Upper Colorado River Endangered Fish Recovery Program

RECOVERY IMPLEMENTATION PROGRAM
SECTION 7 CONSULTATION, SUFFICIENT PROGRESS,
AND HISTORIC PROJECTS AGREEMENT
October 15, 1993 (Revised March 8, 2000)

AND

RECOVERY IMPLEMENTATION PROGRAM
RECOVERY ACTION PLAN
(RIPRAP)

June 12, 2020

PREFACE

This document was originally finalized on October 15, 1993. Part One received a minor revision on March 8, 2000, to accommodate programmatic biological opinions. Part Two has been revised to accommodate annual updates, designation of critical habitat for the endangered fishes, and development of specific recovery goals for each of the species.

PART ONE: Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement

Sections 4.1.5, 4.1.6, and 5.3.4 of the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) outline procedures for consultation pursuant to Section 7 of the Endangered Species Act on water projects in the Upper Colorado River Basin. The Section 7 Agreement (including Section 7 Consultation, Sufficient Progress, and Historic Projects Agreement) was developed by Recovery Program participants to clarify how Section 7 consultations will be conducted on water depletion impacts related to new projects and impacts associated with historic projects (existing projects requiring a new Federal action) in the Upper Basin.

PART TWO: Recovery Implementation Program Recovery Action Plan

The Recovery Implementation Program Recovery Action Plan (RIPRAP) was developed by the Recovery Program participants in support of the Section 7 Agreement using the best, most current information available and the recovery goals for the four endangered fish species. It identifies specific actions and time frames currently believed to be required to recover the endangered fishes in the most expeditious manner in the Upper Basin. The RIPRAP is the Recovery Program's long range plan. It contains dates for accomplishing specific actions over the next 5 years and beyond. The RIPRAP is a measure of accomplishment the U.S. Fish and Wildlife Service (Service) uses to determine if the Recovery Program can continue to serve as a reasonable and prudent alternative for projects undergoing Section 7 consultation to avoid the likelihood of jeopardy to the continued existence of the endangered fishes as well as to avoid the likely destruction or adverse modification of critical habitat.

PART ONE:

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PART TWO:

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RECOVERY ACTION PLAN (RIPRAP)

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1.0 INTRODUCTION

1.1 RECOVERY PROGRAM PURPOSE

The purpose of the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin (Recovery Program) is to recover the humpback chub (*Gila cypha*), bonytail (*G. elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), and razorback sucker (*Xyrauchen texanus*) while existing and new water development proceeds in the Upper Basin (i.e., Upper Colorado River Basin upstream of Glen Canyon Dam, excluding the San Juan River; Cooperative Agreement, 1988) in compliance with the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et. seq.*), state water and wildlife law, interstate compacts, and authorized purposes of Bureau of Reclamation projects. Further, the Recovery Program is intended to serve as a reasonable and prudent alternative to avoid the likelihood of jeopardy to the continued existence of the endangered fishes and to avoid the likely destruction or adverse modification of critical habitat in Section 7 consultations on depletion impacts[1] related to new projects and all impacts, except the discharge of pollutants such as trace elements, heavy metals, and pesticides, associated with historic water projects in the Upper Basin.

1.2 SPECIES RECOVERY GOALS/PLANS

The overall goal for recovery of the four endangered fishes is to achieve naturally self-sustaining populations and to protect the habitat on which those populations depend. Recovery plans for these species have been developed under Section 4(f) of the Endangered Species Act (ESA; U.S. Fish and Wildlife Service 1990a, 1990b, 1991, 1998), and the final rule designating critical habitat was published in the *Federal Register* on March 21, 1994 (59 FR 13374; Appendix). Once critical habitat was designated (see map on next page), the RIPRAP was reviewed by the Service and modified in coordination with the Management Committee. Final recovery goals for the four endangered fish, which amend and supplement the former recovery plans, were approved in August 2002 (U.S. Fish and Wildlife Service 2002a[2], 2002b, 2002c, 2002d).

The recovery goals describe what is necessary for downlisting and delisting each of the species by identifying site-specific management actions/tasks necessary to minimize or remove threats; establishing objective, measurable criteria that consider demographic and genetic needs for self-sustaining, viable populations; and providing estimates of the time to achieve recovery. In a lawsuit by Grand Canyon Trust over the humpback chub recovery goals, U.S. District Court 9th Circuit ruled that review of the substance of Service recovery plans is inappropriate under the Administrative Procedure Act and the

[1]Prior to 2009, the Service concluded that the impacts associated with any amount of water depletion in the Upper Colorado River resulted in a Section 7 jeopardy opinion. Since 2009, the Service requires action agencies to incorporate the Recovery Program and its associated recovery actions as applicant-committed Conservation Measures, which results in non-jeopardy biological opinions.

[2] The 2002 recovery goals for humpback chub were withdrawn and declared of no force and effect by court order on January 18, 2006, for lack of recovery timelines and estimated costs (*Grand Canyon Trust et al.,* v. *Gale Norton et al.*, No. 04-CV-636-PHX-FJM). The 2002 recovery goals were otherwise found to be scientifically sound and still serve as our quantifiable and measurable recovery criteria.

ESA, but ordered the goals vacated until time and cost estimates are updated. The Service is in the process of reviewing and updating the species recovery plans.

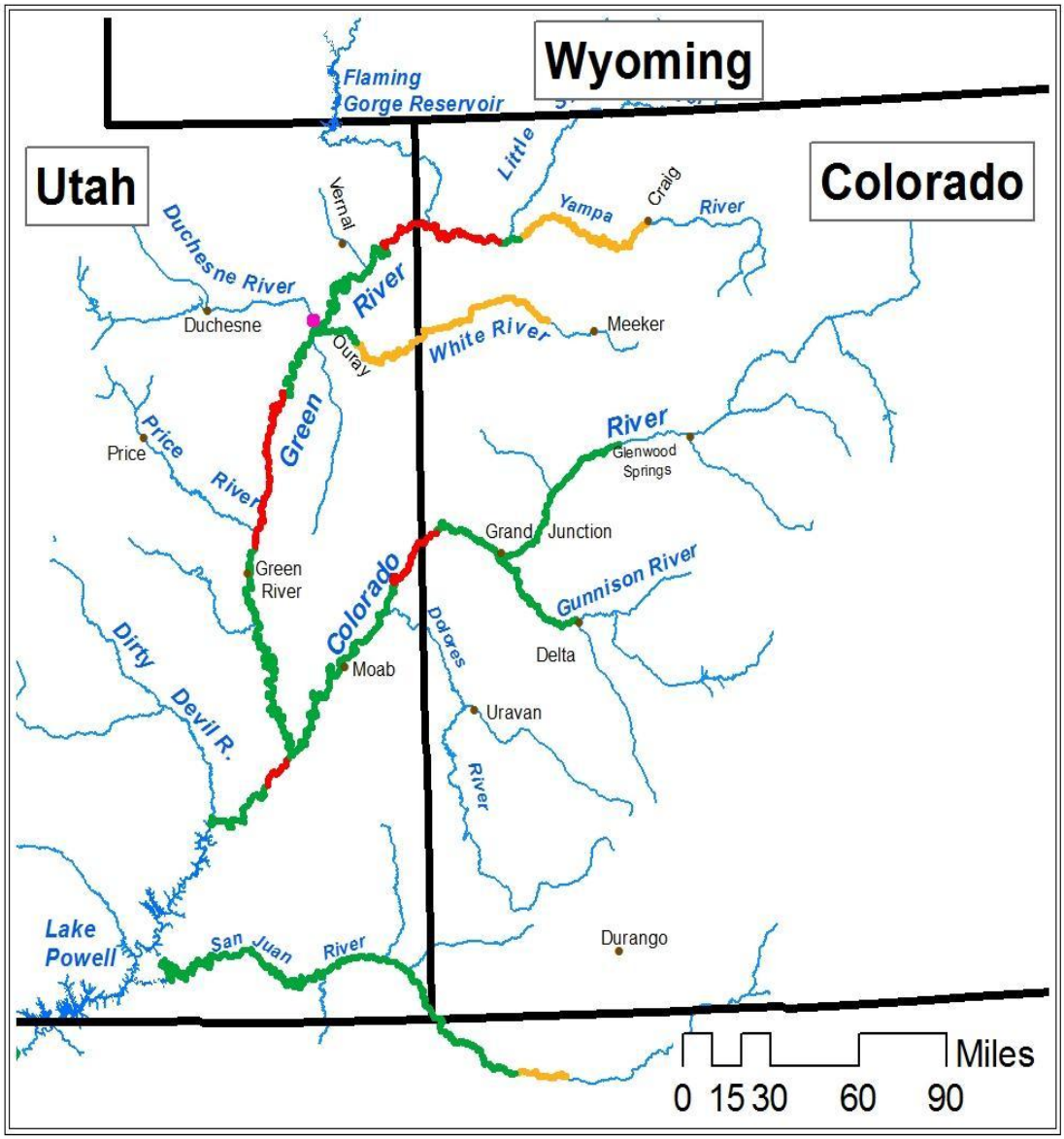
In the context of the recovery goals/plans, recovery of humpback chub, bonytail, and razorback sucker will occur in the Upper and Lower basins (each basin is treated as a "recovery unit"), with separate recovery criteria developed for each of the two recovery units. Based on the Colorado pikeminnow recovery plan, recovery of Colorado pikeminnow will occur in the Upper Colorado River Basin, including the San Juan River subbasin. The Recovery Program and the San Juan River Basin Recovery Implementation Program provide for the coordinated implementation of management actions/tasks to achieve recovery in the Upper Basin recovery unit.

Five-year status reviews were completed for Colorado pikeminnow and humpback chub in 2011 (USFWS 2011a; b) and for bonytail and razorback sucker in 2012 (USFWS 2012a; b). The reviews found that the species remain "endangered." Progress was indicated on whether a recovery factor criterion was "met", "partially met", or "not met."

In 2016, the Service convened a Humpback Chub Recovery Team, which finalized a species status assessment (SSA) in December of 2017 (USFWS 2017). The SSA framework is a focused, repeatable, and rigorous scientific assessment that provides the foundation for all of the Service's ESA policy decisions, such as listing, consultation, and recovery decisions. SSA reports characterize species needs, stressors, current condition, and determine species viability in multiple future scenarios. A five-year status review was completed in March of 2018, recommending downlisting of humpback chub from endangered to threatened (USFWS 2018a). The Service concluded the species no longer met the definition of endangered because of the persistence of multiple self-sustaining populations in the upper basin and a large, stable population in the lower basin. However, management and resource conditions of the species could change such that the species could become an endangered species in the foreseeable future (i.e., the species meets the ESA definition of threatened). A Proposed Rule to reclassify humpback chub was published in the Federal Register on January 22, 2020.

In light of expanding numbers and distribution of stocked razorback sucker, a SSA was initiated for the razorback sucker in late 2015 and was completed in 2018 (USFWS 2018b). A five-year status review followed publication of the SSA, recommending downlisting of the razorback sucker from endangered to threatened (USFWS 2018c). The Service concluded that due to ongoing management actions, the potential loss of one or more razorback sucker populations is not likely to occur now or in the short term. Therefore, the species currently has a low risk of extinction, as long as management actions continue at their current rate and effectiveness (i.e., the species does not meet the ESA definition of an endangered species). Without significant natural recruitment, adult populations depend entirely on continued captive propagation to persist into the future. Given the uncertainty and risk associated with the continuation and effectiveness of management actions, the Service concluded the razorback sucker could become an endangered species within the foreseeable future (i.e., the species meets the ESA definition of threatened).

Designated Critical Habitat in the Upper Colorado River Basin for Federally Listed Colorado River Fish



Upper Colorado River Endangered Fish Recovery Program

Legend

Critical Habitat

- Colorado Pikeminnow
- Razorback Sucker
- Razorback Sucker, Colorado Pikeminnow
- Razorback Sucker, Colorado Pikeminnow, Bonytail Chub, Humpback Chub

State Boundaries

Created by Kevin McAbee using FWS & USGS data. March 11, 2016.

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In 2012, the Service convened a Colorado Pikeminnow Recovery Team to revise that species' recovery plan to incorporate new information; the Recovery Team was expanded to include state partners in 2013. A draft Recovery Plan was reviewed by stakeholders in 2015. The stakeholders asked the Service to defer further revision of the plan until a population viability analysis (PVA) and species status assessment (SSA) can be prepared. The PVA was completed in 2018. A draft SSA was submitted for review in January 2020.

The Program Director's office has recommended deferring update of the bonytail recovery plan until new information warrants, and completed a five-year status review in June 2019.

