a) the trend in adult point estimates for each population does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population; and (c) each point estimate for each population exceeds 5,800 adults; and,

4. certain site-specific management tasks to minimize or remove threats have been identified, developed and implemented.

Delisting

Delisting can occur if, over a three-year period beyond downlisting:

1. genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and **EITHER** in the Upper Colorado River subbasin or the San Juan River subbasin such that: (a) the trend in adult point estimates for each of the two populations does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations; and (c) each point estimate for each of the two populations exceeds 5,800 adults;

2. a genetic refuge is maintained in Lake Mojave;

3. two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit such that: (a) the trend in adult point estimates for each population does not decline significantly; (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population; and (c) each point estimate for each population exceeds 5,800 adults; and,

4. certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Recovery Factor Criteria

Recovery factor criteria in the recovery goals describe site-specific management actions necessary to minimize or remove threats to the species and support wild self-sustaining populations. This LRP incorporates these actions to ensure that this Program is carrying out activities consistent with species recovery. Actions 2 and 5 do not apply to the San Juan River, but are included to show the full scale of actions necessary to address threats to the razorback sucker. The following actions are quoted from the razorback sucker recovery goals (Service 2002b):

1. Reestablish populations with hatchery-produced fish.
2. Identify and maintain genetic variability of razorback sucker in Lake Mohave.
3. Provide and legally protect habitat (including flow regimes necessary to restore and maintain required environmental conditions) necessary to provide adequate habitat and sufficient range for all life stages to support recovered populations.
4. Provide passage over barriers within occupied habitat to allow unimpeded movement and, potentially, range expansion.
5. Investigate options for providing appropriate water temperatures in the Gunnison River.
6. Minimize entrainment of subadults and adults at diversion/out-take structures.
7. Ensure adequate protection from overutilization.
8. Ensure adequate protection from diseases and parasites.
9. Regulate nonnative fish releases and escapement into the main river, floodplain, and tributaries.
10. Control problematic nonnative fishes as needed.
11. Minimize the risk of hazardous-materials spills in critical habitat.
12. Remediate water-quality problems.
13. Minimize the threat of hybridization with white sucker.
14. Provide for the long-term management and protection of populations and their habitats beyond delisting (i.e., conservation plans).

Colorado Pikeminnow

Demographic Criteria

Objective, measurable criteria for recovery of Colorado pikeminnow in the Colorado River Basin were developed for the Upper Colorado River Basin (Service 2002a). Recovery of the species is considered necessary only in the Upper Basin because of the status of populations and because information on Colorado pikeminnow biology support application of the metapopulation concept to extant populations. The need for self-sustaining populations in the Lower Basin and associated site-specific management actions and tasks necessary to minimize or remove threats will be reevaluated during status reviews of the species.

Downlisting

Downlisting can occur if, over a five-year period, the Upper Basin metapopulation is maintained such that:

1. a genetically and demographically viable, self-sustaining population is maintained in the Green River subbasin such that: (a) the trends in separate adult (age 7+; >450 mm TL) point estimates for the middle Green River and the lower Green River do not decline significantly; (b) the mean estimated recruitment of age-6 (400-449 mm TL) naturally produced fish equals or exceeds mean

annual adult mortality for the Green River subbasin; and (c) each population point estimate for the Green River subbasin exceeds 2,600 adults (2,600 is the estimated minimum viable population [MVP] needed to ensure long-term genetic and demographic viability);

2. a self-sustaining population of at least 700 adults (number based on inferences about carrying capacity) is maintained in the Upper Colorado River subbasin such that: (a) the trend in adult point estimates does not decline significantly; and (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality;

3. a target number of 1,000 age-5+ fish (>300 mm TL; number based on estimated survival of stocked fish and inferences about carrying capacity) is established through augmentation and/or natural reproduction in the San Juan River subbasin; and,

4. certain site-specific management tasks to minimize or remove threats have been identified, developed and implemented.

Delisting

Delisting can occur if, over a seven-year period beyond downlisting, the upper basin metapopulation is maintained such that:

1. a genetically and demographically viable, self-sustaining population is maintained in the Green River subbasin such that: (a) the trends in separate adult point estimates for the middle Green River and the lower Green River do not decline significantly; (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality for the Green River subbasin; and (c) each population point estimate for the Green River subbasin exceeds 2,600 adults;

2. either the Upper Colorado River subbasin self-sustaining population exceeds 1,000 adults **OR** the Upper Colorado River subbasin self-sustaining population exceeds 700 adults and San Juan River subbasin population is self-sustaining and exceeds 800 adults (numbers based on inferences about carrying capacity) such that for each population: (a) the trend in adult point estimates does not decline significantly; and (b) the mean estimated recruitment of age-6 naturally produced fish equals or exceeds mean annual adult mortality; and,

3. certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Recovery Factor Criteria

Recovery factor criteria in the recovery goals describe site-specific management actions necessary to minimize or remove threats to the species and support wild self-sustaining populations. This LRP incorporates these actions to ensure that the Program is carrying out activities consistent with species recovery. Action 3 does not apply to the San Juan River subbasin, but is included to show the full scale of actions necessary to address threats to the Colorado pikeminnow. The following actions are quoted from the recovery goals for the Colorado pikeminnow (Service 2002a):

1. Provide and legally protect habitat (including flow regimes necessary to restore and maintain required environmental conditions) necessary to provide adequate habitat and sufficient range for all life stages to support recovered populations.
2. Provide passage over barriers within occupied habitat to allow adequate movement and,

potentially, range expansion.
3. Investigate options for providing appropriate water temperatures in the Gunnison River.
4. Minimize entrainment of subadults and adults in diversion canals.
5. Ensure adequate protection from overutilization.
6. Ensure adequate protection from diseases and parasites.
7. Regulate nonnative fish releases and escapement into the main river, floodplain, and tributaries.
8. Control problematic nonnative fishes as needed.
9. Minimize the risk of hazardous-materials spills in critical habitat.
10. Remediate water-quality problems.
11. Provide for the long-term management and protection of populations and their habitats beyond delisting (i.e., conservation plans).

RECOVERY ELEMENTS AND ACTIONS

This LRP consists of the following six Program elements:

1. Management and Augmentation of Populations and Protection of Genetic Integrity.
2. Protection, Management, and Augmentation of Habitat.
3. Management of Nonnative Species.
4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions.
5. Program Coordination and Assessment of Progress toward Recovery.
6. Information and Education

Changes were made to the Recovery Elements for the 2011 LRP to better distinguish between monitoring; annual and long-term data management, integration, and evaluation; and assessment of progress toward recovery. The title of Element 3 was changed from “Interactions between Native and Nonnative Species” to “Management of Nonnative Species” to remove the reference that interactions within the aquatic community are evaluated under this element. That activity is conducted under Element 4. This new verbiage also reflects the need for management consideration of all potential invasive nonnative species (not just fish) and for including other potential nonnative species management activities such as prevention. Element 4 is now “Monitoring and Evaluation of Fish and Habitat” (formerly “Monitor Fish and Habitat and Conduct Research in Support of Recovery Actions”). Element 4 is intended to be the clearinghouse for all Program activities associated with monitoring including management, integration, and evaluation of all native and nonnative species and habitat data collected. Element #5 is now titled, “Program Coordination and Assessment of Progress toward Recovery” to reflect that the Service will use the information generated under Element 4 for conducting assessments of the Program’s progress toward recovery.

This LRP identifies activities believed necessary to recover the Colorado pikeminnow and razorback sucker in the San Juan River Basin. The LRP describes what actions will be implemented, who will implement them, when they will be implemented, and why. Details of how actions and tasks will be carried out are left to supporting documents and plans, such as genetics management plans, augmentation plans, monitoring plans, and annual work plans. This LRP functions under the principles of adaptive management where annual updates and periodic revisions are necessary to ensure use of the best available scientific information in modifying or eliminating existing activities and formulating future Program activities.

The LRP is intended to facilitate evaluation of the Program's progress toward species recovery and development of sufficient progress reports for ESA Section 7 compliance. Furthermore, this LRP is designed to facilitate tracking of projects and associated budgets to assist the Program Coordinator and Reclamation's budget office. Detailed descriptions of each task with priorities, primary responsibilities, and start and end times are provided in Appendix A. Priorities assigned to tasks in Appendix A reflect necessary actions identified in recovery goals. This LRP identifies actions and tasks that began in 1992, at the initiation of the Recovery Program. Numerous tasks have been completed and that information used to develop strategies for management actions, monitoring, and research. Including past Program activities in the LRP provides documentation and accounting of activities, time schedules, and successes and failures of each. This institutional knowledge of the Program will enable interested parties to assess overall Program progress over time. Completed tasks are included in Appendix B.

Although one of the main goals of this Program is to conserve populations of Colorado pikeminnow and razorback sucker in the Basin consistent with species recovery goals, it is also important to ensure restoration and maintenance of the native fish community. Environmental conditions that support the endangered species also provide suitable conditions for the native fish community and vice versa. Native fishes provide an important food source for the predaceous Colorado pikeminnow, are important in maintaining ecological balance and food web dynamics, and serve as indicator species for a healthy ecosystem. The San Juan River Basin supports seven fish species native to the warm reaches of the drainage, including roundtail chub (*Gila robusta*), Colorado pikeminnow, speckled dace (*Rhinichthys osculus*), bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), razorback sucker, and mottled sculpin (*Cottus bairdi*) (Holden 1999).

Tasks That Address Recovery Goals

This LRP addresses the species recovery goals through specific tasks that detail actions necessary to quantify demographic criteria and remove or minimize species threats (Table 1). For example, the LRP identifies tasks that reestablish populations with hatchery fish in a systematic manner and tasks for monitoring population abundance. Numerous tasks help to provide and legally protect habitat, especially flows, and also provide for fish passage, as well as minimize entrainment. A series of ongoing tasks continue to be evaluated, including protection from overutilization and diseases and parasites, as well as water-quality remediation and minimizing the risk of hazardous materials spills. Control of problematic nonnative fish, regulating their escapement, and minimizing the threat of hybridization for razorback sucker are also important activities of this Program and the subject of several tasks.

Table 1. LRP goals, actions, and tasks that address recovery goals criteria for each species

Recovery Goals Criteria	**Colorado Pikeminnow**	**Razorback Sucker**
Reestablish populations with hatchery-produced fish	1.1.1; 1.1.2; 1.2; 1.3	1.1.1; 1.1.3; 1.2; 1.3
Ensure adequate protection from diseases and parasites	1.2.2.1; 4.1.6	1.2.2.1; 4.1.6
Minimize threat of hybridization	Not Applicable	4.1.5
Minimize risk of hazardous-materials spills	2.4; 2.4.1; 2.4.3	2.4; 2.4.1, 2.4.3
Remediate water-quality problems	2.4; 2.4.1; 2.4.2	2.4; 2.4.1; 2.4.2
Provide and legally protect habitat	2.1; 2.1.1; 2.1.2; 2.2.1-2.2.4; 2.2.3-2.2.6	2.1; 2.1.1; 2.1.2; 2.2.1-2.2.4; 2.2.3-2.2.6

Provide passage over barriers	2.3.1; 2.3.1.3-2.3.1.7	2.3.1; 2.3.1.3-2.3.1.7
Minimize entrainment at diversion structures.	2.3.3; 2.3.3.1-2.3.3.7	2.3.3; 2.3.3.1-2.3.3.7
Regulate nonnative fish releases and escapement	3.2; 3.2.1-3.2.3	3.2; 3.2.1-3.2.3
Ensure adequate protection from overutilization	3.2.1.1; 3.2.1.2; 3.2.2.1-3.2.2.2	3.2.1.1; 3.2.1.2; 3.2.2.1-3.2.2.2
Control problematic nonnative fishes	3.1.1.1-3.1.1.7	3.1.1.1-3.1.1.7
Demographic criteria	4.1.1.1; 4.1.1.2; 4.1.2; 4.1.4.	4.1.1.1; 4.1.1.2; 4.1.2; 4.1.4.

Ongoing Actions

A series of ongoing reports and other activities are identified in this LRP. The reports are designed to provide cohesive and periodic updates on specific issues and are distinct from project reports that describe the findings of a particular study. These reports are provided to the Coordination Committee, the Program Coordinator, Reclamation, and the technical committees and are listed in Table 2. The LRP also identifies several workshops that will be held as necessary to help coordinate Program activities and to provide technical assistance to biologists on population estimators and monitoring. These workshops are also listed in Table 2.

Table 2. Ongoing reports and workshops generated through this Long-Range Plan.

Identified Task	Report or Workshop	Schedule/Interval	Status/Action(s) Required
5.2.1.1	Standardized database; for all stocked and recaptured Colorado pikeminnow and razorback sucker in order to determine the fate of stocked fish.	Annual entry of data with appropriate documentation.	Program Office maintains and annually updates the database; Principal Investigators annually provide data to Program Office by Dec. 31; consolidated data redistributed by Jan. 31.
4.1.1.2	Annual Fish Monitoring Report; to ensure that the best sampling design and strategies are employed.	Annual reports by Biology Committee; compiled by Program Office; posted on Program website	Principal Investigators provide draft reports by March 31 and present results at annual meeting in May. Final reports provided to Program Office by June 30.
5.2.1.3	Data synthesis and integration report; evaluates progress toward minimizing limiting factors, details ongoing Program activities, and assesses current status of native and endangered fish populations.	Annually but may vary in timing due to competing fiscal resources, project scheduling, or significant new information.	Program Office conducts focused data integration annually to address high priority data needs identified by the Biology Committee. Draft reports by March 31 and present results at annual meeting in May. Final reports due by June 30
4.1.1.1	Standardized Fish Monitoring Plan; to assess the presence, status, and trends of Colorado pikeminnow and razorback sucker.	Standing report is updated as necessary. The 2006 Monitoring Plan and Protocols (Propst et al. 2006) is being updated.	Program Office and Biology Committee currently in the process of updating the Program's Comprehensive Monitoring Plan and Protocols; to be completed in 2011.

4.2.1.1	Standardized Habitat Monitoring Plan; to assess habitat and flow relationships.	Standing report is updated as necessary. Included as part of the Program's Comprehensive Monitoring Plan.	See 4.1.1.1.
2.2.2.1	Flow recommendations update report; evaluates and updates flow recommendations and response of native and endangered fishes to flow recommendations.	As necessary.	Reclamation currently developing SJRB Hydrology Model Gen3 after which a comprehensive review and revision of the flow recommendations will occur; expected to begin in 2012.
4.1.1.3	Monitoring Plan Workshop: to coordinate sampling design, data collection, and desired precision and detection levels for detecting responses.	As necessary.	A series of three monitoring workshops were held by the Biology Committee in 2009.
4.2.1.2	Habitat Monitoring and Mapping Workshop; to refine and improve habitat evaluation methods.	As necessary.	A workshop to address this issue is planned for 2011.
4.1.4.4	Population Estimation Workshop; to evaluate population estimators used in other systems to identify the most reliable and suitable estimator(s) for Colorado pikeminnow and razorback sucker.	As necessary.	A population estimate workshop was held in 2007.
3.1.1.7	Non-native fish control workshop; to evaluate the non-native fish management program	As necessary.	A non-native fish workshop was held in May 2010.

Description of Program Elements

The elements and associated tasks are designed to guide the Program for federal fiscal years 2011 through 2023, with annual updates as new information is obtained. This schedule is consistent with the razorback sucker recovery goals that estimate recovery by the year 2023. Authorization for construction costs under P.L. 106-392 (as amended by P.L. 107-375) also extends to the year 2023.

For each Recovery Element, a general explanation of the recovery activities and background are provided in the following narrative sections. Specific goals, actions, and tasks deemed necessary to achieve the overall Program purpose are identified and described by element in Appendix A tables. The goals under each element describe major targets that need to be achieved in order to fulfill the specified element; actions identified under each goal describe the principle actions; and the tasks describe the specific activities or projects. Appendix A tables provide the status of each task and the years in which the activity is planned. Completed tasks are included in Appendix B.