1.3 RECOVERY ACTION PLAN PURPOSE

This Recovery Implementation Program Recovery Action Plan (RIPRAP) has been developed and updated using the best, most current information available on the species' status and the recovery goals for the four endangered fish species. The RIPRAP is intended to provide an operational plan and schedule for implementing recovery actions by the Recovery Program, including development of the Recovery Program's annual work plan and future budget needs. Specifically, the RIPRAP identifies the actions that are necessary to recover the endangered fishes, including schedules and budgets for implementing those actions. Accomplishment of these recovery actions allows the Recovery Program to provide ESA compliance for depletion impacts of new projects and all existing or past impacts related to water projects in place when the Recovery Program was initiated (January 21, 1988) (historic water projects), except impacts from contaminants, in accordance with the October 15, 1993 Section 7 Agreement (Revised March 8, 2000). The RIPRAP was incorporated and is considered part of that Agreement.

1.4 ESTIMATED COST OF RECOVERY ACTIONS

The estimated total budget for the Recovery Program from FY 2018–FY 2023 is approximately $56 million[3]. Funding for the Recovery Program is expected to come from the following sources:

a. An annual operating budget of approximately $7.5 million. PL 116-9 (March 2019), which reauthorized PL 112-270 and PL 106-392, authorized annual appropriations of approximately $5.7 million for the full suite of the Recovery Program's actions through FY2023, with the exception of capital projects. PL 116-94 (Division C, Title III Sec 307) (December 2019) directed hydropower revenues from the Colorado River Basins Power Marketing Fund to carry out these endangered species recovery efforts in FY 2020. The remainder of annual funds are provided by the Service and the states of Colorado, Utah, and Wyoming. Additional annual funding will come from one-time water

[3] Expenditures to date may be found in the pie charts of the 2020 Financial Summary which accompanies the most recent *Program Highlights* briefing document.

development depletion fees on new projects (post-January 21, 1988). Under the Recovery Program, proponents of new water projects, which undergo Section 7 Endangered Species Act consultation, pay a one-time depletion fee based on a project's average annual depletion. The rate is adjusted annually for inflation. As of October 1, 2019, the fee was $22.13 per acre-foot; the rate increases to $22.53 per acre-foot as of October 1, 2020. The actual rate of water development has not been projected therefore it is difficult to predict the amount of funding provided by this source on an annual basis. Through FY2019, depletion fees and interest earned on these fees totaled approximately $3,400,000. These funds may be accumulated and are used to fund recovery actions pursuant to decisions made by the Recovery Program on an annual basis.

b. Approximately $8 million will be spent through appropriations between FY 2020 and FY 2023 for remaining capital projects; an additional $1M will be provided from the State of Colorado. P.L. 106-392 authorized capital funding in October 2000; P.L. 107-375 extended construction authority from 2005 to 2008; and P.L. 109-183 authorized Federal appropriations through 2010, increased authorized Federal appropriations from $46 million to $61 million, and increased the capital-funding total from $62 million to $77 million plus adjustments for inflation to the Federal portion. In March 2009, Section 9107 of P.L. 111-11 authorized an additional $15 million in federal funds and extended the capital construction period through 2023.

1.5 MEASURING PROGRESS TOWARD RECOVERY AND SCHEDULING RIPRAP ACTIVITIES

To achieve recovery in the Upper Basin, it is essential to fully implement all of the actions in the RIPRAP. This can be accomplished only through cooperation by all Recovery Program participants. In general, actions will be scheduled such that recovery will be achieved in the most expeditious and cost-effective manner possible. However, the schedule may require some adjustment based on sequence and impacts of water development and management actions to ensure recovery of the endangered fishes while water development continues.

The Recovery Program continually evaluates the outcome of completed RIPRAP actions to determine their effectiveness in contributing to recovery. Ultimately, success of recovery actions will be measured by species response (change in population size, distribution, composition, etc.). However, it may be many years before such responses are evident. In the interim, the Recovery Program also will gauge its progress towards recovery by accomplishment of the actions identified in the RIPRAP. Toward that end, Program participants assess progress and update the RIPRAP annually.

1.6 RECOVERY ACTION PLAN STRUCTURE

The substance of the RIPRAP is in Section 4.0, where the specific recovery actions are listed in the RIPRAP tables. In addition, significant accomplishments and shortcomings

of the past year are identified in the RIPRAP tables, developed as part of the Recovery Program's annual assessment and update of the RIPRAP.

The RIPRAP tables schedule activities through 2023 (the Recovery Program's Cooperative Agreement is effective through September 30, 2023). Activities that have led to recovery of the endangered fishes will need to be continued after these species are delisted or the Recovery Program ends. Therefore, the RIPRAP tables identify the activities that Program participants anticipate will continue post-Program. Current funding legislation (PL 116-9) includes language that commits the Recovery Program to work with the Secretary of the Interior to submit a Report to Congress by the end of FY 21 that describes recovery actions and associated costs that should occur after 2023.

The first section of the Recovery Action Plan tables identifies general support activities important to the success of the Recovery Program. The subsequent sections that follow the General Recovery Action Plan are for the Green and Colorado rivers and their subbasins in the Upper Basin. Each subbasin table includes recovery actions arranged by the "recovery elements" listed below:

I. Identify and protect instream flows;
II. Restore and protect habitat;
III. Reduce negative impacts of nonnative fishes and sportfish management activities;
IV. Conserve genetic integrity and augment or restore populations;
V. Monitor populations and habitat and conduct research to support recovery actions;
VI. Increase public awareness and support for the endangered fishes and the Recovery Program (in the General Recovery Program Support table only); and
VII. Provide program planning and support (in the General Recovery Program Support table only).

Section 4.0 is provided in table format for ease of scheduling and tracking activities. A general discussion of activities under each recovery element and of recovery priorities in each subbasin is found in Sections 2.0 and 3.0, respectively.

2.0 DESCRIPTION OF RECOVERY ACTION PLAN ELEMENTS

The Recovery Action Plan tables contain brief descriptions of specific recovery actions in each subbasin. This section provides a general description of each recovery element. Specific recovery actions being carried out in each subbasin are discussed in Section 3.0.

2.1 I. IDENTIFY AND PROTECT INSTREAM FLOWS

Recovery cannot be accomplished without securing, protecting, and managing sufficient flows to provide habitat to support self-sustaining endangered fish populations.

Identification and protection of instream flows are key elements in this process. The first step in instream flow protection is to identify flow regimes needed by the fish, typically characterized in terms of peak and base flow needs over a range of hydrologic conditions. In the Recovery Program, determining flow needs is primarily the responsibility of the Service (in cooperation with other participants). Factors considered in determining flow needs include flow effects on reproduction and recruitment; flow effects on food supplies and nonnative fishes; and interrelationships between flow and other habitat parameters believed to be important for the fish, such as channel structure, sediment transport, substrate characteristics, vegetative encroachment, and water temperature. Flow recommendations often are made in stages, with initial flow recommendations based on the best available scientific information, historic conditions, and extrapolation from similar reaches. Recommendations then are refined following additional field research. The contribution of tributaries to recovery was ranked by Tyus and Saunders (2001).

Flow recommendations have been approved for reaches of the Colorado (Osmundson and Kaeding 1991; McAda 2003), Yampa (Modde and Smith 1995; Modde *et al.* 1999), Green (Muth *et al.* 2000), Gunnison (McAda 2003), and Duchesne (Modde and Keleher 2003) rivers. In addition:

- Interim flow recommendations for the White River were updated in 2019 (Anderson *et al.* 2019). The drafting of a White River management plan is expected to begin in 2020, which will ultimately serve as the basis for a White River programmatic biological opinion. This management plan will assess the likely impacts of possible future water development on meeting these flow recommendations, and propose Program actions to offset the impacts of water depletions.

- Under the Gunnison River Basin Programmatic Biological Opinion and Aspinall Unit Study Plan (2011), the Recovery Program is conducting monitoring to assess how well the operation of the Aspinall Unit contributes to meeting target flows in the Gunnison and Colorado rivers and to help determine if managed flows from the Gunnison and Colorado rivers are sufficient for recovery on the Colorado River between the Gunnison River and the Green River confluences.

- Flow and temperature recommendations for the Green River below Flaming Gorge Dam (Muth *et al.* 2000) were evaluated by a Recovery Program workgroup (the Green River Evaluation and Assessment Team, or GREAT). The GREAT's revised recommendations (LaGory *et al.* 2019) were approved by the Recovery Program technical committees in 2019; the Management Committee is expected approve the report in 2020. .

In 2012, USGS finalized results of a sediment transport study on three rivers in the upper Colorado River basin. Samples were collected on the Colorado River at Cameo, Stateline, and Cisco; on the Gunnison River at Grand Junction; and on the Green River at Jensen and the town of Green River (Williams *et al.* 2013). These results provide a

methodology that will help the Recovery Program understand how flow recommendations may be benefitting recovery of the endangered fishes. A team of experts convened in 2013 and 2014 to review the findings and to recommend methodologies to determine whether the current peak flow recommendations are achieving objectives. The resulting Peak Flow Technical Supplement (LaGory *et al.* 2015) offers a range of study approaches and prioritizes river reaches to evaluate the peak flow aspects of the Program's flow recommendations. A high priority is placed on collecting suspended sediment data within ongoing programs of NPS and USGS. In 2017, the Recovery Program funded USGS to expand the existing network of fine sediment monitoring stations in the Green River subbasin to include continuous monitoring near Jensen, UT and near Ouray, UT. Studies and monitoring recommended in the Supplement to address high priority information needs have been incorporated into the RIPRAP.

In 2011 and 2012, the Service and The Nature Conservancy formatted the Recovery Program's flow recommendations and three National Wildlife Refuge water rights for inclusion as non-consumptive water needs in the Colorado River Basin Water Supply and Demand Study (Basin Study) conducted by the Bureau of Reclamation. The study encompasses all seven Colorado River Basin States. It looks at current and future imbalances in water supply and demand in the basin and adjacent areas through 2060 including projected effects associated with climate change, and attempts to develop and analyze options and strategies to resolve imbalances. The final report was published in December 2012 (available at: http://www.usbr.gov/lc/region/programs/crbstudy.html). As per recommendation from the Basin Study and under the WaterSMART Grants program, a review of alternative decision support platforms and tools for incorporating ecological and recreational flows into water management for the Colorado River Basin was completed in 2013 (Alexander *et al.* 2013).

Colorado

In Colorado, the appropriation of an instream water right follows a structured process developed by the Colorado Water Conservation Board (CWCB). The process begins with a Service flow recommendation, which is reviewed by CWCB and Colorado Parks and Wildlife (CPW). Then CWCB issues a notice of intent to appropriate, followed by Board approval to appropriate. Finally, the Attorney General must make a water court filing to confirm the appropriation and to establish the appropriation's priority date. It may take 3 to 4 years from the notice of intent to appropriate to obtain a decree from the water court, depending on the nature of any litigation over the filing. In appropriation, the water right will have a relatively junior priority date (the date CWCB issued the notice of intent to appropriate). In some cases, the appropriation process has lacked support and thus proven to have limited use in the Recovery Program. Therefore, the Recovery Program adopted alternative means of legally providing and protecting flows in some reaches by combining water project re-operations and contracts for the delivery of storage water (e.g., Grand Valley Water Management Plan and deliveries from the Historic Users Pool at Green Mountain Reservoir), and has put programmatic biological opinions (PBOs) in place to monitor new depletions of existing flows on the Yampa,

Little Snake, Gunnison, and Colorado Rivers. Under these PBOs, the Recovery Program and the CWCB will periodically evaluate the need to appropriate new instream flow water rights in Colorado to legally protect such flows. Recovery Program participants anticipate that these methods will prove effective in ensuring instream flows for the endangered fishes.

Where flows are provided through re-operating a reservoir or other component of an existing or new water project, various contracts with reservoir owners and/or downstream beneficiaries may be needed to legally protect the deliveries from being diverted along intervening reaches. Contracts for the delivery and protection of storage releases may be combined with purchase of water rights in Colorado and their physical or legal transfer to supplement storage releases (e.g. Redtop Ditch). Water rights historically used for other purposes may also be purchased or leased in Colorado and temporarily or permanently transferred to instream use to increase and legally protect flows needed for recovery, but this method has not been used by the Program to date.

Utah

Utah officials believe that flows to the Lower Colorado River Basin under the Colorado River Compact have and will continue to ensure sufficient quantities of water remain in the Green River to satisfy the recommended flow requirements. Additional methodologies to protect stream flows exist in Utah but are limited. Current approaches include: 1) acquiring existing water rights and filing change applications to provide for instream flow purposes; 2) withdrawing unappropriated waters by governor's proclamation; 3) approving future applications subject to minimum flow levels; and 4) with proper compensation, preparing and executing contracts and subordinating diversions associated with approved and perfected rights. Although current Utah water law may not fully provide for all aspects of instream-flow protection, Utah can provide an increased level of protection.

This RIPRAP originally contemplated that the Utah State Engineer would establish, by policy, legal protection for endangered fish recommended flows. In 1994, the State Engineer adopted a policy to subordinate future water right application approvals to required fish flows during the summer and autumn periods from Flaming Gorge Reservoir to the confluence of the Duchesne River. There was little resistance to this initial policy adoption and few policy disputes ensued in subsequent years even though the State Engineer’s statutory authority to approve vested instream flow rights is limited to certain entities and circumstances. In 2006, the Utah State Engineer began a public process to extend the policy to protect recommended flows for endangered fish to all seasons and over the entire length of the Green River in Utah, pursuant to RIPRAP objectives. Public concern over the practical distribution implications associated with subordinating to recommended flows led to questions about the State Engineer’s authority to establish instream flow water rights. Ultimately, in 2009, the State Engineer concluded that other means to legally protect flows should be explored to avoid a contest over the extent of his statutory authority. The Recovery Program’s Water Acquisition Committee formed a task force to develop additional options for protecting fish flows on the Green River. In 2010, Utah identified a legal and technical process

and schedule to protect recommended year-round flows for the endangered fishes on the Green River in Utah (Utah Department of Natural Resources 2010). This schedule was updated in 2013, 2017, and requires updating again:

1) Identify issues, concerns and timeframe, 2007-2010
2) Prioritize potential methods and criteria for flow protection, 2009-2011
3) Amalgamate technical information needed to model and resolve issues, 2010-2011
4) Develop model for analysis of historic and future scenarios, 2010-2011
5) Analyze model results, 2017
6) Establish internal policy committee to work with Program partners to explore flow protection options, 2016-2018.
7) Obtain additional authority to protect flows, 2018
8) Implement legal protection in the future.

With the initial modeling of historic and future Green River water use and flow scenarios complete and the report in preparation, Utah now seeks to update their modeling to also incorporate the effects of the Bureau of Reclamation's recent 'Green River Block Exchange' contracting action (see below). Utah continues to make progress evaluating the most appropriate means to protect fish flows within the framework of State water law. An internal policy committee working on flow protection has been receiving input from other Program partners and continues to evaluate a variety of options being proposed.

In 2019, the Bureau of Reclamation signed a 'Green River Block Exchange Contract' with the State of Utah. This contract, currently under legal challenge, would help ensure that up to approximately 59,000 acre-feet of future new depletions on the Green River in Utah, exercised under Utah's existing Ultimate Phase water rights, would be offset by releases from Flaming Gorge Reservoir in a manner intended to help continue meeting the endangered fish flow recommendations in Reaches 1 and 2 of the Green River.

2.2 II. RESTORE AND PROTECT HABITAT

Important elements of habitat protection include restoring and managing in-channel habitat and historically flooded bottomland areas, restoring passage to historically occupied river reaches, preventing fish entrainment at diversion structures (if warranted), enhancing water temperatures, and reducing or eliminating the impacts of contaminants.

Historically, Upper Colorado River Basin floodplains were frequently inundated by spring runoff, but today many of the rivers are channelized by levees, dikes, riprap, and tamarisk. Fish access to flooded bottomlands has been further reduced by decreased peak spring flows due to upstream impoundments. Numerous studies have suggested the importance of seasonal flooding to river productivity, and flooded bottomlands have been shown to support high densities of zooplankton and benthic organisms that are important food sources for young native fish. Floodplain areas inundated and temporarily connected to the main channel by spring flows appear to be important

habitats for all life stages of razorback sucker and bonytail, and the seasonal timing of razorback sucker reproduction suggests an adaptation for utilizing these habitats. Restoring access to these warm and productive habitats is intended to provide the growth and conditioning environments that appear crucial for recovery of self-sustaining razorback sucker populations. In addition, juvenile Colorado pikeminnow use these areas for feeding and adults stage in these habitats prior to migrating to spawning areas. Inundation of floodplain habitats, although most important for razorback sucker, will benefit bonytail and other native fishes by providing growth and conditioning environments and by restoring ecological processes dependent on periodic river-floodplain connections. Restoration of floodplain habitats is achieved through a combination of increased peak flows, prolonged peak-flow duration, lower bank or levee heights, levee removal, and constructed inlets. Studies have shown that a full benefit of these floodplain habitats has been reduced by the presence of large numbers of predacious and competing nonnative fish (Christopherson *et al.* 2004; Modde and Haines 2005).

The Recovery Action Plan tables contain tasks to identify and restore important flooded bottomland habitats. During 1994, the Recovery Program completed an inventory of floodplain habitats for 870 miles of the Colorado, Green, Gunnison, Yampa, and White rivers. From the list of inventoried habitats, high-priority sites were evaluated for restoration potential. Site acquisition began in 1994 and continued through 2003. Since 2003, the Recovery Program has completed the razorback sucker floodplain habitat model and floodplain management plans for the Green and Colorado River sub-basins (Valdez and Nelson 2004a; 2004b; subject to revision as new information is gathered). Based on the model and these management plans, the Recovery Program has shifted from acquisition of additional floodplain sites to better management of sites already acquired or otherwise available. Success will be measured by the response of the endangered fish populations.

The General Recovery Program Support Action Plan table includes tasks to develop an issue paper on floodplain restoration and protection. This paper identified legal, institutional, and political strategies to enhance and protect floodplain habitats for the endangered fishes and ameliorate the effects of levees, diking, riprap, gravel mining, and other forms of floodplain development. Phase 1 of the issue paper identified what floodplain restoration and protection is needed for the endangered fishes (Nelson 1998); Phase 2 determined how to accomplish that restoration and protection (Tetra Tech 2000). The issue paper evaluated responsibilities of the Recovery Program, Recovery Program participants, and other agencies involved in floodplain development, regulation, and management, and their roles and responsibilities with respect to endangered species. Speas *et al.* (2017) reviewed the Recovery Program's state of knowledge relative to floodplain management. They recommended that successful rearing of razorback sucker larvae to the YOY stage will require: 1) the ability to exclude large-bodied nonnative fish from the wetland during the larval entrainment period; 2) maintenance of water levels using water control structures and external water sources; and 3) capture, enumeration and release of YOY fish into the main channel as the wetland is drained in the fall months.

Passage barriers fragmented endangered fish populations and their habitats, resulting in confinement of the fishes to 20 percent of their former range in the Upper Basin. Blockage of Colorado pikeminnow movement by dams and water-diversion structures was suggested as an important cause of the decline of this species in the Upper Basin (Tyus 1984; U.S. Fish and Wildlife Service 1991). Restoring access to historically occupied habitats via fish passage was identified in the Colorado Squawfish [Pikeminnow] Recovery Plan (U.S. Fish and Wildlife Service 1991) and in the recovery goals (U.S. Fish and Wildlife Service 2002c) as one of several means to aid in Colorado pikeminnow recovery.

The Recovery Action Plan tables contain tasks to assess and make recommendations for fish passage at various dams and diversion structures. The need for passage was determined at four sites in Colorado's Grand Valley: Redlands, Grand Valley Irrigation Company (GVIC), Price Stubb, and the Grand Valley Project (GVP). Passage has been restored at all four locations. In addition, a fish passage was completed in 2012 on the Hartland Diversion on the Gunnison River near Delta by NRCS and local interests that benefits both endangered and native fishes. On the Green River near Green River, Utah, a newly rebuilt Tusher Diversion includes a fish passage component, designed similarly to the Price Stubb fish passage. The Tusher rebuild was completed in 2016, removing the last remaining significant barrier to native fish movement in the upper basin. Long-term effectiveness of these fish passages will require upstream sediment management (GVP and Redlands passages); in-passage debris removal (Price Stubb and Tusher Diversion passages); and continued operation of selective fish passage structures (GVP and Redlands passages).

Diversion canals have been found to entrain native and endangered fishes. The Recovery Program has constructed fish screens on major diversions on the Colorado and Gunnison rivers. Construction of fish screens was completed at the Grand Valley Project and Redlands Water and Power Company diversion during 2005. Construction of a screen at the Grand Valley Irrigation Company diversion canal was completed in 2002 and additional improvements to this screen are anticipated. The Grand Valley screens on the Colorado and Gunnison rivers are operated as much as feasible through the irrigation season, though debris and other concerns sometimes interrupt operation. Evaluation of potential entrainment into irrigation canals is an important part of the Recovery Program's decision-making process for screening canals. Studies of diversion structures on the Yampa River determined the Maybell Ditch was not a significant source of entrainment for endangered species, though several large-bodied fish were entrained, including one Colorado pikeminnow. Entrainment of endangered fishes at the Green River Canal near Green River, Utah has been evaluated by the Recovery Program and recent studies documented high levels of entrainment. All four endangered species were documented in the canal through 2018. Based on these findings, the Program in 2019 constructed a vertical weir wall paired with a fish screen in the Green River Canal below the Thayn Hydro facility. Monitoring during 2019 indicated no tagged fish were entrained in the Green River Canal during the irrigation season, suggesting that the weir/screen design is effective at reducing or eliminating entrainment. The Green River Canal was the last remaining known source of substantial entrainment in the upper basin.

A number of potentially harmful contaminants (including selenium, petroleum derivatives, heavy metals, ammonia, and uranium) and suspected contaminant "hot spots" have been identified in the Upper Basin. It is the intent of the Recovery Program to support and encourage the activities of entities outside the Recovery Program (e.g. Reclamation's participation in the Gunnison River Basin Selenium Management Program) that are working to identify problem sites, evaluate contaminant impacts, and reduce or eliminate those impacts. Specifically, the Service will identify actions needed to reduce selenium contamination to levels that will not impede recovery and identify existing pipeline river crossings that need to have spill-control devices installed. New petroleum pipelines with a Federal nexus are required by the Service through the Section 7 process to have shutoff valves. Not all pipelines have a Federal nexus; therefore, the Program Director's office discussed concerns with existing and future pipelines with the States' oil and gas divisions. The Service also is working with EPA, BLM, and USDOT to identify existing pipeline crossings that may need shutoff valves. Additionally, the Service and Utah Division of Water Resources have worked with EPA on spill response contingency planning.

2.3 III. REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES

The introduction, establishment, and proliferation of nonnative fishes are considered the primary remaining threat to the recovery of four Colorado River endangered fishes. Only 13 of more than 50 fish species that now occur in the Upper Basin are native (Bezzerides and Bestgen 2002). Over the last 100 years, native fishes have decreased in range and abundance, while introduced fishes have concurrently become more widespread and abundant (Carlson & Muth 1989, Martinez *et al.* 1994; Bezzerides & Bestgen 2002; Francis & Ryden 2014). An increasing body of evidence characterizes the negative interactions of nonnative fishes with the endangered fishes (Hawkins & Nesler 1991; Minckley 1991; Lentsch *et al.* 1998; Bezzerides & Bestgen 2002; Francis & Ryden 2014), including predation and competition. Direct evidence of predation includes native fish tags being detected in predatory fishes (Staffeldt *et al.* 2017), native fishes obtained from stomach contents of nonnative fishes (Francis *et al.* 2015, Michaud *et al.* 2019)), and by visual observation of predation. Other means by which nonnative fishes may adversely affect native fishes are by competition for food and niche space. Despite years of significant effort and some notable success stories, nonnative fish remain a significant obstacle to recovery of endangered fish.

Warm water game fish, previously stocked in reservoirs for recreational purposes and subsequently escaped and established populations in the rivers, are thought to have the greatest adverse effect on endangered native fishes. Of those species, large-bodied predators are considered the most problematic – specifically centrarchids (smallmouth bass [*Micropterus dolomieu*]), esocids (northern pike [*Esox lucius*]), and percids (walleye [*Sander vitreus*]). For example, the Yampa River experienced a dramatic increase in northern pike and smallmouth bass numbers in the 1990s and 2000s, respectively. Predation by these two piscivorous species wreaked havoc on the native

fish community. Biologists documented significant declines of native fish densities in the Yampa River since that time (Bestgen *et al.* 2015).

In studies on the Green River, researchers documented that young Colorado pikeminnow constituted 5% of the diet of northern pike, even though young Colorado pikeminnow made up a much smaller portion of the available food base in the river (Crowl and Lentsch 1996). Researchers estimated that a single northern pike could consume 100 or more young Colorado pikeminnow per year. In addition, northern pike are known to prey on large-bodied native fishes (Martinez 2001, Hawkins *et al.* 2005, Martin and Wright 2010) including adult Colorado pikeminnow, roundtail chub (*Gila robusta*), and flannelmouth (*Catostomus latipinnis*) and bluehead (*Catostomus discobolus*) suckers.

Recently, numbers of walleye have increased in the Green and lower Colorado rivers and predation of juvenile pikeminnow has been documented (Francis and Ryden 2014). Simultaneously, a decline in Colorado pikeminnow abundance was reported in the lower Colorado River between 2010 and 2015, which researchers attribute to a lack sufficient recruitment to offset adult mortality (Elverud *et al.* 2020). Burbot (*Lota lota*) have been discovered in the Green River below Flaming Gorge Dam. Walleye and burbot pose a significant predatory and competitive threat to native and endangered fishes (Francis and Ryden 2014, Gardunio *et al.* 2011).