Element 1. Management and Augmentation of Populations and Protection of Genetic Integrity

This element ensures that the Program's augmentation protocols maintain genetically diverse fish species while producing and rearing Colorado pikeminnow and razorback sucker to stock in the river system. Wild self-sustaining populations of Colorado pikeminnow and razorback sucker do not currently exist in the San Juan River Basin. Recovery goals for both species identify the need to establish self-

sustaining populations through augmentation with hatchery-produced fish. The Program has adopted a genetics management plan (Crist and Ryden 2003) that identifies appropriate genetic lineages for use in hatchery programs and stocking efforts for the San Juan River. Augmentation plans (Ryden 2003a, 2003b) for each of the two endangered species were also developed. Production, rearing, and stocking of these fish need to continue to establish wild populations. Stocking protocols and fate of stocked fish are monitored and evaluated to determine the best strategies for enhancing survival and recruitment. Survival models are used to estimate and adjust stocking goals of augmentation plans and to ensure that sufficient numbers of genetically viable fish are being stocked.

Surveys in the late 1980s reported a few wild Colorado pikeminnow or razorback sucker in the San Juan River (Platania 1990; Platania et al. 1991). Prior to initiation of the Program, the Service proposed stocking razorback sucker into the San Juan River in 1986 to restore the species to the San Juan River. The effort was not undertaken, but Colorado pikeminnow and razorback sucker persistence in the river was documented. An experimental stocking program for razorback sucker began in 1994, under Program auspices, and experimental stocking of Colorado pikeminnow began in 1996. Brood stocks of razorback sucker are held at Dexter National Fish Hatchery and Technology Center (NFH) where fish are spawned, hatched, and reared. Brood stocks of Colorado pikeminnow are held at Dexter NFH and at the Colorado Division of Wildlife J.W. Mumma Native Species Hatchery where fish are spawned, hatched, and reared at each facility.

Since its inception, the Program continues to identify and develop strategies for producing and rearing both Colorado pikeminnow and razorback sucker, including hatchery production and grow-out facilities. In addition to using Dexter NFH for maintaining broodstock, spawning, hatching, and rearing both species, the Program uses two other grow-out facilities to produce large razorback sucker (>300 mm total length) for stocking to enhance survival. These facilities include Uvalde National Fish Hatchery and Navajo Agricultural Products Industry (NAPI) Ponds located on the Navajo Indian Irrigation Project (NIIP). The numbers of fish that need to be produced by these facilities are identified in the species augmentation plans. In addition to the fish produced by these facilities, excess fish may be stocked into the San Juan River from other facilities that raise Colorado pikeminnow and razorback sucker. In 2010, the Coordination Committee approved cost sharing with the Upper Colorado River Endangered Fish Recovery Program to construct, operate, and maintain Horse Thief Canyon Fish Rearing Ponds near Grand Junction, Colorado. This facility will include four 0.25-acre hatchery ponds for future use by the Program. Construction is proposed to begin in 2011 with ponds becoming operational in 2012.

While the overall goals for this element are the same for both the Colorado pikeminnow and razorback sucker, i.e., *Establish Genetically and Demographically Viable, Self-Sustaining Colorado Pikeminnow and Razorback Sucker Populations (Goal 1.1*), *Evaluate RBS and CPM Augmentation Program and Genetic Integrity* (Goal 1.2), and *Support Operations and Maintenance of Facilities to Support RBS and CPM Stocking Programs (Goal 1.3),* some actions and tasks vary by species.

Element 2. Protection, Management, and Augmentation of Habitat

This element identifies actions and tasks that address protection, management, and augmentation of suitable flows, habitat, range, and water quality to support recovery of Colorado pikeminnow and razorback sucker populations. Flow recommendations were developed for the San Juan River (Holden 1999). The May 1999 report suggested that, based on the SJRB Hydrology Model, the flow recommendations could be met by Navajo Dam and Reservoir operations. Since 1999, Navajo Reservoir has largely been operated to meet the flow recommendations. The foundation for these flow recommendations is mimicry of the natural flow regime of the San Juan River. Ecological communities and species have adapted and evolved to temporal flow variations specific to different riverine systems (Poff et al. 1997). Providing flows that reflect a more natural regime is necessary to provide the

ecological conditions for restoring and maintaining natural biological variability and health (Stanford et al. 1996). For the San Juan River, the intent was to use linkages between hydrology, geomorphology, habitat, and biology to define mimicry in terms of flow magnitude, duration, and frequency for runoff and base flow periods. These flow characteristics were compared with statistics of the pre-Navajo Dam river hydrology to refine the flow recommendations.

Flow recommendations for the San Juan River were developed in part to aid in the creation and maintenance of habitats important to various life stages of native and endangered fish species. Monitoring habitat availability, use, and change in availability in response to flow conditions is important to the evaluation and refinement of the flow recommendations and to the recovery of the San Juan River populations of Colorado pikeminnow and razorback sucker. The data integration analyses of 2006 indicated that complex channel reaches (those with high habitat diversity, islands, multiple channels and complex channel margins) correlate positively to native fish abundance. Backwater and low-velocity habitats are more likely to occur in these reaches, and capture locations of young-of-year (YOY) endangered fishes also tends to be correlated with channel complexity. Hence, flow management is most effective for providing suitable habitats when the processes that create and maintain complex channel reaches, or result in the loss or creation of backwaters and other habitats important to the endangered fishes are understood and monitored. In addition to providing suitable flows, it is imperative that fish have full access to important river reaches.

An important goal of this element is to provide suitable habitat to support recovered populations of Colorado pikeminnow and razorback sucker. Suitable habitat is intrinsically linked to river flows and the Program is evaluating and identifying flows that provide suitable habitat for various life stages of each of the endangered species. Backwaters are important habitats for young and adult Colorado pikeminnow and razorback sucker but are in low abundance in the San Juan River. Initial results of studies in the San Juan River suggest that stocking and holding young Colorado pikeminnow in low-velocity habitats may increase their retention and survival in the river compared to stocking them in high-velocity habitats. The ability to construct experimental backwaters to aid in the retention of stocked Colorado pikeminnow was evaluated and recommended (Bliesner and Lamarra 2000, 2002, 2007) but existing low velocity retention areas were found that negated the need for mechanically creating backwaters for stocking purposes.

Non-flow alternatives that would work in conjunction with flows to create and maintain suitable habitats are being investigated. A detailed reach study (Bliesner 2009) and associated habitat association studies demonstrated the importance of the more complex portions of the San Juan River to a range of life stages of the endangered fish. The studies found habitat types associated with larger sizes of both species are very abundant in the river, but the abundance and persistence of low velocity habitats, particularly backwaters, are low. Further, the complexity that appears to be important to all life stages is diminishing with time (Bliesner et al. 2009). These results indicate that implementation of flow recommendations alone are not creating and maintaining important suitable habitats. The Program's habitat and geomorphology studies have shown that nonnative vegetation encroachment (primarily Russian olive and tamarisk) has contributed to long-term narrowing and simplification of the river channel and may affect the ability of the river to provide important habitats for young endangered fishes (Bliesner 2004, Bliesner and Lamarra 2007). Mechanical removal of these invasive riparian species at selected locations and timed to match high flows, may be necessary and feasible to restore channel complexity. The Program is investigating the use of mechanical habitat manipulation actions by partnering with The Nature Conservancy on a New Mexico Environment Department River Ecosystem Restoration Initiative (RERI) project that will restore secondary channels along the San Juan River starting in 2011. Non-flow alternatives to creating and maintaining suitable habitat could also help offset possible effects of climate variability and to augment the beneficial effects of flow recommendations.

Cold water releases from Navajo Dam were identified as a factor potentially limiting reproduction and upstream distribution of the endangered fishes in the San Juan River (Bliesner and Lamarra 2000). Based on modeling of reservoir and release temperatures (Cutler 2006) and an assessment of longitudinal warming and fish temperature requirements (Lamarra 2007), the Biology Committee determined a temperature control device (TCD) at Navajo Reservoir was not warranted. At that time, impacts to spawning and rearing from cold releases from Navajo Dam into the San Juan River appeared to be minimal and it was thought that spawning was determined more by time-of-year than temperature cues. A TCD may provide seasonal range expansion above critical habitat but it is unknown if range expansion above critical habitat is necessary for recovery. Larval fish surveys conducted on the San Juan River since 1991 indicate that temperature has a greater impact on the spawning period (Brandenburg and Farrington 2009). The Biology Committee surmised at their May 17-18, 2007 meeting that additional information was needed to fully address this issue.

Range fragmentation in the San Juan River impedes movement of fish and access to spawning areas and feeding grounds. Additional range for Colorado pikeminnow and razorback sucker is being provided through modification of water diversions that allow fish to move upstream and downstream. This LRP identifies actions that provide fish passage at diversions that will enable fish to move freely for over 180 miles from the Lake Powell inflow upstream past the confluence of the Animas River. Some of the fish passage facilities selectively pass fish and help to diminish movement by problematic nonnative fish to key habitats of native and endangered fishes. There are eight major diversion structures on the mainstem San Juan River in New Mexico, ranging from soil and boulder dikes to concrete and metal weirs over which the entire river flows. The most upstream of these structures are dikes and levees at the heads of the Citizens Ditch and the Hammond Canal, which are upstream of the Animas River confluence and outside of designated critical habitat for either species. These cooler reaches of river are not likely to be occupied by Colorado pikeminnow and razorback sucker. Five structures, located downstream of Farmington, were identified as impediments or partial impediments to fish movement. Fish access was restored at three sites by removing Cudei Diversion Dam at River Mile (RM) ~142, and constructing fish passages at Hogback Diversion Dam at RM 159 in 2001 and Public Service Company of New Mexico (PNM) Weir at RM 166.6 in 2003. Arizona Public Service Company Weir at RM 163.3 and Fruitland Diversion Dam at RM 178.5, the last two potential impediments for fish passage, are being evaluated to determine the degree of impediment to fish movement and the feasibility of modifying the structures.

Entrainment of all life stages of native and endangered fishes in diversion structures is another potential impediment to recovery. In 2005, the Program funded the design of fish screens or deflection weirs for the Hogback diversion to reduce entrainment of endangered fishes into the Hogback Canal. Construction of a deflection weir at the Hogback Canal is expected to be completed in 2012, given current budget limitations and the status of preconstruction activities. Principles for minimizing entrainment that are learned from the Hogback Canal design will be used to construct these features on other diversions and canals.

A waterfall formed at Piute Farms in the lower San Juan River at the Lake Powell inflow when the water elevation of that reservoir declined below 3,660 feet in 2003. This waterfall is an impediment to upstream movement of native and endangered fish, but also impedes nonnative fish from moving upstream from the reservoir. The Biology Committee discussed the need for an artificial barrier at the lower end of the San Juan River to exclude predators from recolonizing the river when water levels in Lake Powell rise and the waterfall is inundated. Reclamation assessed the risk of this occurring and concluded that there is a 60 to 75% chance that the waterfall will be inundated for a total of 30 months (not necessarily continuously) between 2008 and 2030. Probabilities for longer inundation are available. Strategies for providing passage of native and endangered fish from Lake Powell around the waterfall into the San Juan River (e.g., barriers, passive non-native fish removal, temporary weirs) have been evaluated. If a barrier is determined to be necessary, measures for providing selective upstream passage for native

species will be developed. The Biology Committee determined an assessment was also needed of the extent of San Juan River fish lost over the waterfall especially as it relates to the Program's augmentation program to recover the listed species. Designated Critical Habitat for the endangered fish in the San Juan River basin extends approximately 35 miles downstream into Lake Powell to Neskahai Canyon. Any razorback sucker or Colorado pikeminnow existing in this portion of Lake Powell are considered to be part of the San Juan River population of fish. A fish survey of the San Juan Arm of Lake Powell will be conducted in 2011.

Based on data collection and an evaluation from the 7-year research period by Holden (2000), the Biology Committee concluded that water quality in the San Juan River was not a limiting factor to recovery of the endangered fishes or to restoration and maintenance of the native fish community. In a comprehensive review of water quality and contaminants in the San Juan River, Abell (1994) found a large quantity of information available on water contaminants and pollutants, primarily abiotic data, but very little data linking those contaminants to fish health. She found many of the studies cannot be compared to each other due to varying methodologies and detection levels. She emphasized the need for agencies responsible for protecting and restoring basin fish populations to work together to insure future sampling efforts complement each other to provide as complete a picture as possible of contaminants in the basin. In a synoptic study of contaminants data from the 7-year research period, Simpson and Lusk (1999) concluded harm from selenium as a contaminant issue for the razorback sucker. The Service has serious concerns with current levels of mercury and selenium found in the tissues of razorback sucker and Colorado pikeminnow in the Upper Colorado River and believes a comprehensive contaminants monitoring and remediation plan is needed to identify sources and magnitude of water quality threats that are adversely affecting the endangered species. This type of effort will require pooling of resources within the Upper Colorado River Basin and the expertise of the Biology Committee, contaminant biologists, fish toxicologists, and management and policy experts.

To achieve this element, four recovery goals were established to provide suitable habitat (*Goal 2.1*), suitable flows (*Goal 2.2*), increased range (*Goal 2.3*), and suitable water quality (*Goal 2.4*). The suitable habitat actions and tasks focus primarily on identifying, characterizing, and quantifying habitat and on managing flows to provide and maintain suitable habitat. An action is also included to evaluate and implement habitat restoration strategies to augment the function of flow to create and maintain suitable habitat. The actions and tasks related to suitable flows focus on implementing flow regimes beneficial to both species, providing flow recommendations and guidance for releases out of Navajo Dam, and maintaining a San Juan River hydrology model to evaluate flow recommendations and basin hydrology over time. Actions and tasks to increase range include construction and maintenance of Program structures at diversions to allow for fish passage and prevent entrainment. An action is also included to evaluate passage of San Juan River fish into Lake Powell in light of the waterfall that has formed and to assess the potential for non-native fish movement into the river if the waterfall becomes inundated. Water quality actions and tasks focus on monitoring water quality and contaminants, assessing effects on species recovery, and minimizing the risk of hazardous materials spills.

Element 3. Management of Nonnative Species

This element identifies actions to reduce negative interactions between the endangered fish species and problematic nonnative fish species. Over twenty species of nonnative fish have been documented from the San Juan River Basin, compared to nine native species. Nonnative fishes can numerically dominate riverine habitats and communities, negatively interacting with native and endangered fish species, and contributing to their decline (Mueller 2005). The 2002 recovery goals for Colorado pikeminnow and razorback sucker (Service 2002a, 2002b) identified predation and competition by nonnative fish species as a primary threat to these endangered species. The recovery goals state that management actions to address threats posed by nonnative fishes should be implemented in two steps: (1)

develop management programs to identify the levels of management needed to minimize or remove the threat for selected species in selected river reaches (requirement for downlisting), and (2) implement the identified levels of nonnative fish management (requirement for delisting). Nonnative fish management actions conducted by the Program are consistent with these actions.

The suite of nonnative fishes in the San Juan River includes warm-water sport fishes and non-sport fishes (Brandenburg and Gido 1999; Brooks et al. 2000). Rainbow trout and brown trout comprise the tailwater trout fishery below Navajo Dam (Ahlm 1993; Larson and Ahlm 1994) and do not occupy the same river reaches as the endangered fishes, which are found further downstream in warmer water. The non-sport fish include several species of minnows and suckers with little or no commercial or sport value. No known strategy will eliminate these unwanted species from the Basin and their populations need to be reduced to a level that minimizes or removes the threat of predation and competition to native species.