Recovery Program activities related to nonnative fishes initially focused on identifying impacts/interactions and developing nonnative fish stocking procedures. Nonnative fish control strategies were developed to identify and prioritize options for controlling or removing nonnative fishes from river reaches occupied by the endangered fishes as well as other reaches that serve as production areas for nonnatives that subsequently disperse into occupied habitat (Tyus and Saunders 1996; Lentsch *et al.* 1996; Hawkins and Nesler 1991). In February 2004, the Recovery Program adopted a nonnative fish management policy that addresses the process of identifying and implementing nonnative fish management actions needed to recover the endangered fishes (Upper Colorado River Endangered Fish Recovery Program 2004). Through 2009, emphasis was focused on the control activities identified in these strategies. Development of a new basin wide strategy for the management of nonnative aquatic species began in 2009, and was finalized in early 2014 (Nonnative Fish *ad hoc* Committee 2014). This strategy emphasizes prevention as a major component in efforts to control existing invasive impacts and to avoid similar impacts arising from existing or new species in additional locations within the Upper Basin. Illegal introductions of nonnative fish have, and continue to, spread harmful species to new waters and often necessitate difficult and expensive treatments to remove, control, or contain them.

All nonnative fish control activities are evaluated for effectiveness annually. By thoroughly evaluating the smallmouth bass and northern pike control strategies in the Yampa River basin, the Larval Fish Lab at Colorado State University (CSU) provided the Program with guiding principles for nonnative removal in the entire basin (Breton *et al.* 2014; Zelasko *et al.* 2015). Specifically, both of these comprehensive evaluations indicate that the Recovery Program should focus on disrupting reproduction in the river

and preventing immigration into river habitats, such as by limiting the escapement of these species from reservoirs.

Disrupting in-river reproduction and preventing reservoir escapement are now the two key tenets of nonnative fish management. Limiting reproduction is accomplished through targeted removal of smallmouth bass during spawning (the Surge) and by netting northern pike in backwaters in the Yampa River. Landscape scale spawning disruptions of smallmouth bass via water management are also being considered (Bestgen and Hill 2016; Bestgen 2018; Lagory et al. 2019; *in review*). Reservoir escapement is primarily prevented through installation of physical screens on outlets or channels and nets on spillways. Currently Starvation[4], Elkhead, Juanita and Rifle Gap reservoirs, and Highline Lake, all have screened releases, while Ridgway and Red Fleet reservoirs, and Lake Catamount, are planned for screening in the future. Walleye and other species also move upstream from Lake Powell, but a solution to prevent their escapement has not been developed.

The States and the Service also have developed procedures for stocking of nonnative fishes in the Upper Basin (USFWS 1996a, 1996b). The procedures are designed to reduce the impact on native fishes from stocking of nonnative fishes in the Upper Basin and clarify the role of the States, the Service, and others in the review of stocking proposals. A cooperative agreement has been signed by the States and the Service implementing the Stocking Procedures. The Stocking Procedures were revised in 2009 (USFWS 2009) and the cooperative agreement was updated. The 2009 Stocking Procedures call for a review after 10-years, which was scheduled for 2019. The Recovery Program will review the Stocking Procedures in coming years.

In 2013, the Colorado Wildlife Commission updated changes to Colorado's Wildlife Regulations that apply the provisions of the revised Stocking Procedures to the private aquaculture industry, in waters of both the Upper Colorado and San Juan River. The provisions of the revised Stocking Procedures also are part of Utah's stocking policy (including private aquaculture, which can only stock sterile salmonids without specific State review and approval). All private fish stocking in Wyoming also is subject to State review.

Harvest regulations also play a key role in nonnative fish management. The Upper Basin States have liberalized bag and possession limits for the 'worst of the worse' predators (northern pike, smallmouth bass, walleye, and burbot). Utah and Wyoming have implemented must kill regulations for these species where appropriate. Colorado Parks and Wildlife has developed a "catch and keep" outreach strategy, paired with unlimited harvest and harvest incentives in regulation, and harvest-oriented fishing tournaments,as opposed to must kill regulations. The Colorado Parks and Wildlife Commission ratified unlimited harvest regulations for smallmouth bass and northern pike on the western slope, which took effect on April 1, 2016. CPW holds fishing tournaments targeting smallmouth bass and northern pike, including annual tournaments at Ridgway and Elkhead Reservoirs. According to recent data, the

[4] The screen on Starvation is a temporary structure, but screens all spills.

smallmouth bass tournament at Ridgway Reservoir has resulted in a statistically significant decline in population (Gardunio 2019).

The Recovery Program now implements a comprehensive strategy for nonnative fish management, focusing on in-river removal, reservoir escapement, and policy and outreach components. Over the past decade, the Recovery Program has committed millions of dollars and thousands of hours to removing these problematic predators from hundreds of miles of rivers in the upper Colorado River basin. What began over fifteen years ago as a pilot removal effort in 6 miles of the Yampa River now constitutes a basin-wide removal effort in more than 600 river miles, with some river reaches receiving up to 10 to 15 passes to disrupt spawning and physically remove problematic fish. In addition to this labor intensive effort, Recovery Program stakeholders are now preventing individuals from escaping reservoirs, implementing appropriate stocking and harvest policies, and conducting outreach on the problems of nonnative fish.

2.4 IV. CONSERVE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS

Species recovery depends on protecting and managing species genetic resources. This is a complex activity that includes: determining the genetic diversity of the endangered fishes; protecting species in refuges; planning, developing, and operating propagation facilities; propagating fish for augmentation or restoration, research, and information and education; and planning, implementing, and evaluating augmentation or restoration of species. Stocking is only an interim tool in the Recovery Program because recovery, by definition, implies that the populations will be self-sustaining in the wild. The success of augmentation and restoration stocking is dependent on prior or concurrent implementation of other recovery actions such as flow protection, habitat restoration, and management of nonnative fishes. This dependency is reflected in the schedule of subbasin-specific actions in Section 4.0.

Studies to confirm genetic diversity have been vital to genetics management of the endangered fishes. Species are being protected in refuges to develop broodstocks and guard against catastrophe. Representatives of species thought to be in immediate danger of extinction are brought into refuge immediately. Refuge populations of species are developed using paired breeding matrices to maximize genetic variability and maintain genetic integrity.

Most of this work is included under the General Recovery Program Support Action Plan because it applies to the entire Upper Basin. Subbasin-specific activities of augmenting or restoring species are placed under the subbasin Action Plans. Augmentation or restoration plans are being implemented, fish produced, and river reaches restored and augmented with those fish. The effects of these augmentation efforts are monitored and evaluated.

Four basic documents are used to plan, implement, and coordinate genetics management and artificial propagation for the endangered fishes. These are the Genetics Management Guidelines (Williamson and Wydowski 1994), Genetics Management Plan (Czapla 1999), Coordinated Hatchery Facility Plan (Wydowski 1994), and the Revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015). All four of these plans have been developed and will be revised or updated as needed.

Facilities are required to meet long-term (5 years or more) augmentation and restoration stocking needs. The plans for these facilities were established in the Coordinated Hatchery Facility Plan and updated in the Revised Integrated Stocking Plan. These plans, in accordance with the Genetics Management Plan, define facilities required to meet propagation needs, identify fish needs that can be met by existing facilities, and recommend expansion or modification of existing facilities. Genetics management requires a great deal of operational activity. Refuge and propagation facilities have been planned, built, and are now operated in a coordinated fashion. The State of Colorado raises bonytail at the J. W. Mumma Native Aquatic Species Restoration Facility in Alamosa, Colorado. The State of Utah raises bonytail at the Wahweap State Fish Hatchery in Big Water, Utah. The U.S. Fish and Wildlife Service raises razorback sucker and bonytail at the Ouray National Fish Hatchery with units near Grand Junction, Colorado (Grand Valley Unit) and Vernal, Utah (Randlett Unit). With a few exceptions, these facilities have achieved their stocking targets for the past several decades.

The Integrated Stocking Plan (Nesler et al. 2003) provided specific annual numbers of fish and their sizes to be produced at Recovery Program hatcheries and stocked into Upper Colorado River Basin river reaches. The plan was implemented for over 10 years before being revised based on estimates of survival of stocked fish. The revised stocking plan (Integrated Stocking Plan Revision Committee 2015) recommends stocking larger bonytail and razorback sucker and releasing bonytail in floodplain habitats and backwaters instead of canyon-bound reaches, since new information suggests floodplains may be more suitable habitat. Revisions to augmentation and restoration stocking (primarily for razorback sucker and bonytail) are intended to directly aid in recovery of the species and to establish fish in the system to be able to demonstrate that habitat and instream flow activities are having an effect on endangered fish recovery. Despite implementation of the revised stocking plan, bonytail post-stocking survival does not yet meet target levels needed to reach recovery. Alternative diet studies and flow training are in progress while anti-predator training efforts are being considered by the Program, in addition to ongoing evaluation of new stocking locations in efforts to increase post-stocking survival of bonytail.

Humpback chub are not currently being stocked; however, augmentation of extirpated populations is being considered and additional brood fish from wild populations are being brought into hatcheries. A final report on the genetics of *Gila* spp. (Bohn *et al.* 2019), including humpback chub, assessed genetic variability and uniqueness across the upper and lower basins. Major conclusions included: upper basin populations are more diverse than lower basin, and three should be managed separately as Green River, Upper Colorado, and Lower Colorado genetic management units. Some

evidence of roundtail introgression into the Black Rocks population, which should be monitored, warrants keeping this population separate from the Desolation population. Further investigation into localized genetic structure (perhaps due to spawning site fidelity) is recommended to identify unique alleles.

Colorado pikeminnow are not currently being stocked; however, Recovery Program partners are working collaboratively to replenish existing broodstock at Southwestern Native ARRC and to develop future broodstock for the Upper Colorado River Basin. A pilot effort continued in 2019 to collect age-0 Colorado pikeminnow from the middle- and lower- Green River for broodstock development, resulting in 71 fish from the lower Green and 114 fish from the middle Green collected and held at Southwestern Native ARRC. Broodstock development efforts are expected to continue into the future.

2.5 V. MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS

This category consists primarily of research and monitoring activities that have application to more than one of the foregoing elements. In the General Recovery Program Support Action Plan, this element includes: monitoring populations and habitat and annually assessing changes in habitat and population parameters (i.e., population estimates); determining gaps in existing life-history information and recommending and conducting research to fill those gaps; and improving scientific research and sampling techniques. Research activities are identified for each subbasin only to the extent that such activities are related to another recovery action in that subbasin. Such identification does not preclude further research in that subbasin that may be identified later or that is identified in the General Recovery Program Support Action Plan.

The Recovery Program tracks individual fish via passive integrated transponder (PIT) tags implanted in endangered fish handled by Recovery Program hatchery and research personnel. In recent years, tag and re-sight events have greatly increased, primarily from increased number and survival of stocked fish, increased sampling associated with nonnative fish activities, and detections from several remote antennas installed in locations throughout the Upper Basin. Antennas have significantly increased tag detections and researchers have now begun to incorporate these data into demographic analyses. Colorado Natural Heritage Program (CNHP) designed and built a web-based database that stores and provides queries for the large amount of tag data the Recovery Program now manages (The Species Tagging, Research, and Monitoring System [STReaMS], www.streamsystem.org). The database allows Recovery Program partners to input data easily and effectively, and allows researchers and the public to interact with the data under various permission levels. STReaMS launched in 2016, with structural and quality control improvements occurring in 2017 and 2018. In 2019, CNHP added additional tools to support popular download requests and added calculated fields. In 2020, STReaMS funding declines to a maintenance level.

2.6 VI. INCREASE PUBLIC AWARENESS AND SUPPORT FOR THE ENDANGERED FISHES AND THE RECOVERY PROGRAM

Public information and education is crucial to the Recovery Program's success. Outreach is a powerful way to provide our message to local communities; engagement with local citizens is generally very positive and citizens learn a lot from our presentations and handouts. A strategic, multi-faceted information and education program is being implemented to:

- develop public involvement strategies at the beginning of projects as warranted;
- educate target audiences (including media, the public, and elected officials) about endangered fish and increase their understanding of and support for the recovery of these fish at local, state, and national levels;
- provide opportunities for the public to participate in activities that support recovery; and
- improve communication and cooperation among members of the Recovery Program and their constituents.

Numerous site-specific activities are undertaken to promote understanding of, and support for, Recovery Program actions and to involve the public in decisions that may impact specific locations in the Upper Basin. These include public meetings, presentations, communications (e-mails, newsletters, etc.), exhibits, and distribution of Recovery Program publications. In 2019, the Recovery Program was present at annual meetings for Utah Water Users, Rocky Mountain Coal Mining Institute, Colorado Water Workshop, Colorado River Water Users Association, and Colorado Water Congress. In addition, the Recovery Program was present at public events including Endangered Species Day, Ute Water Children's Festival, and farmers markets. Partners and volunteers provide a substantial workforce to staff these outreach events.

In recent years, the Recovery Program has begun to place additional emphasis on educating the public regarding the gravity of illegal stocking. CPW and UDWR have placed signs at various fisheries in western Colorado warning the public not to transplant fish. Colorado, Wyoming, and Utah fishing regulations call special attention to the problem of and penalties for illegal stocking. States' responses to illegal introductions have included harvest incentives, mechanical removal (electrofishing, sport fishing tournaments), and resetting of the fish community.

The Information and Education Coordinator continues to develop a number of products including publications; up-to-date fact sheets; interpretive signs and displays; annual briefing documents; promotional materials including temporary tattoos, lapel pins, trading cards, stickers, rulers, and greeting cards; and a website. In addition, the Recovery Program actively seeks news media coverage of its activities. In 2019, several news stories covered nonnative fish control, the importance of CROS releases, and proposed downlisting actions. Special educational publications are produced as needed. The Recovery Program also integrates social media into outreach strategies as appropriate.

The *Program Highlights* publication serves as a briefing document for use by the non-Federal partners' annual visit to Washington, D.C., and is used for numerous other purposes throughout the year. In January 2020, the programs redesigned the briefing document to target a public audience. Because funding for capital construction and ongoing operation and maintenance (O&M) for the Upper Colorado River and San Juan River Basin recovery programs is linked in joint federal legislation (Public Laws 106-392, 107-375, 109-183, 111-11,112-270, and 116-9), an annual publication is produced that highlights accomplishments of both recovery programs.

In addition to the *Program Highlights* document, the *Swimming Upstream* field report and freestanding exhibits (in both small and large formats) promote both the Upper Colorado and San Juan recovery programs. Shared outreach efforts help ensure accurate, consistent information about the endangered fish species and efforts to recover them. They have also proved more cost-effective by sharing publication production costs and exhibit fees.

The Upper Colorado and San Juan recovery programs will continue to work with other organizations throughout the Colorado River Basin to ensure that information about the endangered fishes is consistent, current, and accurate.

2.7 VII. PROVIDE PROGRAM PLANNING AND SUPPORT

This work also is placed entirely under the General Recovery Program Support Action Plan. Recovery Program planning and support includes planning and tracking recovery activities, participation in Recovery Program committees, and managing, directing, and coordinating the overall Recovery Program. Another important program support activity involves securing the funding necessary to implement the Recovery Program.

3.0 DISCUSSION OF SUBBASIN RECOVERY ACTIONS

The following is a summary of the importance of the various subbasins in the Upper Colorado River Basin to the endangered fishes and a brief discussion of the major actions directed at recovering the endangered fishes in these subbasins. Critical habitat in each of these subbasins is shown on the map on page 3. A more detailed accounting of the activities is found in Section 4.0.

3.1 GREEN RIVER

3.1.1 Importance

The Green River system supports wild populations of humpback chub and Colorado pikeminnow, and populations of stocked razorback sucker. The Green River historically supported wild populations of all four species. The Colorado Squawfish [Pikeminnow] Recovery Plan (U.S. Fish and Wildlife Service 1991) listed the Green River as the

highest priority area for recovery of the species, and the recovery goals (U.S. Fish and Wildlife Service 2002c) consider the Green River subbasin as the center of the upper basin Colorado pikeminnow metapopulation. Colorado pikeminnow adult abundance in the Green River has declined over the past two decades. Although wild spawning and recruitment are still occurring, recruitment rates have been low since the mid 1990's, and lambda has been below one since 2000, indicating the population is likely to continue to decline unless recruitment can outpace adult mortality (Miller 2018).

Humpback chub are spawning and recruiting in Desolation and Gray canyons in the Green River. This species has not been stocked in the Green or Colorado rivers; however, stocking is being considered for Dinosaur National Monument in the Yampa and Green rivers.

The last known riverine concentration of wild bonytail was in the Green River within Dinosaur National Monument (U.S. Fish and Wildlife Service 1990a, 1990b, 2002a, 2002b). Bonytail are stocked in large numbers in the Green River and in several tributaries in the basin, but are not surviving at high rates. Wild bonytail reproduction has been confirmed in middle Green River wetlands (Stewart Lake and Johnson Bottom) in 2015, 2016, and 2017, prompting stocking into wetland habitats beginning in 2017.

Recovery plans for humpback chub (U.S. Fish and Wildlife Service 1990a) and bonytail (U.S. Fish and Wildlife Service 1990b) identified the Green River in Desolation and Gray canyons and in Dinosaur National Monument as important to recovery.

The Green River supported the last known riverine concentration of wild razorback sucker in the upper basin in the 1990s (Lanigan and Tyus 1989; U.S. Fish and Wildlife Service 1998, 2002d). Razorback sucker became functionally extirpated in the Green River in the late 1990's, but have been reestablished through stocking. Stocked adults are accumulating and spawning aggregations are now found in the middle and lower Green river. Collections of wild produced larval razorback sucker have been on the increase in the middle Green River since 2007; wild produced age 1+ juveniles were collected in the lower Green and Colorado rivers in 2013, 2018, and 2019 and in floodplains off the middle Green River every year since 2013.

3.1.2 Recovery Actions

Recovery actions in the Green River have focused on refining the operation of Flaming Gorge Dam to enhance habitat conditions for the endangered fishes, acquiring and restoring floodplain habitats for endangered fish use, and managing populations of nonnative fish species. A biological opinion was issued on the operation of Flaming Gorge Dam in 1992. This opinion contained seasonal flow recommendations for the Green River at Jensen, Utah, and called for additional research under a specific set of research flows to collect information needed to refine the flow recommendations (particularly flow recommendations for spring and winter) and to develop flow recommendations for other areas of the Green River. The effects of the test flows on the

endangered fishes and their habitat were evaluated through a variety of studies through 1997, and a final report including revised flow recommendations was completed (Muth *et al.* 2000). A new biological opinion was completed in 2005. National Environmental Policy Act (NEPA) compliance on reoperation of Flaming Gorge Dam and a Record of Decision were completed in 2006. A study plan for the implementation and evaluation of flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam was completed in 2007 (Green River Study Plan ad hoc Committee 2007). Following the 2006 Record of Decision, Reclamation provided peak flows that met or exceeded the Muth *et al.* (2000) recommendations. Flows in the Green River are influenced by tributary inputs, especially the Yampa River, as well as Flaming Gorge Dam releases. Reclamation achieved these peak flow magnitudes and durations by timing Flaming Gorge releases to match peak Yampa River flow, thus minimizing releases needed to achieve the targets.

A 2011 synthesis by Bestgen *et al.* showed that after 1993, releases to match the Yampa peak occurred prior to larval razorback sucker drift and suggested that this approach may not be providing for successful razorback sucker recruitment. In response, the Recovery Program proposed that Reclamation place greater emphasis on the occurrence of razorback sucker larvae in channel margin habitats (an indication that larval drift is occurring in the river) as the “trigger” to determine when peak releases should occur from Flaming Gorge Dam (rather than trying to match the Yampa River peak). A Larval Trigger Study Plan (LTSP; Larval Trigger Study Plan ad hoc Committee. 2012), consistent with the Muth *et al.* (2000) flow recommendations, is being implemented. The LTSP recommended an initial, experimental period of about six years. Lagory et al. 2019 (*in review*) recommends continued experimentation with larval triggered spring operations. To date, LTSP operations have proven hugely successful, resulting in an annual autumn release of wild-produced age-0 razorback sucker from floodplains to the Green River main channel; 2013-2019.

In spring 2015, the Green River Evaluation and Assessment Team (GREAT) was convened to evaluate: 1) the Program's performance meeting the Muth *et al.* flow and temperature recommendations since the 2006 ROD; 2) the results of studies identified in the Green River Study Plan (e.g. Floodplain Synth; BW-Synth; and Nonnative studies); and 3) the need for revision of the recommendations. In 2019 the GREAT provided its report with updated flow recommendations to peer reviewers and to the Program technical committees (LaGory *et al.* 2019). That report has been approved by the biology and water acquisition committees and is now under review by the Management Committee.

An element of the 1992 Flaming Gorge Dam biological opinion identified the need to protect dam releases from possible diversion in the occupied habitat of the endangered fishes. The initial focus of this effort was to legally protect Flaming Gorge releases in the Green River down to the confluence of the Duchesne River for the months of July through October. In 2010, Utah identified a legal and technical process (the Green River Utah Water Acquisition Team [GRUWAT]) and schedule to protect recommended year-round flows for the endangered fishes on the Green River in Utah, which was scheduled

to culminate with legal streamflow protection in 2019 (Utah Department of Natural Resources 2010; Mike Styler and Henry Maddux, UDNR, personal communication). That process has been delayed while Utah pursues updates to its Green River model reflecting the Bureau of Reclamation's major 2019 Green River water contracting actions.

Flow recommendations also have been developed for some tributaries to the Green River, such as the Yampa, White (interim flow recommendations adopted in 2019), and Duchesne rivers. In 2012, the PDO developed a position paper on minimum flow management in the Price River (Chart and Mohrman 2012). Tributary and mainstem flow recommendations will be carefully coordinated to address recovery needs from an upper basin-wide perspective.

Other Green River activities involve restoration of bottomlands adjacent to the Green River that flood in the spring and provide important habitat for razorback sucker and bonytail. Levees have been breached to restore nine sites (574 acres) and six perpetual easements were acquired (1008 acres). Speas *et al.* (2017) reviewed the Recovery Program's floodplain management activities and provided recommendations for how to proceed (see Section 2.2. above).

Monitoring of fish entrainment at the Green River Canal near Green River, Utah demonstrated that all four endangered species were entrained, some at substantial levels particularly during low flow years. Construction of a weir wall and fish screen was completed in 2019 to halt the entrainment of individuals. This project follows the reconstruction of the Tusher Diversion on the Green River, which included fish passage as a component of the rebuild.

Projects to identify nonnative fish management strategies for the Green River have been implemented. Active management of northern pike began in 2001. Active management of smallmouth bass began in 2004. Walleye also are emerging as a threat in the Green River and active management began in 2013. White sucker removal is occurring to reduce hybridization with native suckers (Skorupski *et al.* 2012). Gizzard shad (*Dorosoma cepedianum*), green sunfish (*Lepomis cyanellus*), and burbot are other species of concern, but active management of these species has not been proposed by the Recovery Program. Flow-spikes out of Flaming Gorge Reservoirs have been proposed to limit spawning success on a basin-wide scale based on data from naturally occurring storm events (Bestgen 2018).

Increased catches of walleye in the Green River since 2008 are likely linked to emigration of individuals from reservoir populations, such as Lake Powell, Starvation Reservoir (Duchesne River subbasin), and an illegally introduced population in Red Fleet Reservoir (Johnson *et al.* 2014). UDWR installed and operated a temporary barrier at the Starvation Reservoir spillway since 2015, limiting emigration from that source; a long term solution is estimated to be constructed in 2021. UDWR completed a rotenone treatment of Red Fleet Reservoir in the fall of 2015 to eliminate the illegally introduced walleye population. The treatment was followed by stocking of compatible sport fish (including sterile walleye) under an approved lake management plan, with

plans for a downstream screening structure installation in 2020. Lake Powell is also a likely source of substantial walleye in the Green River (Michaud *et al.* 2019); however, a solution to prevent their escapement has not yet been developed. A solution must effectively prevent walleye from upstream movement while allowing bi-directional movement of native fishes, maintain boater safety, and be sustainable over time.

Captive broodstock of razorback sucker collected from the Green River are being maintained at the Ouray National Fish Hatchery, Ouray, Utah, with backup broodstock maintained at Wahweap State Fish Hatchery, Big Water, Utah. The Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015) guides stocking efforts of both razorback sucker and bonytail in the Green River. In recent years, more emphasis has been placed on stocking larger individuals of both species. In 2019, over 8,500 razorback sucker and over 15,000 bonytail were stocked into the Green River at multiple locations.

Population estimates are conducted in the Green River subbasin for Colorado pikeminnow, humpback chub, and most recently for razorback sucker, but not for bonytail. Population estimates for Colorado pikeminnow in the entire Green River subbasin began in 2001 (Bestgen *et al.* 2005). These estimates are conducted on a 3-year on, 2-year off cycle, with the first three-year sampling period having occurred from 2001 to 2003. The second 3-year “on” period was completed during 2006–2008 and showed a continued decline in the numbers of adult fish in the Green River population (Bestgen *et al.* 2010). A third 3-year sampling period was completed in 2013. The most recent report indicated that the population declined form roughly N= 4,000 adults in 2001 to approximately N= 2,000 in 2013 (Bestgen *et al.* 2018). The most drastic declines in adult Colorado pikeminnow abundance have been reported in the Yampa River. However, in 2017, researchers from CSU reported a large number (n=75) of unique Colorado pikeminnow detections at a PIT antenna deployed in the mouth of Vermillion Creek, a small tributary to the upper Green River in Browns Park, CO. This finding, as well as similar detections of all the endangered fish species at other PIT antenna locations, have researchers exploring how to best use this new technology to assist in describing population dynamics. Preliminary analyses from a fourth 3-year sampling period (2016-2018) indicate the population has continued to decline to an adult abundance of less than 1,000 individuals.