Mechanical removal of nonnative fish in the San Juan River began in 1997 and is ongoing. Intensive removal efforts began in 1999 in the river near Farmington and in 2002 in the canyon section between Mexican Hat and Clay Hills, Utah. Additionally, opportunistic removal of nonnative fish during research and monitoring activities augments this effort. Other measures have been implemented such as operating the selective fish passage at PNM Weir to remove all nonnative fish that pass through the structure. Nonnative fish stocking and baitfish policies of affected states are evaluated and nonnative fish are not being stocked in critical habitat of the endangered fishes in the San Juan River. Measurable objectives and quantitative methods for assessing and maintaining effectiveness of nonnative fish control are developed and implemented through this LRP.

Sport fish are important to recreational and commercial interests throughout the southwestern United States. Management of sport fish sometimes conflicts with conservation of native fish species (Clarkson et al. 2005). The San Juan River does not receive a great deal of fishing pressure other than the blue ribbon trout fishery in the tailwaters of Navajo Dam. Nevertheless, appropriate sport fish management is necessary and important to minimize conflicts and ensure conservation of native and endangered fish species. The States of Utah and New Mexico currently have open bag limits on channel catfish and striped bass in the San Juan River. The State of Colorado allows daily bag limits of 10 fish of each species. Although recreational fishing pressure on the San Juan River is limited, maintenance of these regulations will aid the Program in the goal of limiting nonnative fish distribution and abundance. Navajo Nation sport fishing regulations are also included in meeting this goal.

The Biology Committee held a nonnative fish control workshop in 2010 to evaluate and modify, if needed, the nonnative fish management program. A strong message that came out of the workshop was the importance of prevention in managing nonnative species. Nonnative introductions are not limited to fish and all introduced nonnative aquatic species have the potential to become an invasive species. Intentionally or illicitly introduced or stocked aquatic species undermine recovery actions. For the San Juan River, a waterfall at Lake Powell currently keeps nonnative fish from entering the river from that source but other reservoirs in the basin could be sources. The Program needs to be vigilant about preventing introductions of all nonnative species. Nonnative species that are already in the system but not currently a problem need to be tracked because any number of events could potentially trigger a problem.

To achieve this element, two goals have been established to manage nonnative species that could impact the Program's ability to recover the endangered fish species in the San Juan River. These include controlling problematic nonnative fishes *(Goal 3.1)* and preventing the introduction and establishment of other nonnative invasive species (*Goal 3.2*). The actions and tasks under Goal 3.1 focus on full implementation of the nonnative fish control strategy initiated in 2008, evaluation of methods, assessment of effects on the fish community, and development of targets for nonnative fish removal. Also included and action and tasks to handle removed fish in collaboration with state and tribal agencies. Goal 3.2

includes actions and tasks that focus on establishing policies and agreements with states and tribes to manage sport fish and bait species in the San Juan River in a manner compatible with endangered fish recovery and to identify potential invasive nonnative species and control their introduction and escapement into the main river, floodplain, and tributaries. Included are tasks to assess the effects of non-native fish from Lake Powell and from other sources on the fish community in the San Juan River and to track all nonnative species in the basin to the extent possible.

Element 4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions

Monitoring San Juan River native and nonnative fish populations and their habitat is necessary to evaluate management actions and to document the Program's progress toward achieving species recovery. The Program developed a standardized fish monitoring plan and protocols that describes the sampling design and strategies to be used in monitoring Colorado pikeminnow and razorback sucker as part of fish community monitoring (Propst et al. 2000). Through a series of monitoring workshops held by the Biology Committee in 2009, the monitoring plan and protocols were evaluated and an updated comprehensive monitoring plan is being developed (SJRIP 2010). The new plan includes updated and expanded monitoring protocol sections and a section that addresses annual and long-term data synthesis and integration.

Monitoring the endangered fish provides information necessary to assess the status and trends of the Colorado pikeminnow and razorback sucker populations in order to gauge progress toward recovery. Ongoing monitoring of stocked and wild fish helps to evaluate the success of stocking strategies and the need for additional hatchery augmentation. Once populations are established, reliable and precise population estimates will help to determine if downlist and delist criteria of recovery goals are being achieved, as is currently being done for Colorado pikeminnow and humpback chub in the upper Colorado and Green rivers. Recovery goals for the Colorado pikeminnow and razorback sucker are closely linked between this Program and the Upper Colorado River Endangered Fish Recovery Program and continued annual monitoring of fish populations in the San Juan River is important in order to determine survival of stocked fish, reproduction, and recruitment. Bestgen (2009) used methods similar to those used in the Upper Colorado River Basin, in the Green and Colorado River subbasins, to analyze the survival of razorback suckers in the San Juan River using mark-recapture data. The results of this kind of analysis are useful in improving stocking procedures to increase survival of both species and should be repeated periodically. Because recovery goals require wild populations, criteria are needed to supplement catch rate estimators with mark-recapture population estimates of wild-produced adults and juveniles. Relationships between catch rate estimators and mark-recapture population estimates of fish in the upper basin may be helpful in developing these criteria. Implementation of mark-recapture estimators will require a comprehensive assessment of logistics, personnel, equipment, and funds.

Other native and nonnative fish populations are being monitored to better understand the status and trends of these species and their inter-relationships with the endangered fish species. To the extent possible, habitat monitoring is closely coordinated and integrated with fish community monitoring to allow assessment of changing habitat availability and fish use in response to management actions and population recovery. Standardized habitat monitoring for the San Juan River was included in the 2000 monitoring plan and was reviewed and revised for the 2011 version. The plan is designed to monitor and evaluate habitat changes through time. The data and information from habitat monitoring will be integrated with different monitoring activities to assess the effectiveness of management actions, such as flow management, fish population estimates, and nonnative fish population abundances. A focused habitat monitoring workshop is planned for 2011 to evaluate, refine, and improve habitat monitoring and

mapping work on the San Juan River to insure the Program implements methodologies that are conducive to answering outstanding questions.

To adequately evaluate the management actions, the data from all monitoring, management, and research activities is collectively synthesized as a comprehensive date set. The monitoring data is analyzed for each individual protocol during annual data analysis by the principal investigator for each protocol. This annual data analysis uses statistics appropriate for each protocol to test relevant hypotheses and examine data temporally and spatially. The integrated data from individual protocols is used to address questions that synthesize data across protocols. Some synthesis questions can be addressed with the monitoring data that is collected each year while other questions require datasets over multiple years or specific research efforts. Prioritization of questions critical to Colorado pikeminnow and razorback sucker recovery in the San Juan River is a critical element in carrying out annual and long-term data integration exercises.

To achieve this element, four goals have been established to monitor fish populations (*Goal 4.1*), to monitor habitat use and availability (*Goal 4.2*), to integrate and synthesize monitoring data and other information to evaluate fish community and ecosystem responses to recovery actions (*Goal 4.3*), and to identify and conduct research and monitoring in support of recovery actions (*Goal 4.4*). The focus is on implementation of a standardized monitoring program that was developed to track the presence, status, and trends of endangered fish populations and the native fish community and to monitor habitat. In addition, data from all monitoring, management activities and research is integrated and synthesized annually to assess the status of the fish community, evaluate ecosystem responses to the management actions, and support broader, long-term data and information needs. Actions and tasks are included to use adaptive management concepts to evaluate and assess results and methods to refine current methodologies and develop and implement new monitoring and research strategies. A primary purpose of the actions and tasks under Element 4 is to collect and evaluate data in such a way that the Program's progress toward achieving recovery of razorback sucker and Colorado pikeminnow in the San Juan River can be adequately tracked and assessed.

Element 5. Program Coordination and Assessment of Progress toward Recovery

The U.S. Fish and Wildlife Service is responsible for coordinating the San Juan River Basin Recovery Implementation Program. To fulfill this responsibility, the Service has appointed a Program Coordinator who is responsible for overall Program planning and management, information integration and review, and facilitation of contracting funding and management. The Bureau of Reclamation appoints a Funds Manager to maintain and distribute base and capital funds and administer contracts. The Program Coordinator, Program staff, and the Program's technical committees have developed this LRP to facilitate achievement of recovery of the endangered fish species of the San Juan River Basin. There are two major components under this element, Program coordination and data integration and evaluation to assess the Program's progress toward achieving recovery.

Program Coordination

The Program Coordinator works with the Program's technical committees to identify and expedite individual projects that are needed to accomplish the LRP tasks for each of the Recovery Elements. The Program Coordinator, together with the Program's technical committees, drafts Annual Work Plans consisting of high priority individual projects, and forwards these to the Coordination Committee for review and approval. The Program Coordinator is responsible for maintaining records showing distribution and expenditures of all annual and capital funds expended under the Annual Work

Plan by each funding source. The Program Coordinator is responsible for insuring that the Program operates according to the Program Document; including the preparation of this LRP, the Annual Work Plans, budgets, and annual progress reports. In all these tasks, the Program Coordinator is assisted by the technical committees to ensure that appropriate work products are reviewed by the technical committees and all work products are approved by the Coordination Committee. The Program Coordinator annually compiles Program reports for transmittal to the involved agencies and to the Coordination Committee.

Assessment of Progress toward Recovery

Ongoing development, integration, and evaluation of information are essential for assessing progress toward species recovery as well as for guiding future Program direction. An important first step of the Program was implementation of a research phase to document distribution and abundance of resident fishes, characterize species life histories, and identify limiting factors. A 7-year research program, conducted during 1991 through 1997, provided a baseline of information and identified and characterized factors limiting the Colorado pikeminnow and razorback sucker (Holden 2000). The research program was incorporated into the Recovery Program when it was formed in 1992. An array of potential limiting factors have been investigated, including water quality, spawning habitat, nursery habitat, recruitment, hybridization, truncated range, capture-related stress, nonnative fishes, habitat quantity and diversity, flow regime, food, population size, disease, movement barriers, thermal regime, and entrainment in diversion structures. Although activities have been implemented by the Program to address these factors, much remains to be learned about the life history of the endangered fishes, their relationships with other native and nonnative fishes, their habitat associations, and components of their environment that directly and indirectly influence their welfare.

Many of the actions and tasks identified in the initial 7-year research phase of the Program have been completed and the work has contributed to understanding the San Juan River Basin. However, because contemporary Colorado pikeminnow and razorback sucker populations in the San Juan River were extremely small, there is still the need to identify and characterize limitations to the establishment and maintenance of self-sustaining populations. Once a potential limiting factor is identified and characterized through monitoring and research, efforts are made to implement activities that will eliminate or mitigate its impacts. These activities may not always successfully eliminate threats and mitigation alternatives may be developed.

The knowledge gained from the initial and future research coupled with other Program activities is valuable in evaluating progress toward species recovery and guiding future Program direction through annual revisions of the LRP. Annual data collection and analyses included under Element 4, provide the information base for assessing the Program's progress toward achieving recovery. Long-term, broader-based integration and synthesis of this information is also vital to interpreting results of research and management so that informed decisions can be made on future management actions and strategies. The Program Office will use the information and results obtained under Element 4 to prepare on a biennial basis, a written "Sufficient Progress" assessment of the Program's progress towards recovery. This report, as mandated in the Program Document, will assess the Program's ability to provide ESA compliance for water development and management activities and identify any corrective actions needed to ensure future ESA compliance.

To achieve this element, three goals have been established as follows: *Goal 5.1)* facilitate Program planning and management; *Goal 5.2)* ensure integration and synthesis of data and information to evaluate progress toward recovery; and, *Goal 5.3)* facilitate contract and funding management. Accomplishment of *Goal 5.2* relies heavily on activities included in Element 4 such as establishing and maintaining a comprehensive Program database, annual monitoring data analyses, and synthesizing and evaluating information from all activities and studies.

Element 6. Information and Education

The Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program each have a multi-stakeholder structure in which federal and state agencies work with public and private entities to recover endangered fish species in a manner that is consistent with federal, state, and tribal water laws. Although their structure and goals are similar, these recovery programs operate independently, working with their own program partners and governing committees to fulfill requirements detailed in their respective cooperative agreements. Nevertheless, the similarities in these programs provide for effective communication and public outreach under a coordinated effort.

Using a shared approach, the two recovery programs coordinate their outreach efforts to ensure that common audiences receive accurate and consistent information about the endangered fish species and efforts to recover them. These audiences include the general public, elected officials, Indian Tribes, landowners, anglers, river rafters and guides, environmental organizations, water and power developers, teachers, students, and Program participants. Although the geographic coverage of these recovery programs differs, the majority of affected parties are interested in the recovery efforts taking place for both programs.

To achieve this element, a goal was established to increase publish awareness and support for the endangered fish and the recovery program (*Goal 6.1*). Actions and tasks focus on providing information about the recovery program to the public and coordinating with the Upper Colorado River Endangered Fish Recovery Program to conduct an effective outreach program.

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Appendix A. Tasks, priorities, responsibilities, dates, and descriptions for elements of the Long-Range Plan

The following Recovery Element Tables 1-6 are included:

1. Management and Augmentation of Populations and Protection of Genetic Integrity
2. Protection, Management, and Augmentation of Habitat
3. Management of Nonnative Species
4. Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions
5. Program Coordination and Assessment of Progress toward Recovery
6. Information and Education

The following are criteria used as guidance for "Recovery Goals Priority" used in the *P* column of the following tables:

Low *(L)*	The task is not linked to site-specific management actions of recovery goals and is not necessary for species recovery.
Medium *(M)*	The task is indirectly linked to site-specific management actions and may be supportive of species recovery.
High *(H)*	The task is linked or related to a site-specific management action cited in recovery goals and may be necessary to achieve species recovery goals.
Critical/Compliance *(C)*	The task reflects a site-specific management action cited in recovery goals or biological opinions as a compliance measure and is considered necessary to achieve species recovery (formerly Highest).

Status Categories: Ongoing, Annually, Pending, As Needed, As Requested, On Hold, Completed

The following are abbreviations used in the following Tables:

BC	Biology Committee
BIA	Bureau of Indian Affairs
BOR	Bureau of Reclamation
CC	Coordination Committee
CPM	Colorado pikeminnow
DNFH	Dexter National Fish Hatchery and Technology Center
FWS	U.S. Fish and Wildlife Service
GJ	Grand Junction
NMDGF	New Mexico Game and Fish Department
NN	Navajo Nation
PO	Program Office
RBS	Razorback sucker
UNFH	Uvalde National Fish Hatchery

Table A1. Tasks, priorities, responsibilities, dates, and descriptions for Element 1—Management and Augmentation of Populations and Protection of Genetic Integrity.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 1.1—Establish a Genetically and Demographically Viable, Self-Sustaining CPM and RBS Populations.									
	Action 1.1.1 Develop plans for rearing and stocking CPM and RBS.									
H	Task 1.1.1.1 Review and update augmentation plan for CPM and adjust stocking goals as scheduled.	FWS, BC, PO	Ongoing	X	X	X	X	X	X	An annual review of the CPM augmentation plan (Ryden 2005, 2003) will evaluate whether the stocking goals are being met and if the plan is adequate to achieve goals. The augmentation plan will be updated as needed. Stocking protocols for acclimation were developed in 2009 (*draft*, Furr and Davis 2009). A draft CPM Stocking Plan for 2010-2020 is currently under review.
H	Task 1.1.1.2 Review and update augmentation plan for RBS and adjust stocking goals as needed.	FWS, PO, BC	Ongoing	X	X	X	X	X	X	An annual review of the RBS augmentation plan (Ryden 2005, 2003, 1997) will evaluate whether the stocking goals are being met and if the plan is adequate to achieve species recovery goals. A 2005 addendum to the stocking plan suggested the 8-year stocking period (2003-2011) begin when the production program was at full implementation, estimated to start no later than 2007. The augmentation plan will be updated as needed.
	Action 1.1.2 Produce, rear, and stock sufficient numbers of CPM to meet stocking goals of augmentation plan.									
C	Task 1.1.2.1 Annually produce and rear at least 400,000 age-0 CPM (50–55 mm TL) at Dexter NFH.	FWS, DNFH	Ongoing	X						At least 400,000 age-0 (50–55 mm TL) CPM will be produced and reared annually at the Dexter NFH for an 8-year period beginning in 2011 (see Task 1.1.1.1). *SOW 11-9*
C	Task 1.1.2.2 Annually stock >400,000 age-0 CPM into the San Juan River	FWS, DNFH	Ongoing	X						At least 400,000 age-0 (50–55 mm TL) CPM will be released annually from the Dexter NFH, into the San Juan River for an 8- year period beginning in 2011. *SOWs 11-7 and 11-8*
M	Task 1.1.2.3 Opportunistically stock available CPM in excess of those described above.	FWS, PO, BC	Ongoing	X						Excess CPM may be available from the upper basin or other sources. These should be procured and stocked opportunistically in excess of the numbers described above.
	Action 1.1.3 Produce, rear, and stock sufficient numbers of RBS to meet stocking goals of augmentation plan.									