Population estimates for humpback chub in Desolation and Gray canyons were conducted in 2001 and 2002, expanded in 2003 (Jackson and Hudson 2005) and then assumed a two-year on, two-year off schedule. In the mid-2000’s, this population appeared to decline and recommendations were made to secure the genetics by bringing fish into captivity (Badame 2012). In 2009, twenty-five adult humpback chub were captured and taken to the Ouray National Fish Hatchery, Randlett Unit; of these 25, 11 remain. UDWR conducted humpback chub population estimation in Desolation and Gray Canyons in 2014 and 2015; specific site estimates were extrapolated to canyon(s)-wide estimate of 1,863 adult humpback chub in 2014 and 1,672 adult humpback in 2015 (Howard and Caldwell 2018). There are no significant trends in site-specific population estimates between 2006 and 2015. UDWR returned to Desolation

and Gray Canyons in 2018 and 2019 to resume population estimation and employ several new sampling techniques.

A razorback sucker population estimate for the Green River was completed for the first time using capture data from Colorado pikeminnow sampling trips. Estimates indicate a population ranging from 25,482 to 36,355 from 2011 to 2013, but capture probabilities were low resulting in imprecise estimates (Zelasko et al 2018).

Selenium contamination of water and soil in Stewart Lake and Ashley Creek near Jensen, Utah, may adversely affect endangered fishes. The Bureau of Reclamation and Utah Division of Wildlife Resources manages ongoing remediation of Stewart Lake, in the form of fill, drain, and dry. Historic selenium levels in bottom sediments exceeded 15 ppm but the goal is 4 ppm or less (USGS 2003). The most recent sediment samples, taken in 2012, average less than 9 ppm and indicate that selenium concentrations decline substantially following high flow years on the Green River. Despite elevated selenium levels, UDWR has documented rapid growth of razorback sucker larvae entrained into Stewart Lake under the LTSP suggesting it can play an important role in recovery of razorback sucker (Breen and Skorupski 2012, 2013, Schelly *et al.* 2014). The periodic draining and drying schedule used for both razorback sucker rearing and selenium remediation has created perfect conditions for cattail growth, which is currently impeding presence of razorback sucker. UDWR coordinated a multi-agency controlled burn of cattails at Stewart Lake just prior to the 2018 spring runoff, and a contractor used a Marsh Master roller-chopper to treat cattails again in December 2019. Continued coordination with the selenium remediation team is necessary to maximize secondary benefits (periods of inundation) to endangered fish.

3.2 YAMPA RIVER AND LITTLE SNAKE RIVER

3.2.1 Importance

The Yampa River is the largest remaining substantially unregulated river in the Upper Colorado River Basin, and its inflow into the Green River, 65 miles downstream of Flaming Gorge Dam, ameliorates some effects of dam operation on spring flows, sediment load, and temperature (Muth *et al.* 2000). Holden (1980) concluded that flows from the Yampa River, especially spring peak flows, were crucial to the maintenance of the Green River's "large-river" characteristics and, therefore, very important to maintaining suitable conditions in the Green River downstream of the confluence. The Yampa River supports resident subadult and adult Colorado pikeminnow, contains one of the primary Colorado pikeminnow spawning areas in the Upper Basin, and was a major producer of endangered fishes for the entire Green River subbasin (Tyus and Karp 1989). A small population of humpback chub historically existed in the Yampa River in Dinosaur National Monument (Tyus and Karp 1989; U.S. Fish and Wildlife Service 1990a, 2002a), but is now believed to be extirpated.

Historically, spawning aggregations of adult razorback sucker were observed near the mouth of the Yampa River, and adult razorback sucker were captured upstream to the mouth of the Little Snake River (Tyus and Karp 1989). The lower portion of the Yampa

River was part of the historic range of bonytail and was associated with some of the last captures of wild fish. The Bonytail Recovery Plan (U.S. Fish and Wildlife Service 1990b) identified the Yampa River within Dinosaur National Monument as a high priority recovery and/or restoration site. As discussed earlier, the number of adult Colorado pikeminnow residing in the Yampa River has been greatly reduced, largely because of persistent high densities of nonnative predators, and perhaps also because of extended drought.

The Little Snake River provides approximately 28% of the Yampa River's flow and 60% of the Yampa River's sediment supply. The sediment supply of the Little Snake River is believed to be important to the maintenance of backwater nursery areas utilized by young Colorado pikeminnow in the Green River (Smith and Green 1991). Adult Colorado pikeminnow have been captured in the Little Snake River upstream to near Baggs, Wyoming, and humpback chub have been captured in the lower 10 miles of the Little Snake River (U.S. Fish and Wildlife Service 2002a, 2002c).

3.2.2 Recovery Actions

Recovery actions in the Yampa River are focused on control of nonnative fishes and maintaining and legally protecting the flow regime required to recover the endangered fishes.

Colorado filed for a junior instream-flow water right for the Yampa River between the confluences of the Williams Fork and Little Snake rivers in December 1995. Forty-eight statements of opposition were filed against these filings in State water court. Because of concerns expressed by the Service and other Recovery Program participants, CWCB withdrew the baseflow and recovery flow instream-flow filings on the Yampa and Colorado rivers. With the approval of the PBO for the upper Colorado River upstream of the Gunnison River confluence, CPW staff was instructed by CWCB to develop new methodologies and flow recommendations.

To achieve flow protection objectives, the Recovery Program developed the Yampa River Management Plan with extensive local input. The Plan identifies management actions necessary to provide and protect the needs of the endangered fishes while existing depletions for human use continue and water resources are developed to serve foreseeable future human needs in the Yampa River basin (Roehm 2004). A cooperative agreement implementing the Yampa River Management Plan and a PBO were completed in 2005.

The Yampa River Management Plan proposed to augment Yampa River base flows in accordance with the Yampa River flow recommendations (Modde *et al.* 1999). Of thirteen alternatives identified and evaluated in the Plan, enlargement of Elkhead Reservoir provided the most reliable water supply at an acceptable cost. Construction of enlargement for human and endangered fish water supplies was completed in 2005 and water releases for the endangered fish began in 2007. The Recovery Program funded a 5,000 af pool of permanent storage out of the 12,000 af Elkhead enlargement and has the option to lease up to an additional 2,000 af on an as-needed basis from the

Colorado River Water Conservation District. In 2017, the Recovery Program partnered with the Colorado River Water Conservation District, Maybell Irrigation District, and the Yampa-White River Roundtable to install flow measurement improvements and automate operations at the upper end of the Maybell Canal to allow the Maybell District to more quickly adjust its diversions and ensure that Elkhead fish releases remain in the Yampa River.

The Recovery Program and CWCB are expected to reevaluate the need for instream-flow filings or other protective mechanisms at least every 5 years and document their findings. The Recovery Program determined in November 2011 that additional permanent protection in the form of instream flow filings on the Yampa was not necessary at that time. Depletion accounting reports for water uses through 2015 in the Yampa River and Snake River basins (provided in 2019 by the States of Colorado and Wyoming) indicate that few if any net new depletions have occurred in those river basins relative to the 1998 PBO baseline, nor are substantial new depletions anticipated in the near future. For this reason, the Program and CWCB do not consider additional instream flow filings or other flow protection mechanisms to be a high priority in the Yampa River basin at this time.

The Recovery Program has evaluated several low-head agricultural-water diversion dams on the Yampa River for Colorado pikeminnow passage. A variety of existing diversions between Craig, Colorado, and Dinosaur National Monument were inventoried in 1994–1995. Disturbance of fish habitat related to maintenance of diversion structures was evaluated and found to be minimal based on the limited area and duration of the disturbance. Several diversions were identified as possible barriers to fish migration under certain conditions (Hydrosphere 1995a). However, due to uncertainties about whether these diversions were in fact barriers to Colorado pikeminnow movement during the migration period, a study was conducted to determine threshold flows for adult Colorado pikeminnow passage on the Yampa River between Craig and Dinosaur National Monument (Masslich 1993). It was determined that these barriers present little if any problem to fish movement during the periods when Colorado pikeminnow migrate to and from spawning habitats downstream. Evaluation of entrainment of Colorado pikeminnow in the larger Maybell Canal diversion produced only one endangered fish, a Colorado pikeminnow, which was detected in 2012 (Speas *et al.* 2014). The Service recommended in their 2014 Sufficient Progress Review that the Recovery Program should strive to offset impacts at the Maybell Canal by completing the Yampa River nonnative fish control actions identified in the RIPRAP.

The Recovery Program began removing nonnative sportfish from certain reaches of the Yampa River and, where feasible, relocating them to more acceptable waters in 1999. Active management of channel catfish in Yampa Canyon began in 2001, but the Recovery Program discontinued this work in 2007 (except for incidental removal of large fish) to focus on the control of smallmouth bass, whose population expanded dramatically in the early 2000s coincident with the abrupt decline in small-bodied and juvenile native fishes and a rapid increase in virile crayfish (*Orconectes virilis*) (Martinez 2012). Active removal of northern pike downstream of Hayden, Colorado began in 2003.

The Recovery Program now removes smallmouth bass and northern pike from Steamboat Springs downstream to the confluence with the Green River.

Northern pike distribution in the Yampa River extends from reservoirs in the upper reaches downstream to the Green River, but pike numbers are highest in the cooler upstream reaches. Active removal of northern pike began in 2003 and has been adjusted routinely since, with removal now taking place at varying levels from Steamboat Springs downstream to the Green River confluence.

In 2015, CSU completed an investigation of northern pike abundance and population dynamics in the Yampa River during the removal period of 2004 to 2010 (Zelasko *et al.* 2015). Northern pike abundance was highest in upstream reaches, but survival was highest in downstream reaches. Combined immigration and recruitment from river and reservoir sources were determined to offset northern pike removal rates; therefore, northern pike removal rates in the Yampa River were deemed insufficient to reach removal targets without reducing reproduction and escapement. CPW and others have undertaken a spawning suppression project using gill nets in backwaters. This effort has captured many northern pike before they could reproduce and electrofishing catch rates have decreased in nearby reaches.

Northern pike were illegally introduced into Stagecoach Reservoir and subsequently spread downstream into the privately owned Lake Catamount. Lake Catamount is known to contribute northern pike downstream into the Yampa River, including into critical habitat (Orabutt 2006; Finney and Haines 2008; Martin and Wright 2010). CPW conducts intensive mechanical removal of northern pike from Catamount Reservoir and is working with the Catamount Ranch and Club (CRC) to restore the trout fishery there. CRC has implemented must-kill for northern pike in the reservoir. Pike numbers and the size of captured pike have been reduced, but individuals can reinvade the reservoir from Stagecoach Reservoir, which is upstream; however, only one pike confirmed to have escaped from Stagecoach Reservoir has been captured in Catamount Reservoir. CPW has also completed several habitat remediation projects to reduce northern pike spawning habitat in the upper Yampa River near Steamboat Springs.

Unlike northern pike, smallmouth bass densities in the Yampa River are higher in the lower, warmer portions of the river. Active removal of smallmouth bass in the Yampa River began in 2004 and has been increased and adjusted since. Smallmouth bass removal occurs throughout critical habitat on the Yampa River.

The Recovery Program's multi-year assessment of smallmouth bass escapement from Elkhead Reservoir (Breton *et al.* 2013) demonstrated that a solution for nonnative fish escapement was needed. In 2016, Program partners completed installation of a net across the spillway to eliminate further escapement. The net is supported by an updated lake management plan that describes in-reservoir actions to disadvantage the existing populations of northern pike and smallmouth bass. CPW also holds an annual tournament at Elkhead Reservoir targeting both smallmouth bass and northern pike.

The programmatic synthesis of smallmouth bass (Breton *et al.* 2014) populations in the upper Colorado River basin is also complete. In general, abundant year classes of young smallmouth bass produced in low flow and warm years such as 2007 have potential to overwhelm removal efforts, and the year class persists for one or more years. Nonetheless, it appears that increased electrofishing removal efforts from 2007 to present resulted in sustained reductions in density of smallmouth bass sub-adults and adults throughout the Middle Yampa Canyon reach. .

Stocking bonytail at the confluence of the Yampa and Green rivers was initiated in 2000. The Revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015) recommends more and larger bonytail be stocked at in the Yampa at Echo Park, Deerlodge or Hell's Canyon (Mantle Ranch). In 2019, over 2500 bonytail were stocked into the Yampa River at Deerlodge.

3.3 DUCHESNE RIVER

3.3.1 Importance

Colorado pikeminnow and razorback sucker regularly utilize the mouth of the Duchesne River especially during spring runoff. Fishery surveys conducted in 1993 documented the use of the lower 15 miles of the Duchesne River by Colorado pikeminnow and razorback sucker (Cranney 1994). Limited fish surveys conducted in the lower 33 miles of the Duchesne River documented presence of razorback sucker and bonytail (Groves and Fuller 2009). More recently, one Colorado pikeminnow was found near the town of Randlett by the Ute Indian Tribe (Fuller and Groves 2010). An opportunistic survey in 2017 documented Colorado pikeminnow, bonytail, and razorback sucker presence, accompanied by concerning numbers of nonnative fish, including smallmouth bass, northern pike and walleye.