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 1.1.3.1 Produce and rear RBS at Dexter NFH for stocking to grow-out facilities.	DNFH	Ongoing	X						RBS will be produced and reared annually at Dexter NFH in accordance with the genetics management plan and stocked into grow-out facilities, currently NAPI ponds and Uvalde NFH. Fish of sufficient size should be marked with PIT tags. Eight-year time period, 2003-2011 (see Task 1.1.1.2). *SOWs 11-7 and 11-10*
C	Task 1.1.3.2 Rear and stock hatchery-reared RBS from three NAPI grow-out ponds (3,000-3,500 fish per pond, > 200 mm TL).	DNFH, NN	Ongoing	X						RBS will be stocked annually into three NAPI grow-out ponds with 3,000-3,500 (> 200 mm TL) hatchery-reared RBS produced at Dexter NFH (expectation to harvest 40-60%) using a single cohort strategy; pit tag and stock 300 mm fish in 12 months. Eight-year time period, 2003-2011 (see Task 1.1.1.2). *SOW 11-12*
C	Task 1.1.3.3 Produce 12,000 RBS per year (>300 mm TL) at Uvalde NFH.	UNFH	Ongoing	X						A total of 12,000 RBS per year (>300 mm TL) will be produced annually at Uvalde NFH. Eight-year time period, 2003-2011 (see Task 1.1.1.2). *SOWs 11-11*
C	Task 1.1.3.4 Stock at least 91,200 RBS (> 300 mm TL) during 2003-2011 or 11,400 per year.	FWS	Ongoing	X						At least 91,200 RBS (> 300 mm TL) will be harvested annually from grow-out ponds and/or supplemental hatchery facilities and stocked into the San Juan River over an 8-year period, 2003-2011, or 11,400 per year. A 2005 addendum to the stocking plan specified the eight-year stocking period to begin when the production program was at full implementation, estimated to start no later than 2007 (see Task 1.1.1.2). *SOWs 11-7, 11-10, 11-11, and 11-12*
M	Task 1.1.3.5 Opportunistically stock available RBS in excess of the 11,400 described above.	PO, FWS	Ongoing	X						Excess RBS may be available from the upper basin or other sources. These should be procured and stocked opportunistically in excess of the 12,000 described above.
	Goal 1.2—Evaluate RBS and CPM Augmentation Program and Genetic Integrity.									
	Action 1.2.1 Evaluate status and success of stocked RBS and CPM.									
H	Task 1.2.1.1 Develop a standardized database for all stocked and recaptured RBS and CPM in order to determine the fate of stocked fish	PO	Ongoing	X	X	X	X	X	X	All RBS and CPM released into the San Juan River will be tabulated and tracked to understand survival of fish and success of the augmentation program. Fish of sufficient size will be PIT-tagged and a standardized database will be established and updated annually for access by researchers. This database is part of the overall Program database.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 1.2.1.2 Determine survival and recruitment of stocked RBS and CPM to assess stocking success and to determine when to implement mark-recapture population estimates.	FWS, BC	Ongoing	X	X	X	X	X	X	Every RBS and CPM captured will be examined for marks (e.g., coded wire tag, PIT tag, etc.) and information will be assimilated on these marked fish to estimate survival and recruitment. The numbers of stocked RBS surviving in the wild will be estimated from the monitoring program (see Goal 4.1 Monitor Fish Populations). These surviving fish will help to contribute toward reproduction in the wild and eventual species recovery.
	Action 1.2.2 Evaluate methods to improve RBS and CPM stocking successes.			X						
H	Task 1.2.2.1 Identify, describe, and implement strategies for improving survival and retention of stocked razorback sucker and Colorado pikeminnow, including acclimation prior to stocking, size of fish stocked, time and location of stocking, physiological conditioning, and predator avoidance	FWS	Ongoing	X	X	X	X	X	X	Factors that limit or impede survival of stocked RBS and CPM will be identified and strategies will be developed to eliminate or ameliorate these factors. Scientific evidence shows that acclimation by fish before release may reduce dispersal and increase survival. Experiments should be conducted to evaluate dispersal and survival of fish released directly into the wild vs. fish held at on-site acclimation pens. Protocols for acclimating stocked CPM were developed in 2009 (*draft*, Furr and Davis 2009).
H	Task 1.2.2.2 Assimilate the genetics information on CPM and RBS to describe best strategies for establishing and maintaining genetically viable wild populations of endangered fish.	FWS, NMGF	Ongoing					X		Although a genetics management plan has been developed, ongoing genetic monitoring of fish stocks is necessary to ensure genetic integrity of CPM and RBS.
L	Task 1.2.2.3 Monitor genetics of Colorado pikeminnow and razorback sucker in the San Juan River to determine if and to what extent wild produced individuals depart from genetic structure of parental stock (hatchery derived).	FWS	As needed							
	Goal 1.3— Support Operations and Maintenance of Facilities to Support RBS and CPM Stocking Programs.									
	Action 1.3.1. Support Production and Grow-out Facilities.									
H	Task 1.3.1.1 Support operation and maintenance of hatchery facilities (Dexter and Uvalde NFH) for RBS production.	PO, FWS	Ongoing	X	X	X	X	X	X	The operation and maintenance of hatchery facilities at Dexter and Uvalde NFH will be supported for RBS and CPM production.
M	Task 1.3.1.2 Operate and maintain NAPI grow-out ponds.	NN, FWS	Ongoing	X	X	X	X	X	X	The operation and maintenance of Navajo Agricultural Products Industry (NAPI) grow-out ponds will be supported for RBS production.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 1.3.1.3 Support construction, operation, and maintenance of Horse Thief Canyon Fish Rearing Ponds	PO, BR, FWS	Ongoing	X	X	X	X	X	X	The Program is cost sharing with the Upper Colorado River Endangered Fish Recovery Program to construct, operate, and maintain Horse Thief Canyon Fish Rearing Ponds near Grand Junction, Colorado. This facility will include four 0.25-acre hatchery ponds for future use by the Program. Construction is proposed to begin in 2011 with ponds becoming operational in 2012.

Table A2. Tasks, priorities, responsibilities, dates, and descriptions for Element 2—Protection, Management, and Augmentation of Habitat.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 2.1—Provide Suitable Habitat to Support Recovery of CPM and RBS Populations.									
	Action 2.1.1 Identify, characterize, and quantify suitable habitat.									
H	Task 2.1.1.1 Assess data collected to identify and describe flow-habitat relationships.	PO, BC	Ongoing	X						Use available data collected to date to accomplish task.
M	Task 2.1.1.2 Identify habitats and areas of essential habitat to native and endangered fishes at different volumes of water released (including timing and duration) from Navajo Dam.	PO, BC	Ongoing	X						Fish may change distributional patterns with different flow regimes. These changes may be seasonal or caused by changes in habitat.
C	Task 2.1.1.3 Assess to endangered fishes (or suitable native fish surrogate if needed)) response to various flow releases from Navajo Dam can be determined.	PO, BC	Ongoing	X						Flow recommendations were designed to maintain channel complexity and provide necessary habitats for native and endangered fishes. This task will link information gathered under Tasks 1.3.1.1 and 1.3.1.2 with the hydrology of flow recommendations to evaluate endangered fish response to the flow recommendations.
M	Task 2.1.1.4 Characterize channel geomorphology and river channel dynamics to better understand flow-habitat relationships.	PO, BC	Ongoing	X						Use available data collected to date to accomplish task.
	Action 2.1.2 Create and maintain habitat complexity to minimize loss and degradation of habitat for the endangered fish in the SJR									
C	Task 2.1.2.1 Support implementation of TNC's Conservation/Habitat Planning Project (RERI).	TNC	Ongoing	X	X					Habitat monitoring and research has shown a downward trend in channel complexity, an important habitat component for the endangered fishes. Flow management coupled with mechanical methods may be needed to create and maintain backwaters and side channels. TNC's Conservation/Habitat Planning Project (RERI) will restore several backwater and side channel projects along the river in 2011. Site monitoring will be conducted in 2012 to assess functionality.
	Goal 2.2—Provide Suitable Flows to Support Recovery of CPM and RBS Populations.									
	Action 2.2.1 Develop flow regimes to provide adequate flow and function to maintain habitat for CPM and RBS.									

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 2.2.1.1 Implement flows that provide suitable habitat for endangered fishes and other native fishes in the San Juan River.	BOR, FWS, BC	Ongoing	X	X	X	X	X	X	Flow recommendations were developed in 1999 (Holden 1999). Reclamation is implementing the flow recommendations through the operations decision criteria of Navajo Dam. Releases are made to provide sufficient releases of water at times, quantities, and durations necessary to protect the endangered fish and their designated critical habitat while maintaining the other authorized purposes of the Navajo Unit.
C	Task 2.2.1.2 Use data and information gathered from habitat assessments as the foundation for evaluating the effectiveness of the flow recommendations and operations decision criteria for Navajo Dam in providing suitable habitat for the endangered fish.	FWS, BC	Ongoing	X	X	X	X	X		Flow recommendations continue to be implemented and evaluated. A great deal of data and information has been collected, and continues to be collected on the San Juan River riverine habitats. This information needs to be continually assimilated, synthesized, and interpreted to assess and evaluate the habitat response to flow recommendations to determine if the habitat response is consistent with the objective of the flow recommendations.
H	Task 2.2.1.3 Develop and implement a process for revising flow recommendations.	BOR, FWS	Pending	X	X					The process for revising flow recommendations uses information from habitat to flow relationships and the hydrology model. The flow recommendations will continue to be evaluated and revised for long-term flow management for the San Juan River and the RBS and CPM are recovered.
H	Task 2.2.1.4 Evaluate and update flow recommendations and response of native and endangered fishes to flow recommendations.	BC, FWS	As needed	X	X					Upon completion of Gen3 of the San Juan Basin Hydrology Model (SJBHM), the BC will assemble a report that evaluates and updates the flow recommendations. This report will be provided to the CC for approval.
	Action 2.2.2 Develop and maintain a hydrology model to evaluate flow recommendations in the context of water supply and demand in the Basin.									
C	Task 2.2.2.1 Develop, evaluate, and refine a San Juan Basin hydrology model that provides a scientifically sound and biologically relevant representation of the San Juan River.	FWS, BOR, BC	Ongoing	X						The SJBHM was developed to provide a tool to analyze ways to manage flows in the San Juan River Basin for the benefit of endangered fish while allowing water development to proceed. The purpose of the model is to: a) provide input to the development and periodic evaluation and analysis of flow recommendations, and b) assess the impact of project development on basin depletions and recommended flows for endangered fish. Model development has undergone two generations (Generations I and II) and development of a third (Generation III) is in progress. The utility and effectiveness of the hydrology model is evaluated periodically by technical experts appointed by Program participants. *SOW 11-13*

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
M	Task 2.2.2.2 Conduct peer review of the hydrology model by qualified specialists not affiliated with the Program.	PO	Pending	X						An independent peer review will be conducted of Generation III of the hydrology model to determine if the model properly represents San Juan River hydrology and to ensure that the model can be used to evaluate flow recommendations.
H	Task 2.2.2.3 Provide model analysis for the evaluation of flow recommendations.	BOR, BC	As requested							Model analyses for the evaluation of flow recommendations and project impacts will be conducted by the Program's technical committees and experts at the request of the Coordination Committee or FWS.
H	Task 2.2.2.4 Support operation and maintenance of stream gauges for San Juan River as needed	BOR, PO	Annually	X	X	X	X	X	X	Stream gauges necessary for monitoring flow of the San Juan River will be supported with supplemental discharge rating measurements as may be needed for improving gaging reliability.
	Action 2.2.3 Coordinate with BOR on Navajo Dam operations.									
M	Task 2.2.3.1 Provide input and recommendations to Fish and Wildlife Service and Reclamation on alternate dam operations when extreme hydrologic conditions prevent flow recommendations from being met.	BC, PO	Ongoing							BOR will organize semi-annual meetings with stakeholders on operations of Navajo Dam. BOR will coordinate these meetings and solicit input from stakeholders.
H	Task 2.2.3.2 Make determination of perturbation for Navajo Dam operations.	BC	Annually	X	X	X	X	X	X	The BC will provide a determination of perturbation year to Reclamation in January of each year.
	Action 2.2.4 Provide and protect flows in the San Juan River consistent with flow recommendations.									
C	Task 2.2.4.1 Develop and implement mechanisms for protecting water required to meet flow recommendations.	BOR	Ongoing	X	X	X	X	X	X	BOR will coordinate with the States of New Mexico and Colorado to ensure protection of water released from Navajo Reservoir storage intended to fulfill flow recommendations.
	Action 2.2.5 Review and evaluate San Juan River stream flow in light of hydrology variability.									
H	Task 2.2.5.1 Conduct a comprehensive analysis of hydrologic variability in the San Juan River.	BOR, FWS	Pending	X						
H	Task 2.2.5.2 Evaluate the possible and most probable impacts of hydrologic variability on future water availability.	BOR, FWS	Pending	X						The long-term consequences of climate change are unknown. Possible impacts on stream flow and other environmental variables need to be evaluated in order to identify possible contingencies and alternative management actions.
H	Task 2.2.5.3 Evaluate ability of the river to meet the functions provided by the flow recommendations during extended periods of drought.	BOR, FWS, BC	Pending							An evaluation of the river's ability to meet flow recommendations under periods of extended drought should be evaluated.
C	Task 2.2.5.4 Develop contingency strategies to meet the functions provided by flow recommendations during extended periods of droughts.	BOR, FWS, BC	Pending							Alternative strategies for meeting the functions provided by flow recommendations during extended periods of droughts should be developed.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Action 2.2.6 Evaluate and implement habitat restoration strategies to augment the function of river flow to create and maintain suitable habitat.									
C	Task 2.2.6.1 Use data and information gathered from habitat assessments as the foundation for identifying and evaluating the need to implement other recovery actions, including but not limited to, habitat modification (flow or mechanically induced) and population augmentation.	FWS, BC	Ongoing	X	X	X	X	X	2015	Flow recommendations continue to be implemented and evaluated. A great deal of data and information has been collected, and continues to be collected, on the San Juan River fishes. This information needs to be continually assimilated, synthesized, and interpreted to describe best strategies for providing suitable habitat for native and endangered fish.
H	Task 2.2.6.2 Evaluate construction of backwater habitats to serve as low-velocity nursery habitat if lack of backwater habitat is found to be limiting recovery.	BOR, PO, BC NN	Ongoing							Backwaters serve as low-velocity nursery habitats for native and endangered fish. Backwaters will be mechanically created. Included as compliance measure in Navajo-Gallup BO.
H	Task 2.2.6.3 Evaluate selective nonnative vegetation removal in conjunction with high flow conditions for habitat creation and maintenance.	BOR, BC, FWS, NN	Ongoing	X						Tamarisk and Russian olive have encroached into riparian areas, stabilized the channel, and reduced channel complexity that is selected by native and endangered fishes.
M	Task 2.2.6.4 Evaluate large-scale nonnative vegetation control, as feasible and necessary.	BOR, BC, FWS, NN	As needed							Tamarisk and Russian olive have encroached into riparian areas, stabilized the channel, and reduced channel complexity that is selected by native and endangered fishes.
H	Task 2.2.6.5 Evaluate non-flow alternatives that would work in conjunction with flows to meet the functions provided by flow recommendations.	BOR, FWS, BC	Ongoing	X						Non-flow alternatives should be evaluated to help offset possible effects of climate variability and to augment the beneficial effects of flow recommendations. The Program is working on this task through development of SJBHM Gen III and TNC's Conservation/Habitat Planning Project
H	Task 2.2.6.6 Develop and implement a plan for feasible habitat restoration strategies and implement such plan as funding becomes available.	BOR, BC, FWS, NN	Ongoing	X						Other habitat creation and restoration strategies will be developed and implemented (2010–2012), as identified by Program review processes.
	Goal 2.3—Provide Increased Range to Support Recovery of CPM and RBS Populations.									
	Action 2.3.1 Provide and maintain fish passage at diversion structures.									
C	Task 2.3.1.3 Provide and maintain fish passage at the Hogback Diversion.	BIA, NN	Ongoing	X	X	X	X	X	2023	Passive fish passage at Hogback Diversion was completed in 2002. The Hogback Diversion is owned by the Navajo Nation
C	Task 2.3.1.4 Provide and maintain fish passage at the Public Service Company of New Mexico (PNM) Weir.	FWS, NN	Ongoing	X	X	X	X	X	2023	Selective fish passage at Public Service Company of New Mexico (PNM) Weir was completed in 2003. *SOW 11-13*

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 2.3.1.5 Provide and maintain fish passage at the Arizona Public Service Company (APS) Weir.	BOR	Pending	X	X	X	X	X	2015	An evaluation of the need for fish passage at the APS diversion structure was done in 2005 (Stamp et al. 2005). Design for fish passage at the Arizona Public Service Company (APS) Weir was completed in 2008.
C	Task 2.3.1.6 Evaluate fish passage at the Fruitland Diversion.	BOR, NN	Pending	X	X	X	X	X	2015	The Fruitland Diversion is owned by the Navajo Nation. An evaluation of the need for fish passage at the Fruitland diversion structure was done in 2005 (Stamp et al. 2005). A feasibility study was completed in 2008 for a simple but effective approach to improving fish passage at the Fruitland Diversion.
H	Task 2.3.1.7 Evaluate strategies for providing passage of native and endangered fish from Lake Powell around the waterfall into the San Juan River.	FWS, BOR, BC								If necessary, strategies for providing fish passage at this natural barrier should be developed. If a barrier is determined to be necessary, the BC believes it should provide selective upstream passage for native species and should be built in a location where it can be operated, possibly at Mexican Hat (see Tasks 3.1.3.1 and 3.1.3.2).
	Action 2.3.3 Minimize fish entrainment at diversion structures.									
C	Task 2.3.3.1 Identify and evaluate diversions with potential endangered fish entrainment in the San Juan River.	BC	Ongoing	X						Diversions and canals will be evaluated for potential entrainment of fish. This may lead to design and construction of fish screens or deflection weirs to address significant entrainment issues.
C	Task 2.3.3.2 Design and construct a fish deflection weir at the Hogback Diversion.	BOR, BC, PO, FWS, NN	Ongoing	X	X					A fish deflection weir has been designed for the Hogback Diversion. BOR is working on securing a long-term contract for O&M and on NEPA and ESA compliance. A contract for construction may be awarded in FY2011.
C	Task 2.3.3.3 Evaluate the need for and construct, if appropriate, a fish screen or deflection weir at the Arizona Public Service Company (APS) Weir.	BOR, BC, POFWS	Pending							Need for a fish screen or deflection weir will be evaluated at the Arizona Public Service Company (APS) Weir.
C	Task 2.3.3.4 Evaluate the need for and construct, if appropriate, a fish screen or deflection weir at the Fruitland Canal.	BOR, BC, PO, FWS	Pending							Need for a fish screen or deflection weir will be evaluated at the Fruitland Canal.
C	Task 2.3.3.5 Evaluate the need for and construct, if appropriate, a fish screen or deflection weir at the Jewett Valley Ditch.	BOR, FWS	Pending							Need for a fish screen or deflection weir will be evaluated at the Jewett Valley Ditch.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 2.3.3.6 Evaluate the need for and construct, if appropriate, a fish screen or deflection weir at the San Juan Generating Station.	BOR, BC, PO, FWS	Pending							Need for a fish screen or deflection weir will be evaluated at the San Juan Generating Station.
C	Task 2.3.3.7 Evaluate the need for and construct, if appropriate, a fish screen or deflection weir at the Farmer's Mutual Ditch.	BOR, BC, PO, FWS	Pending							Need for a fish screen or deflection weir will be evaluated at Farmer's Mutual Ditch. Diversions on the San Juan River and Animas River should be evaluated.
	Goal 2.4—Provide Suitable Water Quality to Support Recovery of CPM and RBS Populations.									
	Action 2.4.1 Describe water quality and identify potential problems to native and endangered fish.									
C	Task 2.4.1.1 Evaluate water quality of the San Juan River Basin, in coordination with other agencies, and identify potential effects to native and endangered fish.	FWS, BOR, BC	Ongoing	X	X	X	X	X	X	Initial investigations revealed a suite of water quality issues on the San Juan River, but none could be independently or synergistically linked to failure of the CPM or RBS populations. In coordination with other agencies, strategies for research and monitoring will be developed.
C	Task 2.4.1.2 Compile, evaluate, and synthesize historic water quality information on the San Juan River to identify water quality parameters that may be detrimental to native and endangered fish species (e.g., mercury, selenium, polycyclic aromatic hydrocarbons [PAHs]).	BC, BOR	Ongoing	X	X	X	X	X	X	Historic water quality information for the San Juan River was compiled and evaluated in 1994 to identify water quality parameters that may be potentially detrimental to native and endangered fish species (Abell 1994). Results of the 7-year research period were assimilated by Holden (2000). Simpson and Lusk (1999) summarized contaminants data from the 7-year research period. Continuation of water quality monitoring and compilation of information is needed to evaluate trends and patterns of various water quality components.
C	Task 2.4.1.3 Evaluate water quality as potential limiting factors.	FWS	Ongoing	X	X	X	X	X	X	Various studies have been completed that assessed various aspects of water quality (e.g., Abell 1994; Buhl and Hamilton 2000; Hamilton and Buhl 1997a, 1997b; Odell 1995, 1997; Wilson et al. 1995).
	Action 2.4.2 Remediate Water Quality Problems									
C	Task 2.4.2.1 Develop and implement a comprehensive contaminants monitoring plan to identify water quality threats to the endangered species.	FWS								The steps to developing this plan would include: • Defining issues and the process for plan development. • Defining the role of the Program in contaminants assessment with concurrence by the CC. • Identifying specific monitoring tasks for the Program and incorporate into the LRP

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Task 2.4.2.2 Identify effects of contaminants on recovery of endangered fish.	FWS, BC								
	Task 2.4.2.3 Provide assistance in developing recommended water quality criteria for problematic contaminants for consideration by state and federal water quality regulatory agencies when those agencies adopt enforceable water quality standards.	FWS								
	Action 2.4.3 Minimize the risk of hazardous-materials spills in critical habitat.									
C	Task 2.4.3.1 Identify and remediate potential sources of hazardous materials to areas of designated critical habitat (e.g., oil pipelines, riverside retention ponds).	FWS	Ongoing	X						The Program will identify and remediate any potential sources of hazardous materials, such as gas lines, oil product pipelines, riverside retention ponds, etc.
C	Task 2.4.3.2 Review and recommend modifications to state and federal hazardous-materials spills emergency-response plans to ensure adequate protection for razorback sucker and Colorado pikeminnow populations from hazardous-materials spills, including prevention and quick response to hazardous-materials spills.	FWS								
C	Task 2.4.3.3 Implement State and Federal emergency-response plans that contain the necessary preventive measures for hazardous-materials spill.	FWS								
C	Task 2.4.3.4 Identify the locations of all petroleum-product pipelines within the 100-year floodplain of critical habitat.	FWS								
C	Task 2.4.3.5 Assess the need for and install emergency shut-off valves on problematic petroleum-product pipelines within the 100-year floodplain of critical habitat to minimize the potential of spills.	FWS								
C	Task 2.4.3.6 Develop Best Management Practices for heavy equipment use within the 100 year floodplain.	FWS								

Table A3. Tasks, priorities, responsibilities, dates, and descriptions for Element 3—Management of Nonnative Species.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 3.1—Control Problematic Nonnative Fishes as Needed.									
	Action 3.1.1 Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish.									
C	Task 3.1.1.1 Mechanically remove nonnative fish to achieve objectives.	FWS, UDWR	Ongoing	X	X	X	X	X	X	Full implementation of the nonnative fish control strategy began in 2008. Principal Investigators: upper river control – Davis; lower river control – Elverud *SOWs 11-17 and 11-18*
C	Task 3.1.1.2 Remove nonnative fish at selective fish passage structures.	NN, FWS	Ongoing	X	X	X	X	X	X	Nonnative fish will be removed at PNM selective fish passage structure (see Task 2.3.1.4). *SOW 11-15*
C	Task 3.1.1.3 Remove nonnative fish during Program research and monitoring activities.	P.I.s	Ongoing	X	X	X	X	X	X	Nonnative fish captured during other Program activities will be removed when possible.
C	Task 3.1.1.4 Conduct annual review of success nonnative fish control strategy.	BC	Annually	X	X	X	X	X	X	The nonnative fish reduction strategy will be evaluated annually to determine if current efforts are meeting established criteria (Task 3.1.2.1). If criteria are not being met, increases or reallocation of effort may be necessary or alternative strategies identified and implemented. Data will be integrated with other Program data (Element 4)
C	Task 3.1.1.5 Develop a comprehensive non-native species management plan, including measurable river wide objective to determine effects of removal effort on native and nonnative fishes.									
H	Task 3.1.1.6 Establish target criteria for reduction of problematic nonnative fish species to estimate time, effort, and cost for controlling nonnative fishes.	BC, FWS	Ongoing	X						Target criteria will be established for reduction of the most problematic nonnative fish species. These criteria will describe annual and long-term target removal levels. These criteria may be expressed as percentage reduction of the total population, as generated by Ricker stock-recruitment models; or as exploitation rate, such as the Kwak and Peterson model. These models estimate the proportion of population reduction necessary to cause recruitment failure; i.e., mortality exceeds survival (lambda < 1.0). Bioenergetics models may also apply. The BC held a workshop in 2010 to evaluate the non-native fish control program.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 3.1.1.7 Evaluate and implement effective alternative nonnative fish reduction methods.	FWS, BC	Ongoing	X						The effectiveness of mechanical removal will be evaluated by analyzing trends in catch rates, length distributions, population size of nonnative fishes, and determining if removal criteria are being met. If mechanical removal is determined to be ineffective, alternative methods will be developed, evaluated, and implemented. These may include use of chemicals (e.g., rotenone, cyanide), species-specific viruses (e.g., carp viremia), and genetic manipulation (e.g., Trojan gene). The BC held a workshop in 2010 to evaluate the non-native fish control program and make adjustments as appropriate. Data will be integrated with other Program data (Element 4)
	Action 3.1.2 Establish and evaluate strategies for handling removed nonnative fish in collaboration with state and tribal agencies.									
M	Task 3.1.2.1 Evaluate and revise, as necessary, translocation strategy for channel catfish removed from the San Juan River.	FWS	Ongoing	X	X	X	X	X	X	Channel catfish removed from the San Juan River are translocated to closed impoundments within the San Juan River Basin. These translocations will be evaluated and revised, as necessary, to ensure compliance with all state, federal and tribal regulations.
M	Task 3.1.2.2 Implement standardized fish health analysis for translocated channel catfish to avoid transfer of harmful pathogens.	FWS	Ongoing	X	X	X	X	X	X	Standardized fish health analysis will be implemented on channel catfish every 2 years to identify and prevent the unintentional spread of harmful pathogens to local impoundments. If potential fish health problems are detected, the translocation strategy will be appropriately revised.
H	Task 3.1.2.3 Develop, evaluate, and implement standard procedures for disposal of fish that cannot be translocated.	FWS	Ongoing	X	X	X	X	X	X	Procedures for disposal of fish are important to maintain good relationships with affected stakeholders and the public.
	Goal 3.2—Prevent introduction and establishment of other nonnative invasive species.									
	Action 3.2.1 Ensure that sport fishing regulations and enforcement are consistent with endangered fish recovery.									
M	Task 3.2.1.1 Review sport fishing regulations and revise, as necessary, to ensure consistency with endangered fish recovery.	PO,BC, NN, States	Ongoing	X	X	X	X	X	X	State and tribal fishing regulations will be reviewed. Recommendations may be made for new regulations or revision of existing regulations that are consistent with endangered fish recovery. An example is to increase or remove bag limits for problematic nonnative species.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
M	Task 3.2.1.2 Collaborate with state and tribal agencies to enforce fishing regulations.	PO,BC, NN, States	Ongoing	X	X	X	X	X	X	Illicit translocation of nonnative fish can introduce new problematic species and expands their range. The Recovery Program will collaborate with state and Navajo Nation law enforcement agencies to reduce illicit translocations, including baitfish and live-well releases.
	Action 3.2.2 Develop and implement policies and agreements among stakeholders on nonnative game fish management to prevent introduction of invasive species									
C	Task 3.2.2.1 Develop and implement a sport fish stocking policy among the states and tribes.	PO, CC, BC, NN, States	Pending	X	X	X	X	X	X	A sport fish stocking policy among the States and Tribes for the San Juan River Basin has been developed and is currently in the signature process. The plan will be implemented upon completion.
H	Task 3.2.2.2 Execute agreements among the states and tribes to prevent the spread of nonnative invasive species.	PO, CC, BC, NN, States	Pending	X	X	X	X	X	X	One or more agreements will be executed, as needed, among the States of New Mexico, Utah, Colorado, and the Tribes to implement a nonnative sport fish stocking policy.
	Action 3.2.3 Identify potential invasive nonnative species and control their introduction and escapement into the main river, floodplain, and tributaries.									
L	Task 3.2.3.1 Consolidate all information for a comprehensive report and risk assessment of waterfall inundation and associated immigration of nonnative fish from Lake Powell including options and recommendations for potential management actions.	PO, BC	As needed							At present, a natural waterfall exists at the outflow of the San Juan River that prevents access by most fish from Lake Powell. The risk of immigration of nonnative fishes from Lake Powell into the San Juan River were assessed and measures will be identified to reduce the risk, if necessary.
C	Task 3.2.3.2 Develop a plan to control non-native fish entering the SJR from Lake Powell and be prepared to implement when the lake refills.	PO, BC	Pending							Measures identified necessary in Task 2.3.1.7 will be implemented to reduce the risk of immigration of nonnative fish from Lake Powell, as feasible and necessary. If a barrier is determined to be necessary, the BC believes it should provide selective upstream passage for native species and should be built in a location where it can be operated, possibly at Mexican Hat (see Tasks 2.3.2.2).
H	Task 3.2.3.3 Identify major sources of nonnative fish from tributaries and off-channel features to minimize reinvasion of riverine habitats by problematic species.	BC	Ongoing	X	X	X	X	X	X	Major sources of nonnative fish from tributaries and off-channel features will be identified, including inflowing streams, riverside ponds, canals, or other features. Isotopes may be used to locate sources of nonnative fish with established signatures of source waters. Measures to reduce escapement of nonnative fish from these sources will be identified. The BC will hold a workshop in 2010 to evaluate the non-native fish control program and make adjustments if appropriate