3.3.2 Recovery Actions

Initial flow recommendations were developed for the Duchesne River in 1995 to address immediate concerns of several proposed water projects being considered in the Duchesne River basin. A follow-up study to evaluate and refine these flow recommendations began in 1997 and was completed in 2003 (Modde and Keleher 2003). A water availability study was completed that identified sources of water to meet the flow recommendations. A coordinated reservoir operations study was completed in 2004. The Duchesne Biological Opinion issued in 1998 was updated in 2005. The 2005 update set targets for maintaining baseflows of 50 cfs year-round and no less than 115 cfs during periods of fish migration (March through June). It also formalized high flow recommendations based on an evaluation of the high flows that occurred during the 1977-2002 period of record and the response of sediment and other channel characteristics to these flows. Agreements were developed to provide flows in the Duchesne River for the endangered fishes, primarily based on voluntary cooperation between water managers, water users, and government agencies. Since 2005, the local Duchesne River Workgroup has improved water operations and provides baseflows for

native fish at increasingly better frequencies (Central Utah Water Conservancy District, 2013).

The Recovery Program participated in rehabilitation of the Myton Townsite Diversion Dam on the Duchesne River (completed in 2009) to help implement the flow recommendations for the endangered fish. More recently, the Ute Tribe, Utah Division of Wildlife Resources, Bureau of Reclamation, and the U.S. Fish and Wildlife Service funded and constructed a selective fish passage structure on this diversion to allow fish passage and to increase available habitat for endangered and other native fishes. In addition, a Candidate Conservation Agreement with Assurances (CCAA) and Safe Harbor Agreement (SHA) were finalized for the portions of the Duchesne River between the Myton and Knight diversions and the Strawberry River below Starvation Reservoir. These agreements between the State of Utah, U.S. Fish and Wildlife Service, and the Associated Water Users of the Strawberry and Duchesne rivers, formalize the agreement to allow water from Starvation Reservoir to reach the Myton Diversion without being claimed by irrigators in return for guarantees for no future Endangered Species Act requirements from the Service. UDWR operated the Myton Fish Passage in 2016, 2018, and 2019, with varying levels of success, but did not document any endangered species. In 2017, Duchesne River flows were too high to operate the passage.

Nonnative fish management has occurred intermittently in the Duchesne River since the mid-2000s, but is not being conducted annually under the RIPRAP. An opportunistic survey conducted during high flows in 2017 demonstrated substantial walleye numbers and smallmouth bass of all size classes, demonstrating the need for actions in this basin. Nonnative fish escapement from reservoirs in the Duchesne River basin is considered a priority and solutions are being developed. In 2011, isotopic analyses indicated that Starvation Reservoir and/or Lake Powell are a source of walleye entering the Green River; therefore, preventative escapement measures were re-evaluated. A temporary barrier has been in place and operated the last five years. UDWR has funded the design of a permanent screening solution for the Starvation Reservoir spillway stilling basin, which will be located outside of the dam's Primary Jurisdiction Zone. A permanent fish screen was planned for 2018 installation but has been delayed until 2021.

3.4 WHITE RIVER

3.4.1 Importance

Construction of Taylor Draw Dam in 1984 blocked native fish passage in the upper White River, including Colorado pikeminnow migration. However, adult Colorado pikeminnow occupy the White River downstream of Taylor Draw Dam near Rangely, Colorado, in relatively high numbers. Adult Colorado pikeminnow residing in the White River are known to spawn in the Green and Yampa rivers. However, in 2011, researchers documented for the first time razorback sucker and Colorado pikeminnow spawning in the White River (Webber *et al.* 2013). Juvenile and subadult Colorado pikeminnow also utilize the White River on a year-round basis. Incidental captures of

razorback sucker have been increasing in the lower White River, despite little stocking directly into this river. A passive integrated antenna array near the Bonanza Bridge (installed September 2012) demonstrated that razorback sucker and Colorado pikeminnow use the Utah portion of the White River in higher numbers than previously thought. The White River within Utah appears to be a stronghold for native fishes and management efforts in this basin should strive to preserve this feature of the river (Breen and Hedrick 2009, 2010). A recent expansion of smallmouth bass in the White River and a more recent illegal introduction of northern pike into Kenney Reservoir are cause for concern for this native fish stronghold.

3.4.2 Recovery Actions

A work plan for the White River (Lentsch *et al.* 2000) was developed to synthesize current information about the endangered fish and provide recommendations for specific recovery actions, including the merits of providing fish passage at Taylor Draw Dam. Interim flow recommendations for the White River were completed in 2004 (Irving *et al.* 2004) and a review began in 2009. In 2019, USFWS adopted substantially revised interim flow recommendations based on reviewing additional data collected since that time, and evaluating hydrologic models of the river under current levels of development. In 2020 work will begin on developing a White River management plan that ultimately will serve as the basis for a White River programmatic biological opinion. This management plan will evaluate the effects of possible future water development on the ability to meet the flow recommendations. Instream-flow filings are on hold pending reevaluation of how flows will be legally protected in Colorado, in conjunction with completion of the management plan.

In 2011, researchers reported increasing abundance of smallmouth bass and evidence of reproduction below Taylor Draw Dam. The Recovery Program began intensive removal of smallmouth bass from the White River in 2012 and has increased effort in this subbasin in subsequent years. The clear, warm water below Taylor Draw Dam provides ideal spawning habitat for smallmouth bass, even in years in which other basins see reduced reproduction. The population is apparently increasing in distribution from Taylor Draw Dam downstream into Utah, with multiple age-classes present. Recovery Program crews now remove smallmouth bass with multiple passes from Taylor Draw Dam to the Enron boat ramp in Utah, in an effort to reduce this population. Further efforts need to investigate how to sufficiently disadvantage this emerging population in a native fish stronghold.

Unfortunately, northern pike were found in Kenney Reservoir in 2018, the result of a suspected illegal introduction. In 2019, CPW collected multiple size classes of northern pike while the fish attempted to spawn in the reservoir. CPW has initiated removal efforts and established an angler cash harvest incentive to catch and remove northern pike from the reservoir and adjacent river segments.

Razorback sucker and bonytail are being stocked in the White River in accordance with the revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015).

3.5 COLORADO RIVER

3.5.1 Importance

The mainstem Colorado River from Rifle, Colorado, to Lake Powell, Utah, supports populations of humpback chub and Colorado pikeminnow, and is recognized as important to the recovery of all four endangered fishes (U.S. Fish and Wildlife Service 1990a, 1990b, 1991, 1998, 2002a, 2002b, 2002c, 2002d). Relatively dense populations of humpback chub occur at Black Rocks and Westwater canyons near the Utah-Colorado state line. Both populations experienced a decline around the year 2000 and remained low for over a decade (Elverud 2012; Francis and McAda 2011). Populations in both Black Rocks and Westwater stabilized in 2011-2012 and preliminary estimates from sampling in 2016-2017 show signs of population increases (Francis *et al.* 2016, Hines *et al.* 2016, T. Francis and B. Hines, unpublished data). Population estimates will resume in 2020. A small but persistent humpback chub population occurs in Cataract Canyon where some of the last wild bonytail in the Colorado River were collected.

All life stages of Colorado pikeminnow occur in the section of river from Palisade, Colorado, downstream to Lake Powell. Numbers of adult Colorado pikeminnow fluctuated around 600 fish from1992 to 2008 (Osmundson and White 2009), but have declined since. The most recent (preliminary) population estimates (collected in 2013 - 2015) indicate the adult population has declined to about 400 individuals, among the lowest estimates on record. Researchers report strong numbers of subadults and record high catch of age-0 Colorado pikeminnow in 2015. Age-0 catch rates were strong in 2016 and 2018, but were dramatically lower in 2017. Since 2008, with the completion of the Price-Stubb fish passage structure, the endangered fish have regained access to historically occupied reaches of the Colorado River upstream of Palisade, Colorado.

Wild razorback sucker populations in the mainstem Colorado River declined precipitously in the early years of the Recovery Program, but stocked individuals have been accumulating over the past decade, with around 8,000 adults estimated in 2015. Wild-produced age 1+ and 2+ juveniles were collected in the lower Colorado River in 2013, and wild age-0 fish were collected in 2018.

Bonytail are stocked in the Colorado River according to the revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015), but similar to other upper basin locations, their survival appears to be low.

3.5.2 Recovery Actions

A variety of recovery actions are planned, ongoing, or completed for the Colorado River.

Numerous actions are being taken to restore flows in the 15-Mile Reach immediately upstream from the confluence of the Gunnison River to levels recommended by the

Service. Water is made available annually from multiple sources for purposes of augmenting flows in the 15-Mile Reach:

- Reclamation and CWCB make available 5,000 acre-feet of water annually plus an additional 5,000 acre-feet in four of every five years from Ruedi Reservoir to augment flows in the 15-Mile Reach for endangered fish.
- Water is annually available from the permanent commitment of 10,825 acre-feet/year from East and West slope water users. The West Slope commitment is met through a 2012 contract/agreement that provides 5,412 acre-feet of water annually from Ruedi Reservoir, and the East Slope commitment through a 2013 contract/agreement that provides 5,412 acre-feet annually from Lake Granby.
- Water also is provided to the 15-Mile Reach through an MOA with CRWCD for delivery of up to 6,000 acre-feet of water annually from Wolford Mountain Reservoir, in accordance with a 1998 biological opinion for that reservoir.
- In 1996, an agreement reached between multiple parties, including the United States (Reclamation taking the lead) and water users in the Grand Valley, known as the Orchard Mesa Check Case settlement, makes available up to 66,000 acre-feet of water annually from the federal Green Mountain Reservoir 'Historic Users Pool' (HUP) to augment flows in the 15-Mile Reach. On average since 1998 more than 34,000 acre-feet/year of HUP surplus water has been released for the benefit of the 15-Mile Reach.

Other activities have further supplemented the water available for the 15-Mile Reach, including irrigation efficiency improvements to Grand Valley Water Project operations, modified operations of Federal and private water projects, and short-term leasing of additional water for the 15-Mile Reach. As the water available annually to augment flows in the 15-Mile Reach frequently falls short of that needed to fully meet flow recommendations, these additional activities and water sources play a key role in reducing shortages to flow targets. As an important example, since 2015, the CWCB has entered into a series of one-year lease agreements with Ute Water Conservancy District for Ruedi Reservoir water to supplement 15-Mile Reach flows which have resulted in 6,000 to 12,000 acre-feet of additional water available for release annually for the endangered fish.

The Service's average monthly summer minimum base flow recommendation of 810 cfs continues to be difficult to achieve / maintain during dry years. However, the summer base flow augmentation program often increases flows in the 15-Mile Reach by 200 cfs or more. Flow augmentation strategies for the 15-Mile Reach are developed each spring and adjusted as the year progresses, considering all possible sources of water, priorities, antecedent conditions, projected flows and supplies, and coordination of operations with various water users including GVIC and Grand Valley Project beneficiaries. This includes a coordination of efforts in May or June (known as Coordinated Reservoir Operations or CROS), when hydrologic conditions are suitable, to voluntarily bypass some quantity of runoff upstream that otherwise could be stored in reservoirs to boost the peak flow magnitude in the 15-Mile Reach for a period of seven to ten days.

In April 2013, a combination of conditions (including below-average snowpack, low runoff, early onset of the irrigation season, cold temperatures curtailing upstream runoff, and conservation in upstream storage) resulted in flows of 50 cfs or less in the 15-Mile Reach. Temporary but similarly worrisome low-flow conditions also developed in April 2017 and 2018. As a result, water users and the Service now address the potential for this situation to recur as a topic of regular HUP coordinating calls for the 15-Mile Reach, to determine what measures, if any, should be taken to reduce the risk of extreme low April flows. Additional options for responding to this concern in the future are under consideration.

Water from these various sources is protected to and through the 15-Mile Reach through various mechanisms. One mechanism is instream flow rights: the State of Colorado has a 581 cubic feet per second (cfs) instream-flow right (1992 priority) for the 15-Mile reach for the months of July, August, and September. CWCB holds an additional 300 cfs instream flow right (1994 priority) applicable to the lower two miles of the 15-Mile Reach during the same months, to protect the return flows that typically accrue to the reach. In addition, contracts have been established to ensure that water released from the HUP pool at Green Mountain Reservoir will be delivered down the Colorado River to the municipalities of Palisade, Grand Junction, and Fruita for municipal/recreational purposes.

No additional instream flow rights relevant to endangered species protection in the Colorado River are under consideration at this time. The Recovery Program and CWCB will determine where the Program currently stands with respect to commitments to periodically reevaluate the need for instream-flow filings or other protective mechanisms and document their findings.

From 1997 to 2019, more than 2 million acre-feet of water has been released or bypassed from reservoirs in the upper reaches of the mainstem (including Green Mountain, Ruedi, Wolford Mountain, Williams Fork, Granby, Windy Gap, and Willow Creek reservoirs, plus the Palisade Bypass return) to enhance spring and summer flows to improve habitat in the 15-Mile Reach near Grand Junction.

The Recovery Program has constructed fish passage at the GVIC, GVP, and Price-Stubb diversion dams on the upper Colorado River. The Price-Stubb passage was retrofitted with PIT tag antennas in 2010 and has detected bonytail, razorback sucker, Colorado pikeminnow and other native fish. Fish passage at these diversion dams benefits all four species of endangered fish (as well as other non-listed, native species) by providing access to approximately 50 miles of the river that was used historically by these fishes.