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 3.2.3.4 Implement measures to reduce escapement of nonnative fish from tributaries and off-channel features, as necessary.	PO, BOR, FWS	Pending							Measures identified necessary in Task 3.1.3.3 will be implemented to reduce escapement of nonnative fish from tributaries and off-channel features, as necessary. Potential problems have been identified at the newly filling Lake Nighthorse. Warm water fish stocking was not originally anticipated; the BO assumes no escapement; the "bassomatic" may not prevent 100% escapement as originally anticipated; Animas River fish have been found in the reservoir (Contact: Rob Waldman, Reclamation).
H	Task 3.2.3.5 Coordinate with other programs, agencies, and activities to track occurrences of nonnative species in the San Juan River Basin and, if a potential invasive species problem is identified, develop and implement preventive actions as appropriate.	PO, BC, States	Ongoing	X	X	X	X	X	X	

Table A4. Tasks, priorities, responsibilities, dates, and descriptions for Element 4— Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 4.1—Monitor Fish Populations of the San Juan River.									
	Action 4.1.1 Develop a standardized monitoring program for fish.									
M	Task 4.1.1.1 Develop and revise a Standardized Fish Monitoring Plan to assess the presence, status, and trends of Colorado pikeminnow and razorback sucker and fish community.	BC, FWS, PO, NMDGF	Ongoing	X	X	X	X	X	X	A Monitoring Plan And Protocols was developed for the San Juan River Bain in 2000 and updated in 2006 (Propst et al. 2006) to identify changes in the endangered and other native fish populations, status, distributions, and habitat conditions. The goals of the plan are to: 1) track the status and trends of endangered and other fish populations in the San Juan River, 2) track changes in abiotic parameters, including water quality, channel morphology, and habitat, important to the fish community, and 3) utilize data collected under Goals 1 and 2 to help assess progress towards recovery of endangered fish species. This monitoring plan describes protocols for monitoring larval drift, YOY and small-bodied fish, subadults and adults; and channel geomorphology, cobble bars, backwaters, habitat mapping; as well as water temperature, and water quality. BC held workshops in 2009 and an update of the plan is expected in 2011.
H	Task 4.1.1.2 Analyze and evaluate monitoring data and produce Annual Fish Monitoring Reports to ensure that the best sampling design and strategies are employed.	BC	Annually	X	X	X	X	X	X	As a goal of the monitoring plan, this task will a) determine relative annual reproductive success of CPM and RBS; and b) determine population trends, including size-structure of adult and juvenile fishes.
H	Task 4.1.1.3 Organize and conduct Monitoring Plan Workshops, as necessary, to coordinate sampling design, data collection, and desired precision and detection levels for detecting responses.	PO, BC	As needed							Monitoring workshops were held 2009 to coordinate sampling design, data collection, and desired precision and detection levels for detecting responses. An update of the plan is expected in 2011. Additional workshops will be held as necessary to accomplish Task 4.1.1.1.
	Action 4.1.2 Implement a Standardized Monitoring Plan to track the presence, status and trends of endangered fish populations.									
H	Task 4.1.2.1 Conduct larval fish studies to determine if reproduction is occurring, locate spawning and nursery areas, and to gauge the extent of annual reproduction.	P.I.s	Ongoing	X	X	X	X	X	X	Long-term CPM and RBS sucker larval fish surveys have been conducted since 2003. Principal Investigators: Monie, Brandenburg, and Farrington. *SOW 11-21*

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 4.1.2.2 Conduct juvenile and small-bodied fish studies to determine if young fish are surviving and recruiting and the areas and habitat used for rearing.	P.I.s	Ongoing	X	X	X	X	X	X	Long-term small-bodied fish monitoring has been in place since 2003. Principal Investigator: Monie *SOW 11-20*
M	Task 4.1.2.3 Conduct adult fish studies to estimate densities of fish (CPUE) and estimates of population size (mark-recapture estimates).	P.I.s	Ongoing	X	X	X	X	X	X	Long term monitoring of sub-adult and adult large-bodied fishes has been in place since 2003. Principal Investigator: Ryden. *SOW 11-19*
	Task 4.1.2.4 Deposit, process, and secure SJR fish specimens, field notes, and associated data at an organized permanent repository.	P.I.s	Ongoing	X	X	X	X	X	X	UNM Div. of Fisheries Museum of Southwestern Biology currently provides this service for the Program. In addition to curation and deposition, species identification and data are verified, entered into an electronic catalog, and georeferenced in ArcView. *SOW 11-12*
H	Task 4.1.2.5 Collect catch rate statistics to estimate relative abundance of endangered fish populations.	P.I.s	Ongoing	X	X	X	X	X	X	Implemented via long-term monitoring, non-native fish removal, and stocking programs.
	Action 4.1.3 Collect data on the endangered fish and native and nonnative fish communities during other Program management activities, when possible									
H	Task 4.1.3.1 Collect data on the endangered fish and native fish community during nonnative fish control activities to aid in tracking the presence, status and trends of endangered fish populations.	FWS, BC	Ongoing	X	X	X	X	X		See *SOW 11-17 and 11-18*
H	Task 4.1.3.2 Collect data on the endangered fish and native fish community during PNM selective fish passage operations to aid in tracking the presence, status and trends of endangered fish populations.	FWS, NN	Ongoing	X	X	X	X	X		See *SOW 11-15*
	Action 4.1.4 Obtain reliable population estimates of RBS and CPM.									
H	Task 4.1.4.1 Implement pilot mark-recapture population estimates to develop target criteria for full implementation of population estimates consistent with recovery goals requirements.	BC	Pending							Reliable and precise mark-recapture population estimates are required for recovery goals. Criteria will be developed to transition from catch rate indices to mark-recapture population estimators for subadult and adult RBS and CPM. These criteria may be numbers of fish per kilometer or a similar metric that signals when population sizes are sufficiently large to implement mark-recapture sampling. See Tasks 4.1.4.2 and 4.1.4.3.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 4.1.4.2 Use mark-recapture population estimators, when feasible, and in conjunction with catch rate estimators, to provide reliable estimates of adults, subadults, survival, and recruitment consistent with recovery goals criteria to gauge recovery of CPM and RBS.	FWS, BC, P.I.s	Ongoing	X	X	X	X	X	X	Via long-term monitoring, non-native fish removal, and stocking programs, implement and refine mark-recapture population estimates for RBS and CPM that provide reliable and precise estimates of subadult and adults, as well as estimates of survival. After workshops in 2009, the BC determined existing Program mark-recapture data will be used to do population estimates in the near term.
	Task 4.1.4.3 Analyze mark-recapture data with methods used by Bestgen (2009) to estimate survival rates of razorback sucker.	PO BC	Ongoing		X			X		Bestgen (2009) used methods similar to those used in the Upper Colorado River Basin, in the Green and Colorado River subbasins, to analyze the survival of razorback suckers in the San Juan River using mark-recapture data. These analyses will be replicated every 3-5 years.
H	Task 4.1.4.4 Conduct Population Estimation Workshops and evaluate population estimators used in other systems to identify the most reliable and suitable estimator(s) for Colorado pikeminnow and razorback sucker.	PO, BC	As needed							Monitoring workshops were held in 2009 to evaluate population estimators to be used for RBS and CPM in the San Juan River. Estimation techniques used in other systems were evaluated to identify the most reliable and suitable estimators. The monitoring plan is being updated and will address this issue.
H	Task 4.1.4.5 Procure adequate numbers of PIT tags for marking native and endangered fish.	BOR	Ongoing	X	X	X	X	X	X	PIT tags are the standard marking tool for the endangered fishes. *SOW 11-27*
	Action 4.1.5 Evaluate the risk of hybridization among sucker species.									
M	Task 4.1.5.1 Quantify the extent of hybridization among native suckers to determine if releasing large numbers of hatchery razorback suckers into the San Juan River will reduce genetic diversity and viability of razorback sucker and/or flannelmouth sucker.	BC	Ongoing		X				\	Hybridization may be reducing genetic viability of native suckers and may require actions such as mechanical removal to reduce white suckers. There is some information on the extent of hybridization between native suckers (i.e., razorback, flannelmouth, bluehead) and nonnative white suckers in the San Juan River (Turner et al. 2002, 2008). A reassessment should be conducted in 2012.
M	Task 4.1.5.2 Quantify the extent of hybridization between native suckers with nonnative white suckers to determine if hybridization is reducing genetic diversity and viability of native suckers (i.e., razorback sucker, flannelmouth sucker, bluehead sucker).	BC	Ongoing		X			X		Observational surveys are conducted during other Program activities. Hybridization between native suckers and nonnative white suckers does not currently appear to be a problem in the San Juan River. A reassessment should be conducted in 2012.
M	Task 4.1.5.3 Identify and implement necessary actions to minimize hybridization among native suckers and nonnative suckers.	BC	As needed		X					Reassessment should be conducted in 2012.
	Action 4.1.6. Ensure adequate protection from diseases and parasites.									

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 4.1.6.1 Track health of fish in the San Juan River to ensure adequate protection from diseases and parasites.	PO, P.I.s	Ongoing	X	X	X	X	X	X	Ensuring adequate protection from diseases and parasites is indentified as a potential limiting factor for RBS and CPM population recovery. During fish handling and capture activities on the San Juan River, optical inspections of general fish health and condition is conducted and any indication of poor health of endangered fishes is logged and reported. If any indications of poor health are found
C	Task 4.1.6.2 Identify causes and recommend corrective actions if any indications of poor health are of concern.	P.O., BC, P.I.s	As needed							
	Goal 4.2—Monitor Habitat Use and Availability.									
	Action 4.2.1 Develop a standardized monitoring program for habitat.									
M	Task 4.2.1.1 Develop and revise Standardized Habitat Monitoring Plan.	BC	Ongoing	X						BC workshops were conducted in 2009 to evaluate current fish and habitat monitoring and develop a comprehensive plan for both fish and habitat monitoring. Final results of the detailed reach results were available in 2010. A comprehensive monitoring plan is being developed and will incorporate this information. A habitat monitoring workshop to refine and improve habitat evaluation methods is planned for 2011.
M	Task 4.2.1.2 Organize and conduct Habitat Monitoring and Mapping Workshops, as necessary, to refine and improve habitat evaluation methods.	PO, BC	As needed	X						BC workshops were conducted in 2009 to evaluate current fish and habitat monitoring and develop a comprehensive plan for both fish and habitat monitoring. A focused habitat monitoring workshop to refine and improve habitat evaluation methods is planned for 2011.
	Action 4.2.2 Implement a standardized monitoring program for habitat.									
H	Task 4.2.2.1 Quantify attributes of habitats important to each life stage of endangered fish**.**	FWS, BC	Ongoing							Habitats used by various life stages of CPM and RBS should be monitored and related to flow and river location.
	Task 4.2.2.2 Map habitat at different flows as described in the Standardized Habitat Monitoring Plan	P.I.s	Ongoing		X	X	X	X	X	*SOW 11-24*
H	Task 4.2.2.3 Monitor long-term habitat response of the river channel to flow recommendations.	BC	Ongoing		X	X	X	X	X	Long-term river-wide response of the river channel (i.e., aggradation or degradation) will be monitored and related to the flow recommendations to assess gross overall channel change (as needed).

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 4.2.2.4 Monitor water quality in the San Juan River (see Action 2.4.1.).	FWS, BIA, BOR	Ongoing		X	X	X	X	X	Elevated levels of selenium and mercury have been detected in the San Juan River and identified by the FWS as potential causes of failure of CPM or RBS populations. Continued monitoring of critical water quality parameters is needed to track and assess water quality effects on the endangered fish. Long-term monitoring for selenium and temperature is a required measure in the NIIP BO. The Program currently monitors temperature. Principle Investigator: Bliesner
H	Task 4.2.2.5 Monitor stream flows	P.I.s	Annually	X	X	X	X	X	X	Five USGS streamflow gaging stations on the mainstem of the SJR provide flow data. USGS takes additional flow measurements at Archuleta, Farmington, Shiprock, and Four Corners. *SOW 11-14*
C	Task 4.2.2.6 Monitor water temperature	P.I.s	Annually	X	X	X	X	X	X	Daily water temperature data at key locations are used by all researchers and allow future assessment of the impact of releases from Navajo Dam on critical habitat. *SOW 11-24*
	Task 4.2.2.7 Obtain river videography	P.I.s	Annually	X	X	X	X	X	*X*	High definition videography taken in late summer during base flow conditions is used for developing maps of the river, evaluating habitat relationships, and providing a database for comparing future conditions. *SOW 11-25*
	Action 4.2.3 Identify and refine habitat/fish relationships.									
H	Task 4.2.3.1 Determine if a habitat/fish relationship can be defined, the probability of success, the level of data needed to accomplish this, and the cost of collecting the data.	FWS, BC								Workshops were conducted in 2009 to evaluate and modify current monitoring and data collection methodologies and address data integration. A comprehensive fish and habitat monitoring plan will be completed in 2011.
H	Task 4.2.3.2 Identify principal river reaches and habitats used by various life-stages of endangered fish.	FWS, BC								An understanding of river reaches and habitats used by CPM and RBS is important in understanding how flows benefit these habitats.
	Task 4.2.3.3 Relate geo-referenced fish capture data to habitat data.	P.I.s, PO	Ongoing	X						This was initiated by Bliesner during the detailed reach study. Starting in 2010, P.I.s will record GPS coordinates for all captures and recaptures during monitoring and nonnative fish removal activities.
	Goal 4.3— Integrate And Synthesize Monitoring Data And Information To Evaluate Fish Community And Ecosystem Responses To Recovery Actions.									
	Action 4.3.1 Describe life history parameters of wild CPM and RBS.									

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 4.3.1.1 Document and quantify reproduction, survival, and recruitment.	FWS, BC	Ongoing	X	X	X	X	X	X	Survival will be estimated by age group for RBS and CPM. Survival can be estimated from periodic comparison of abundance estimates and from mark-recapture analyses. Recruitment will be estimated from periodic abundance estimates of subadults and adults. Estimates of recruitment are demographic criteria of recovery goals. 1992 - present
	Action 4.3.2 Develop fish community and ecosystem response strategies									
H	Task 4.3.2.1 Develop a centralized database that incorporates all data from standardized monitoring and integrate into the Program database.	PO, BC	Ongoing	X	X	X	X	X	X	The San Juan River Basin Recovery Implementation Program maintains a centralized database of all monitoring activities. This database is part of the overall Program database—see Task 5.2.1.1.
H	Task 4.3.2.2 Use previous and current data collected during ongoing investigations to characterize dynamics of native fishes and their response to management activities intended to improve status of listed species.	PO, BC	Ongoing	X	X	X	X	X	X	In coordination with the BC, the Program Office is responsible for ensuring that information is integrated and synthesized to evaluate Program progress toward recovery-see Goal 5.2.
M	Task 4.3.2.3 Evaluate and review available fisheries data for use in the model to evaluate recovery actions.	PO, BC	As needed							A great deal of information has been gathered on the fish community of the San Juan River. This information should be assimilated. Data Integration and Habitat and Fish Monitoring Workshops were held in 2009.
M	Task 4.3.2.4 Update population model specific to the San Juan River and use with other existing data to evaluate fish community response to recovery actions.	PO, BC	As needed	X						The population model will be updated to assist in evaluating possible responses by fish species to management actions.
	Action 4.3.3 Identify and implement appropriate monitoring and research strategies to evaluate ecosystem response									
H	Task 4.3.3.1 Develop and implement an integrated fish and habitat monitoring plan that includes an annual process for assessing and modifying monitoring activities so that current status of native and endangered fish populations and habitat can be assessed and progress toward recovery can be determined.	PO, BC	Ongoing	X	X	X	X	X	X	Workshops were conducted in 2009 to evaluate current fish and habitat monitoring. A stated purpose of the workshops was to develop an integrated fish and habitat monitoring plan that includes annual evaluation and data integration, and an adaptive management component. The plan is being developed and should be complete in 2010.
	Action 4.3.4 Use data from monitoring and management actions and research information to evaluate and modify recovery activities, as necessary, to ensure progress toward recovery.									

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 4.3.4.1 Identify, describe, and implement strategies for improving long-term survival and recruitment of razorback sucker and Colorado pikeminnow including but not limited to nonnative fish removal, enhancing habitat and food resources, enhancing genetic diversity and viability, and mitigating barriers to range fragmentation.	PO, BC	Ongoing	X	X	X	X	X	X	Use adaptive management strategies to eliminate, add, or adjust monitoring and research activities and management actions to obtain needed information and improve species and habitat status and condition.
H	Task 4.3.4.2 Use data and information gathered from fish surveys, hatchery augmentation, and survival studies to describe best strategies for establishing wild populations of endangered fish and restoring the native fish community.	PO, BC	Ongoing							Information will be assimilated and evaluated on a continual basis to assess stocking success and establishment of wild populations of CPM and RBS.
H	Task 4.3.4.3 Use data and information gathered from nonnative fish efforts to evaluate effects of nonnative fish control on distribution, abundance, and demographics (e.g., fish size, age, sexual maturity) of the endangered fish populations and native fish community.	FWS, BC	Ongoing							Fish population respond in various ways to severe reduction from mechanical removal. These responses need to be evaluated to determine if removal will require different strategies for minimizing negative impacts to native and endangered fish species. Ongoing evaluation is needed, including assessment of new technologies for controlling nonnative fishes.
H	Task 4.3.4.4 Evaluate effects of nonnative fish control on distribution, abundance, and demographics (e.g., fish size, age, and sexual maturity) of nonnative fish populations.	FWS, BC	Ongoing							Full implementation of the nonnative fish control strategy began in 2008. The BC will hold a workshop in 2010 to evaluate the non-native fish control program and make adjustments if appropriate
	Goal 4.4— Identify and Conduct Research and Monitoring in Support of Recovery Actions									
	Action 4.4.1 Annually identify potential project/activities/questions/information needs									
	Lake Powell endangered fish									
	Passive Pit Tag Detection Methods									
	Radiotelemetry Study									
	Tributary Sampling									e.g., Yellow Jacket Canyon
	Conduct Inventory of all potential problematic reservoirs (i.e., potential sources of nonnative species)									
	Action 4.4.2 Implement project/activities as necessary to obtain needed information									
H	Task 4.4.2.1 Conduct fish studies in the SJR Arm of Lake Powell as needed to assess presence/absence of SJR endangered fish populations	P.I.s	As needed	X						A fish survey of Lake Powell will be conducted in 2011. Principal Investigator: Ryden SOW *11-28*

Table A5. Tasks, priorities, responsibilities, dates, and descriptions for Element 5.— Program Coordination and Assessment of Progress toward Recovery.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 5.1—Facilitate Program Planning and Management.									
	Action 5.1.1 Provide Ongoing Program Management ***SOW 11-29***									
H	Task 5.1.1.1 Coordinate and schedule meetings and activities of the Coordination Committee and the technical committees, as necessary.	PO	As Needed	X	X	X	X	X	X	The Program Office will coordinating the activities of the Coordination Committee and the Program's technical committees, including providing notices, agendas, information packets, and providing draft and final summaries for committee and subcommittee meetings and conference calls as per the committee meeting.
H	Task 5.1.1.2 Annually review and update the Long-Range Plan to reflect new information, new projects and Program progress.	PO, BC, CC	Annually	X	X	X	X	X	X	The LRP is a living document that will be reviewed and revised annually according to the process described in the SJRRIP Program Document (2006). The Program Office will update the LRP in coordination with the CC and technical committees to reflect accomplishments during the past year, new projects needed to achieve goals, and changes in timing of projects. The LRP will include those actions the Program and Service believe are necessary to achieve recovery and those ESA compliance actions identified in the biological opinions that the Program has assumed responsibility for implementing.
H	Task 5.1.1.3 Convene annual Program coordination meetings to review the preceding year's monitoring, recovery and research data; assess progress toward recovery; and provide recommendations to modify the Long-Range Plan.	PO, BOR	Annually	X	X	X	X	X	X	The Program Coordinator will chair an annual meeting of the Coordination and Biology committees and the Service to review the preceding year's monitoring, recovery and research data, assess progress toward recovery, and provide recommendations to modify monitoring, recovery and research actions, as appropriate.
H	Task 5.1.1.4 Develop list of prioritized actions and projects for the Annual Work Plan that most benefit recovery of the endangered fish populations.	BC, PO	Annually	X	X	X	X	X	X	Based on the Long-Range Plan, the Program Office will work with the technical committees to develop a list of prioritized projects for the next Annual Work Plan. The prioritized list will be consistent with the Long Rang Plan, include input from the technical committees, and be approved by the Coordination Committee.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 5.1.1.5 Develop and issue Requests for Proposals (RFPs) and request Scopes of Work (SOWs) for projects that most benefit recovery of the endangered fish populations.	PO, BOR	Annually	X	X	X	X	X	X	Scopes of work will be prepared for the list of prioritized projects and requests for proposals will be solicited. Upon receipt of the scopes of work, and responses to requests for proposals, the prioritized projects will have associated budgets. These will be compared to the availability of funds. Projects that are low on the priority list will not be included in the Work Plan if funding is not available to fund all projects in that fiscal year. This effort will be conducted by the Program Coordinator. Unfunded, low priority, projects may be considered in the next Annual Work Plan.
H	Task 5.1.1.6 Assemble and review annual Scopes of Work to identify most suitable projects for funding and implementation.	PO, BOR	Annually	X	X	X	X	X	X	If the Program Office, in consultation with the Service and the Program's Coordination Committee and technical committees, identifies an action that may facilitate the recovery of the endangered fish populations in the San Juan River and the action is not included in the Long-Range Plan, the Program Coordinator will forward to the Coordination Committee a recommendation for the inclusion of the action in the LRP, along with information on the identified action that the Coordination Committee needs to complete its review and approval of the recommendation. Approval will be based on whether the LRP accurately reflects the best scientific information available, the efficient implementation of recovery goals, and the management actions of the Program.
	Action 5.1.2 Oversee and Conduct Endangered Species Act Compliance									
H	Task 5.1.2.1 Administer Program and review BOs consistent with the Program's Principles	PO	Ongoing	X	X	X	X	X	X	The Program is intended to provide measures for compliance with the ESA for water development and water management activities in the San Juan River Basin. The Coordination Committee in 2001 adopted the *Principles for Conducting Endangered Species Act section 7 Consultations on Water Development and Water Management Activities Affecting Endangered Fish in the San Juan River Basin (Principles)*. The Principles constitute a guide to define how Program actions will be used to provide ESA compliance for water development and water management activities.
H	Task 5.1.2.2 Monitor and ensure implementation of Program actions identified as RPAs and RPMs in BOs	PO	Ongoing	X	X	X	X	X	X	The Program Office will ensure necessary actions are being implemented to meet the requirements of the BOs that rely on the Program for ESA compliance. The Coordination Committee will be informed of any problems or issues that may arise according to the Principles

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 5.2— Ensure Integration and Synthesis of Information to Evaluate Program Progress Toward Recovery *SOW 11-29*									
	Action 5.2.1 Synthesize and evaluate information from all studies for Program to evaluate progress toward recovery.									
H	Task 5.2.1.1 Establish and maintain a Program database of information collected under the various Program projects including all rare fish collections.	PO	Annually	X	X	X	X	X	X	The Program Office will maintain and continually improve a comprehensive database to centralize data for all Program activities, including monitoring, stocked fish, nonnative fish control, etc. The database includes all rare fish collection information in a relational database for use by Program participants.
H	Task 5.2.1.2 Conduct annual Program reviews and develop annual reports that integrate monitoring and research data and results to track and assess yearly Program progress toward recovery.	PO, BC	Annually	X	X	X	X	X	X	The Program Office will annually review Program progress to include review and evaluation of progress, annual, and final reports; as well as all monitoring, recovery and research activities, data and results. The Program Office will ensure, in coordination with Program committees, that all required Program documents are completed on schedule and as needed to accomplish the Program purpose and goals. This report will assess the preceding year's monitoring data, progress toward recovery, and adaptive management recommendations, including recommendations for changes in direction, termination of projects, new projects, or other pertinent recommendations.
H	Task 5.2.1.3 Conduct a biennial comprehensive review and assessment of Program progress towards recovery (i.e., Sufficient Progress Report).	PO, BC	Every two years		X		X		X	The Program Office will prepare on a biennial basis a "Sufficient Progress" assessment of the Program's progress towards recovery, the Program's ability to provide ESA compliance for water development and management activities, and any corrective actions needed to ensure future ESA compliance. A "Sufficient Progress" Report was completed in 2010.
	Action 5.2.2 Ensure new information is identified and developed, as necessary to achieve Program goals and Assess Progress Toward Recovery	PO								
C	Task 5.2.2.1 Coordinate and oversee development of revisions to the SJRB Hydrology Model and the Program's flow recommendations	PO, BOR	Ongoing	X	X					The Program Office will work with Reclamation and other Program participants to improve, maintain, and utilize the Hydrology Model for use in revising the SJR flow recommendations. Hydrology Model Gen 3 will be completed in 2011; flow recommendations revisions will begin in 2012.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
C	Task 5.2.2.2 Develop positive population response criteria for the Colorado pikeminnow for 2012-2016 to meet recovery demographic criteria for downlisting and delisting specified in recovery goals/plans adopted by the Service.	FWS, PO, BC		X						This process will involve coordinating with the BC to: 1) evaluate past positive population response criteria for Colorado pikeminnow to develop reasonable criteria for the future; 2) determine the cause of not meeting 2007-2011 positive population response criteria; 3) Identify any additional management actions necessary to attain those criteria that should be carried out by the Program; and, 4) revaluate and update the criteria in 2016.
C	Task 5.2.2.3 Develop positive population response criteria for the razorback sucker for 2012-2016 to meet recovery demographic criteria for downlisting and delisting specified in recovery goals/plans adopted by the Service.	FWS, PO, BC								This process will involve coordinating with the BC to: 1) evaluate past positive population response criteria 2007-2011; 2) develop a new set of criteria for 2012 and beyond that leads to achievement of demographic criteria for down listing and delisting consistent with the revised recovery goals; 3) Identify any additional management actions necessary to attain those criteria that should be carried out by the Program; and, 4) revaluate and update the criteria in 2016.
C	Task 5.2.2.4 Identify and evaluate limiting factors and determine necessary research to identity actions that will minimize or remove these limiting factors	FWS	Ongoing	X	X	X	X	X	X	The Program Office will use previous and current data and information from habitat assessments, nonnative fish efforts, ongoing investigations to characterize dynamics of native fishes and their response to management activities intended to improve status of listed species, water quality assessments, and data collected to better define the interdependence of protected and unprotected native species to evaluate and identify potential limiting factors.
C	Task 5.2.2.5 Use monitoring and research information to evaluate and use adaptive management strategies to modify recovery activities, as necessary, to ensure progress toward recovery**.**	FWS	Ongoing	X	X	X	X	X	X	In coordination with the Program's technical committees, use adaptive management strategies to eliminate, add, or adjust monitoring and research activities and management actions to obtain needed information and improve species and habitat status and condition.
	Action 5.2.3 Ensure Scientific Integrity of Program Information and Coordination with other Associated Programs, Projects, and Studies									
H	Task 5.2.3.1 Maintain a standardized process for peer review by qualified specialists in appropriate technical disciplines for significant Program science projects and reports.	PO, BOR	Annually	X	X	X	X	X	X	The Program Office will ensure that a standardized process for peer review is maintained. This review will be done by qualified specialists in appropriate technical disciplines for significant Program science projects and reports. *SOW 11-31*

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
H	Task 5.2.3.2 Coordinate in activities of the Upper Colorado River Endangered Fish Program and other related programs and promote participation by SJRRIP partners.	PO, BC	Ongoing	X	X	X	X	X	X	The Program Office will participate in the five-year status review, updating of recovery goals for Colorado pikeminnow and razorback sucker, and preparing combined documents and reports (e.g., Report to Congress). SJR researchers and partners will be encouraged to participate in meetings such as the Upper Basin Researcher's Meeting to exchange information, reduce redundancy, and learn new techniques.
	Goal 5.3—Facilitate Contract and Funding Management. ***SOW 11-33***									
	Action 5.3.1 Ensure appropriate and legal contract and funding practices.									
C	Task 5.3.1.1 Maintain and distribute annual base and capital funds allocated under the Annual Work Plan by each funding source.	BOR, PO	Annually	X	X	X	X	X	X	The Program Office will work with the Bureau of Reclamation to maintain and distribute all annual base and capital funds allocated under the Work Plan by each funding source. Reclamation will administer the Program contracts funded with power revenues or state/local cost-shares. This task includes development of scopes of work, advertising of requests for proposals, managing the contractor selection process, contracting with the selected contractor, monitoring and reporting of performance to the Program, ensuring contractor compliance with the contract, and closeout of the contract.
H	Task 5.3.1.2 Administer Program contracts and provide an accounting of Program funds expended at the end of each federal fiscal year.	BOR, PO	Annually	X	X	X	X	X	X	Reclamation will provide an accounting of Program funds and any matching funds from other sources within 60 days of the end of each federal fiscal year. An accounting of funds expended during the preceding year will be provided to the Program after the end of each federal fiscal year.
H	Task 5.3.1.3 Manage Capital Improvement Program to maintain records showing the distribution and expenditures of capital funds under the Annual Work Plan by each funding source, and provide an accounting of funds expended at the end of each federal fiscal year.	BOR, PO	Annually	X	X	X	X	X	X	Reclamation will manage the Capital Improvement Program and work with the Program Office to maintain records showing the distribution and expenditures of capital funds expended under the Work Plan by each funding source. An accounting of funds expended during the preceding year will be provided at the end of each federal fiscal year.

Table A6. Tasks, priorities, responsibilities, dates, and descriptions for Element 6.—Information and Education.

P	Tasks	Who	Status	FY 11	FY 12	FY 13	FY 14	FY 15	Out Years	Description
	Goal 6.1—Increase Public Awareness and Support for the Endangered Fishes and the Recovery Program. *SOW 11-34*									
	Action 6.1.1 Provide information to the public on the Recovery Program.									
H	Task 6.1.1.1 Provide public information through news articles, press releases, radio and television ads, and other media to inform the public of Program activities in collaboration with the UCRRP I&E Coordinator. Provide press releases routinely on the SJRIP for distribution to the media in Farmington, Durango, Albuquerque, and others in the basin.	PO	Ongoing	X	X	X	X	X	X	Public information will be provided through news articles, press releases, radio and television ads, and other media to inform the public of Program activities.
H	Task 6.1.1.2 Maintain a Recovery Program Website.	PO	Ongoing	X	X	X	X	X	X	http://www.fws.gov/southwest/sjrip/
H	Task 6.1.1.3 Develop SJRRIP brochure.	PO	Ongoing	X						A primary purpose of the brochure will be to give Principle Investigators Program information that can be given to individuals encountered on the river.
	Action 6.1.2 Coordinate public outreach with Upper Basin Recovery Program.									
H	Task 6.1.2.1 Develop and maintain a formal outreach support agreement between the San Juan River Basin Recovery Implementation Program and the Upper Colorado River Endangered Fish Recovery Program.	PO	Annually	X	X	X	X	X	X	A formal outreach support agreement will be executed and maintained between the San Juan River Basin Recovery Implementation Program and the Upper Colorado River Endangered Fish Recovery Program.
H	Task 6.1.2.2 Develop and exchange information and materials to incorporate into PowerPoint presentations, newsletters, Program highlights and Program displays.	PO	Ongoing	X	X	X	X	X	X	The I&E coordinator will develop and exchange information and materials to incorporate into PowerPoint presentations, newsletters, Program highlights and Program displays.
H	Task 6.1.2.3 Participate in selected outreach efforts at local, state, and regional water development conferences.	PO	Ongoing	X	X	X	X	X	X	The I&E program will participate in selected outreach efforts at local, state, and regional water development conferences.

Appendix B. Completed Long-Range Plan Tasks *(from 2009 LRP Elements 1-7)*

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Goal 1.1—Describe Biotic and Abiotic Baseline Conditions.					
Action 1.1.1 Determine the relative abundance and distribution of endangered fishes, as well as other native and nonnative fishes in the San Juan River Basin.					
Task 1.1.1.1 Conduct ichthyofaunal surveys of mainstem, tributary streams, and secondary channels to determine fish species associated with these habitats.	Medium (Completed)	FWS, NMGF, BC	1987	1997	Ichthyofaunal surveys were during 1987-1989 (Platania 1990) to determine the size of the remaining CPM population and to characterize the fish population of the San Juan River. Additional surveys were done during the 7-Year Research Program.
Task 1.1.1.2 Conduct radio telemetry investigations to help define species distributions, movements, spawning sites, and habitat use.	Medium (Completed)	FWS	1991	2000	Although this task was completed (Ryden 2000; Miller and Ptacek 2000), more radiotelemetry work may be necessary to better understand habitat use and movement of newly established populations of CPM and RBS.
Task 1.1.1.3 Monitor the distribution and abundance of wild fish populations in the San Juan River to document status and trends.	High (Completed)	BC	1991	1997	Results of the 7-Year Research Program were assimilated (Holden 2000) and strategies for research and monitoring were developed.
Action 1.1.2 Describe life history parameters of wild CPM and RBS.					
Task 1.1.2.2 Locate and describe areas of reproductive activity and nursery habitats to better understand species spawning needs.	High (Completed)	FWS, BC, NMGF	1991	1997	Reproduction should be documented from capture of ripe and gravid fish, drifting larvae, and age-0 fish. Wild adult CPM were radio-tracked during 1991-1997 (Ryden 2000) and in 1993-1994 to assess habitat use (Miller and Ptacek 2000). Results of the 7-Year Research Program were assimilated (Holden 2000) and strategies for research and monitoring were developed
Task 1.1.2.3 Describe and quantify habitats	High	FWS, NMGF	1991	1997	Capture locations of RBS and CPM should be

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
selected by various life stages of CPM and RBS.	(Completed)				described and quantified and river flows documented. Results of the 7-Year Research Program were assimilated (Holden 2000) and strategies for research and monitoring were developed
Action 1.1.3 Describe and evaluate flow, habitat, and other abiotic relationships.					
Task 1.1.3.1 Describe, model and evaluate different flow regimes.	High (Completed)	FWS, BOR	1995	1997	Requested releases have been evaluated for response of habitat (Pucherelli and Clark 1990; Pucherelli and Goettlicher 1992; Goettlicher and Pucherelli 1994; Bliesner and Lamarra 2002) and fish (Propst et al. 1999).
Task 1.1.3.2 Determine response of geomorphology and habitat to flow with the use of habitat mapping and river geomorphology.	High (Completed)	FWS, NMGF	1995	1997	Relationships have been developed between channel geomorphology, mesohabitats, and river flow to identify flows that maximize habitat of various life stages of RBS and CPM (Archer and Crowl 2000b; Archer et al. 2000; Bliesner and Lamarra 2000, 2007; Gido and Propst 1999; Lamarra 2004; Miller and Ptacek 2000). River reaches with simple, moderate, and complex channels have been mapped for geomorphic features and mesohabitats.
Action 1.1.4 Identify and evaluate limiting factors and determine necessary research to identity actions that will minimize or remove these limiting factors.					
Task1.1.4.1 Compile, evaluate, and synthesize historic water quality information on the San Juan River to identify water quality parameters that may be detrimental to native and endangered fish species (e.g., mercury, selenium, polycyclic aromatic hydrocarbons [PAHs]).	Highest	BC, BOR	1991	1997	Based on data collection and evaluation during the 7-year research period, the BC concluded that water quality in the San Juan River was not a limiting factor to recovery of the endangered fishes or to restoration and maintenance of the native fish community. Years of monitoring and research have not clearly linked water contaminants and pollutants with adverse effects to the Colorado pikeminnow and razorback sucker

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
					(Abell 1994). In a synoptic study of contaminants data from the 7-year research period, Simpson and Lusk (1999) concluded harm from selenium as a contaminant issue for the razorback sucker.
Task 1.1.4.2 Determine and quantify mesohabitat types and channel forms used by native and endangered fish.	High (Completed)	FWS, NMGF	1991	1997	Primary habitats used by wild fish have been documented (Archer and Crowl 2000b; Archer et al. 2000; Bliesner and Lamarra 2000, 2007; Gido and Propst 1999; Lamarra 2004; Miller and Ptacek 2000).
Task 1.1.4.3 Evaluate effects of nonnative fish on native and endangered species and identify the most problematic nonnative species.	Highest (Completed)	FWS, NMGF	1996	1999	Initial evaluation of nonnative fish in the San Juan River has been completed (Brooks et al. 2000; Propst and Hobbes 2000).
Task 1.1.4.4 Estimate numbers of wild CPM and RBS in the San Juan River Basin and evaluate prospects for reestablishment of populations with and without hatchery augmentation.	High (Completed)	FWS, NMGF, BC	1991	1997	Numbers of wild CPM and RBS were found to be low in the San Juan River (Holden 2000).
Task 1.1.4.5 Survey health of fish in the San Juan River to ensure adequate protection from diseases and parasites.	Highest (Completed)	FWS	1998	2000	Fish health surveys were conducted on the San Juan River during 1992-1997 (Landye et al. 2000).
Action 1.1.5 Synthesize and integrate information to describe baseline conditions and to guide future actions.					
Task 1.1.5.1 Synthesize, integrate, and evaluate the 7-year research program.	High (Completed)	FWS, NMGF		2000	A 7-Year Research Program was conducted 1991-1997 (Holden 2000). This effort helped to provide baseline information for the ichthyofauna of the San Juan River. During this program effort, methods were sometimes modified to meet the exigencies of the San Juan River, to incorporate new information and technologies, and to improve efficiency and quality of data collected.
Goal 1.2—Develop New Information as Necessary.					
Action 1.2.3 Assemble information from nonnative fish capture information.					

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Task 1.2.3.1 Use data and information gathered from nonnative fish efforts to describe best strategies for minimizing negative impacts to native and endangered fish species.	Highest (Initial phase completed)	FWS, NMGF	2000	2005	A pilot study and ongoing investigations have been conducted to implement and evaluate the best strategies for controlling nonnative fish. Ongoing evaluation is needed, including assessment of new technologies for controlling nonnative fishes.
Goal 2.1—Establish a Genetically and Demographically Viable, Self-Sustaining CPM Population.					
Action 2.1.1 Develop plans for rearing and stocking CPM.					
Task 2.1.1.1 Develop a genetics management plan to guide artificial propagation and ensure genetic diversity and viability of CPM.	Highest (Completed)	FWS, DNFH		2003	A Genetics Management Plan for RBS and CPM was developed in 2003 (Crist and Ryden 2003).
Task 2.1.1.2 Develop an augmentation plan for CPM to provide a strategy for producing, rearing, and stocking fish.	Highest (Completed)	FWS		2003	An Augmentation Plan for CPM was developed in 2003 (Ryden 2003).
Action 1.1.2 Produce, rear, and stock sufficient numbers of CPM to meet stocking goals of augmentation plan.					
Task 1.1.2.1 Annually produce and rear at least 300,000 age-0 (50–55 mm TL) and 3,000 age-1 CPM at Dexter NFH.	Highest (Completed)	FWS, DNFH	2000	2009	At least 300,000 age-0 (50–55 mm TL) CPM will be produced and reared annually at the Dexter NFH for an 8-year period, 2002–2009. Analyses showed no survival advantage to stocking age-1 CPM. Goal revised in 2010 to produce, rear, and stock 400,000 age-0 CPM.
Task 1.1.2.2 Annually stock >300,000 age-0 CPM.	Highest (Completed)	FWS, DNFH	2000	2009	At least 300,000 age-0 (50–55 mm TL) CPM will be released annually from the Dexter NFH, into the San Juan River for an 8- year period, 2002–2009. See above.
Task 1.1.2.3 Annually stock 3,000 age-1 CPM.	Highest (Completed)	FWS, DNFH	2000	2009	A total of 3,000 age-1 CPM will be stocked and PIT tagged annually in the San Juan River through 2009. No age-1 CPM will be stocked beginning in 2011.
Goal 2.2—Establish a Genetically and Demographically Viable, Self-Sustaining RBS Population.					
Action 2.2.1 Develop plans for rearing and stocking RBS.					

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Task 2.2.1.1 Develop a genetics management plan to guide artificial propagation and ensure genetic diversity and viability of RBS.	Highest (Completed)	FWS, BC		2003	A Genetics Management Plan for RBS and CPM was developed in 2003 (Crist and Ryden 2003).
Task 2.2.1.2 Develop an augmentation plan for RBS to provide a strategy for producing, rearing, and stocking fish.	Highest (Completed)	FWS, BC		2003	An experimental stocking program for RBS was conducted 1994-1997. An Augmentation Plan for RBS was developed in 1997 (Ryden 1997) for a 5-year period, 1997-2001, and recommended stocking 73,482 RBS; only 5,890 were stocked for a lack of hatchery and grow-out facilities. An addendum to the plan was developed in 2003 (Ryden 2003) to extend the program for 8 years, 2004-2011, and recommended stocking 91,200 age-2 RBS (> 300 mm TL) or 11,400 annually.
Goal 3.1—Provide Suitable Flows to Support Recovery of CPM and RBS Populations.					
Action 3.1.1 Develop flow regimes to provide adequate base flow and function to maintain habitat for CPM and RBS.					
Task 3.1.1.1 Identify and develop flow recommendations for the San Juan River.	Highest (Completed)	BC		1999	Flow Recommendations for the San Juan River were developed and implemented in 1999 (Holden 1999).
Goal 3.3—Provide Increased Range to Support Recovery of CPM and RBS Populations.					
Action 3.3.1 Provide and maintain fish passage at diversion structures.					
Task 3.3.1.1 Identify and evaluate fish barriers in the San Juan River.	Highest (Completed)	BC		1996	Fish barriers were identified and evaluated in 1996 by Masslich and Holden (1996).
Task 3.3.1.2 Remove Cudei Diversion to provide fish passage.	Highest (Completed)	BIA, NN		2001	The Cudei Diversion was removed in 2001. The Cudei Diversion is owned by the Navajo Nation.
Task 3.3.1.3 Provide and maintain fish passage at the Hogback Diversion.	Highest (Completed)	BIA, NN		2002	Fish passage at Hogback Diversion was completed in 2002. The Hogback Diversion is owned by the Navajo Nation.

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Task 3.3.1.4 Provide and maintain selective fish passage at the Public Service Company of New Mexico (PNM) Weir.	Highest (Completed)	FWS, NN		2003	Fish passage at Public Service Company of New Mexico (PNM) Weir was completed in 2003.
Action 3.3.2 Evaluate fish passage for native and endangered fish species to and from Lake Powell in light of a natural waterfall at low reservoir elevations.					
Task 3.3.2.1 Identify extent of problem from natural waterfall on passage of native and nonnative fish from Lake Powell into the San Juan River.	High (Completed)	FWS, BOR, BC	2009	2010	The extent that the natural waterfall in the lower San Juan River impedes fish migration should be determined. BOR assessed the risk for predators recolonizing the river when water level in Lake Powell rises to a level that the waterfall is inundated. They concluded that there is a 60 to 75% chance the waterfall will be inundated for a total of 30 months (not necessarily continuously) between 2008 and 2030. Probabilities for longer inundation are available (6-26-07 CC Meeting).
Goal 3.4—Provide Suitable Water Quality to Support Recovery of CPM and RBS Populations.					
Action 3.4.2 Evaluate effects of river temperature on native and endangered fish.					

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Task 3.4.2.1 Determine if cold water releases from Navajo Dam into the San Juan River impede endangered fish reproduction or limit endangered fish populations downstream of the Animas River.	High (Completed)	BC		2006	Based on the reports, *SJR Fishes Response to Thermal Modification – A White Paper Investigation* (Lamarra 2007) and Cutler (2006) *Navajo Reservoir and SJR Temperature Study*, the BC determined a temperature control device (TCD) was not warranted. Impacts to spawning and rearing from cold releases from Navajo Dam into the SJR appeared to be minimal. Spawning is determined by time-of-year more than temperature cue. A TCD may provide seasonal range expansion above critical habitat but is unknown if range expansion above critical habitat is necessary for recovery. More information is needed (BC Meeting, May 17-18, 2007).
Goal 4.1—Control Problematic Nonnative Fishes as Needed.					
Action 4.1.1 Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish.					
Task 4.1.1.1 Identify and prioritize the most problematic nonnative fish species.	Highest (Completed)	BC	2000	2003	This determination was made through a risk assessment and consensus of biologists. Davis (2003) identified channel catfish and common carp as the most problematic species.
Task 4.1.1.2 Design and implement a pilot program to evaluate nonnative fish control strategies and gears.	Highest (Completed)	FWS	2000	2003	The Nonnative Fish Monitoring And Control Plan (Davis 2003) served as a pilot program and identified removal reaches and evaluated sampling gears and strategies.
Task 4.1.1.3 Develop a long-term nonnative fish control strategy and specific objectives for nonnative fish control...	Highest (Completed)	FWS	2009	2010	A nonnative fish control strategy will be developed and implemented for the San Juan River. This strategy will identify removal tactics, gear types, personnel, and costs necessary to meet removal criteria established in Task 5.1.1.2.
Goal 5.2—Monitor Habitat Use and Availability.					
Action 5.2.3 Identify and refine habitat/fish relationships.					

Tasks	Recovery Goals Priority	Primary Responsibility	Start Date	Completion Date	Description and Comments
Task 5.2.3.4 Collect geo-referenced habitat and fish use habitat data in at least two selected reaches with complex morphology to determine habitat selection.	High (Pilot study completed in 2010)	BC	2007	2009	Geo-referenced habitat association data will be collected with fish capture data, as feasible, to provide habitat use data for RBS and CPM of all life stages.
Task 5.2.3.5 Map at high resolution and monitor changes in habitat in at least two selected reaches with complex morphology at different flows.	High (Pilot study completed in 2010)	BC	2007	2010	This task will use bankfull channel area, island counts, and bed-form topographic data to monitor response of at least two selected reaches with complex morphology and habitat to flow recommendations (2005-2009).
Task 5.2.3.6 Refine and standardize habitat classification for consistent use with fish sampling and habitat mapping.	High (Completed)	BC	2007	2010	A standard habitat classification system is needed that can be used for fisheries, hydrology, and geomorphology.
Goal 5.3— Integrate And Synthesize Monitoring Data And Information To Evaluate Fish Community And Ecosystem Responses To Recovery Actions.					
Action 5.3.1 Develop fish community and ecosystem response strategies					
Task 5.3.1.2 Develop an ecosystem model specific to the San Juan River and present it for approval by the Biology Committee.	Medium (Completed)	BC, FWS	2000	2005	Completed in 2000-2005. The Program may choose to further develop an ecosystem model specific to the San Juan River to assist in evaluating possible responses by fish species to management actions.
Task 5.3.1.3 Hold workshop on ecosystem model specific to the San Juan River to evaluate model and determine future direction of this effort	Medium (Completed)	FWS, BC	2007	2007	Workshop held in 2007.
Goal 7.1—Facilitate Program Planning and Management.					
Action 7.1.1 Develop and coordinate a Program plan.					
Task 7.1.1.1 Develop and implement a Long-Range Plan as a framework for ongoing and future Program activities.	Highest (Completed)	PO	1995	1995	A Long Range Plan was developed in 1995 (San Juan River Basin Recovery Implementation Program 1995).