To prevent entrainment of endangered fishes into diversion canals, fish screens have been constructed at GVIC and at the Grand Valley Project. The Recovery Program also salvages fish from these canals when the screens cannot be operated full-time throughout the irrigation season. Salvage efforts have occurred every year since screens were completed, although effort was reduced in fall of 2019 due to funding cuts.

From 2009-2019, the GVIC screen was operating, on average, 63% of the days during the irrigation season, with debris accumulation, mechanical failures, and periodically low flows frequently forcing GVIC to bypass the screens. . From 2012-2019, the GVP screen was operating about 92% of the days during the irrigation season.

To restore floodplain habitats, levees have been breached at three sites (46 acres) and ten properties have been acquired in perpetual easement or fee title to protect 394 acres. These sites primarily serve as habitat for adult fishes during higher flows, or in some cases, as grow out ponds for stocked razorback sucker or bonytail. Other off-channel ponds are managed to reduce sources of nonnative fish inputs. Since 2015, Colorado Parks and Wildlife has operated a Merwin trap net at a connected pond near Rifle, CO to prevent northern pike from reaching the Colorado River, and this strategy appears to be mitigating the threat of escapement back to the river. Current surveys indicate that northern pike have been eradicated from the pond. UDWR and The Nature Conservancy are leading an effort to restore wetland habitat on the Scott Matheson Preserve near Moab, Utah. In 2019, the first phase of construction was completed on Matheson Wetland, allowing for the successful entrainment of razorback sucker larvae.

Nonnative fish are a threat to recovery in the Colorado River drainage. Active removal of smallmouth bass, largemouth bass, northern pike, white sucker, gizzard shad, and walleye occurs annually. A CSU/CPW study to determine the source of centrarchid fishes suggested that floodplain pond contributions to riverine nonnative fish populations fluctuate with the inter-annual variations in flow regime and river–pond connectivity (Whitledge *et al.* 2007). Recovery Program projects remove nonnative fish from selected streamside ponds in order to limit escapement of these individuals into the river when they connect. Recovery Program concerns about increasing collections of northern pike in the Colorado River near Rifle led to increased removal efforts beginning in 2011. In 2013, CPW installed a fish screen to prevent nonnative fish escapement from Rifle Gap Reservoir. Northern pike are now rarely captured in the mainstem Colorado River, with only one or two individuals captured each year since 2017. Expansion of walleye numbers in the lower reaches observed in 2013 has raised concerns (these fish may be coming from Lake Powell) (Francis and Ryden 2014). Specifically, walleye catches have greatly increased in the lower reaches of the Colorado River, overlapping with nursery habitat for Colorado pikeminnow. Documented predation on juvenile Colorado pikeminnow (~250mm) in this reach demonstrates the impact that predatory walleye can have on recruitment of the long-lived pikeminnow. An expansion of gizzard shad from Lake Powell may be supporting high walleye numbers, as gizzard shad are a preferred prey for walleye and constituted the most numerous catch in the Colorado River in 2017.

Operation of the fish barrier net at Highline Reservoir has been ongoing since 1999; the net was replaced in March 2006 and again in March 2014. Annual maintenance at Highline Reservoir to flush sediment requires unscreened releases from the outlet works. These releases are carefully timed in late summer when released waters are anoxic to minimize escapement of smallmouth bass and largemouth bass, which occur in Highline Reservoir. A small gap between the net and the lake bottom was noted and repaired in 2017. A replacement net will be needed within the next three years.

Razorback sucker and bonytail are being stocked in the Colorado River in accordance with the revised Integrated Stocking Plan (Integrated Stocking Plan Revision Committee 2015). In 2019, over 4,000 razorback sucker and over 18,000 bonytail were stocked into the Colorado River at multiple locations.

Razorback sucker spawning activity was documented in the Colorado River inflow of Lake Powell in 2014-2016 (near Trachyte Creek and Castle Butte). Biologists collected 954 adult razorback sucker between 2 and 14 years old from 2014-2016; 8% were without a PIT tag. In 2014, 811 larvae were collected and in 2015, biologists identified three spawning areas in the Lake Powell inflow area.

3.6 GUNNISON RIVER

3.6.1 Importance

The Gunnison River is currently occupied by Colorado pikeminnow, razorback sucker, and bonytail. Several adult Colorado pikeminnow were captured in the Gunnison River in fishery surveys conducted in 1992 and 1993. Unrestricted upstream migration of fish was limited by the 10-foot high Redlands diversion dam located 2 miles upstream from the mouth of the Gunnison River until construction of a selective fish ladder in 1996. Several Colorado pikeminnow larvae have been collected in the Gunnison River upstream and downstream of the Redlands diversion dam. Kidd (1977) reported that adult razorback sucker were collected frequently by commercial anglers near Delta, Colorado, between 1930 and 1950. Razorback sucker larvae have been collected in the Gunnison River (Osmundson and Seal 2009), and the reach near Delta is considered a priority razorback sucker restoration site. The native fish assemblage in the Gunnison River is presently less impacted, compared to other rivers, by nonnative fishes (particularly piscivorous species). CPW management efforts are emphasizing preserving this feature of the river.

3.6.2 Recovery Actions

Recovery activities on the Gunnison River are focused on operating and evaluating a fish ladder at the Redlands diversion dam, re-operating the Aspinall Unit to improve flow/habitat conditions in the Gunnison River, and restoring flooded bottomland habitats near Delta. Perpetual easements have been acquired on three properties (198 acres) for bottomland habitat. Construction of a fish ladder at the Redlands diversion dam provides passage of all four endangered fishes and other native fishes (as well as allowing exclusion of nonnative fishes). In 2010, the first humpback chub (previously captured in Westwater Canyon, Utah) used the ladder. In 2018, a record 39 Colorado pikeminnow, eight bonytail, two razorback sucker were caught at the Redlands fish ladder. Thirty-eight Colorado pikeminnow (one was found dead) and six bonytail were translocated to various locations upstream along the Gunnison River. In 2019, six razorback sucker and eight bonytail used the fish ladder. To prevent entrainment of adult and subadult endangered fish into diversion canals, a fish screen was installed at

Redlands in 2005. In 2019, the Redlands screen was in operation from March – November with only a few hours of down time.

A 5-year research plan to evaluate the anticipated effects of reoperation of the Aspinall Unit on the endangered fishes and their habitat was completed in 1997. During this research period, Reclamation and Western Area Power Administration provided test flows. The research culminated with the Service's flow recommendations in 2003 (McAda 2003). The Service completed their Gunnison River Basin Programmatic Biological Opinion (PBO) in December 2009. In April 2012, Reclamation signed their Record of Decision on an EIS to re-operate the Aspinall Unit to provide flows for endangered fish in the Gunnison and Colorado rivers. A study plan to evaluate effects of Aspinall Unit operations to benefit habitat and recovery of endangered fishes in the Gunnison and Colorado rivers was completed in 2011 (Aspinall Unit Study Plan *ad hoc* Committee 2011). A Gunnison River fish community monitoring study was initiated in 2011 to evaluate Aspinall reoperation. A team of geomorphology experts convened in 2013 and 2014 to review the findings of the USGS sediment transport study (Williams *et al.* 2013) and recommend methodologies the Recovery Program should consider to further evaluate the physical habitat expectations of the peak flow recommendations for the Gunnison and Colorado rivers. Recommendations from the resulting Peak Flow Technical Supplement (LaGory et al. 2015) were incorporated into the RIPRAP. The supplement offers a range of study approaches and prioritizes river reaches to evaluate the peak flow aspects of the Program's flow recommendations. High priority is placed on collecting suspended sediment data and investigating bed load transport within ongoing programs of NPS and USGS. Pursuant to this objective, in May 2016. Toby Minear (USGS) used hydrophones to monitor bedload mobilization at selected locations in the Gunnison River, on the rising limb and peak of the spring hydrograph. A number of sites (mostly riffles) indicated bedload movement at 5,000 cfs, and nearly all sites at 9,000 cfs. Based on this and other studies, the Service's flow recommendations for the Gunnison River (McAda 2003) may be revised and then legal protection of Aspinall releases and State protection of instream flows in the Gunnison River will be addressed.

The 2009 Gunnison Basin PBO included a requirement for Reclamation to "develop and implement a Selenium Management Program (SMP), in cooperation with the State of Colorado and Gunnison River basin water users to reduce adverse effects of selenium on endangered fish species in the Gunnison and Colorado rivers…" An SMP Action Plan was developed and is updated regularly to reduce the existing selenium load from existing sources and prevent, minimize, or mitigate potential new selenium loading from new activities. Muscle plugs have been collected from endangered and surrogate species to determine baseline selenium concentrations and evaluate effectiveness of selenium remediation.

Beginning in 1995, the Service experimentally stocked razorback sucker in the Gunnison River near Delta. Stocking of razorback sucker continues in the Gunnison River, in accordance with the Revised Integrated Stocking Plan. In 2019, over 3,000 razorback sucker were stocked in the Gunnison River near Delta.

In 2012, CPW treated Paonia Reservoir to remove a source population of nonnative northern pike. Actions like this are consistent with the Basinwide Strategy. CPW has reported that illegally introduced smallmouth bass in Ridgway Reservoir on the Uncompahgre River (a tributary to the Gunnison) are established and occupy habitats near the spillway. CPW, the reservoir owners, and the Recovery Program are working together to develop short and long-term solutions to prevent these fish from escaping the reservoir. CPW implemented an unlimited harvest of smallmouth bass beginning April 1, 2015 and has conducted a harvest tournament at the reservoir in each of the last four years. Harvest tournaments have reduced the population by an estimated 79% over five years. Tri-County Water has avoided using the spillway since 2014, when the problem of smallmouth bass escapement was recognized. Stakeholders are working together to design and install fish an escapement solution at Ridgway Reservoir, likely in fall 2020.

3.7 DOLORES RIVER

3.7.1 Importance

The Dolores River is historic habitat for Colorado pikeminnow; both adult and young-of-the-year fish were captured in the 1950's and 1960's. Valdez *et al.* (1991) documented the use of the lower 1 mile of river by Colorado pikeminnow. Uranium processing facilities operated during the late 1940's through the 1960's severely affected the river and may have contributed to the decline of Colorado pikeminnow in the Dolores River drainage (Valdez *et al.* 1982).

3.7.2 Recovery Actions

Recovery actions for the Dolores River drainage have been limited to efforts independent of the Recovery Program to try to prevent/limit escapement of nonnative sport fish (e.g., smallmouth bass, walleye, yellow perch, and kokanee salmon) from McPhee Reservoir, and to manage McPhee Reservoir spills to maximize benefits to recreation and downstream fisheries. However, additional efforts by Program participants aid in improving the habitat and native fish community in this subbasin.

In 2018, CWCB secured a decreed instream flow right on the Dolores River to aid various native species for 34 miles below the San Miguel River confluence. The decreed ISF right is 900 cfs (4/15-6/14), 400 cfs (6/15-7/15), 200 cfs (7/16-8/14), 100 cfs (8/15-3/15), and 200 cfs (3/16-4/14). Also in 2018, Reclamation provided the report, “Flow Management and Endangered Fish in the Dolores River, 2012-2017”, to comply with a conservation recommendation in the 2009 Gunnison River Basin PBO to "assess and provide a report on the extent to which flow management may contribute to endangered fish recovery" (Speas 2018). Among the report's conclusions are that "while it seems clear that a small subset of endangered fish utilize the lower reaches of the Dolores River on a seasonal basis, available information appears insufficient to identify linkages between Reclamation’s flow management at McPhee Dam and endangered fish recovery. This is due largely to limited amounts of fish detection antenna data and lack of a robust baseline data series on endangered fish use of the Dolores River. Also

... hydrology [of the lower Dolores River] is strongly controlled by the San Miguel River, which tends to obscure effects of the dam most of the time."

Smallmouth bass have become established in the Dolores River and could become an additional source for this invasive species in the Colorado River. In 2013, CPW treated Miramonte Reservoir to remove a source population of nonnative smallmouth bass. In July 2017, CPW targeted the smallmouth bass by scheduling a three-day, 4,000 cfs release at a time when males were guarding the nest. On a 14-mile stretch from below Snaggletooth Rapid to Slick Rock Canyon, biologists removed 600 smallmouth bass. Walleye also are in McPhee Reservoir, but have not been captured downstream. The Recovery Program needs to determine if nonnative fishes in the Dolores River basin pose a threat to endangered fishes and determine appropriate response. The Dolores River Working Group is exploring opportunities for improving the viability of native fishes in the Dolores River below McPhee Dam. The Lower Dolores River Monitoring, Implementation & Evaluation Plan contains objectives for nonnative fish monitoring and removal.

Environmental contaminant cleanup is being pursued by State and Federal agencies independent of the Recovery Program.

Utah conducted surveys on the Dolores in 2005 and 2013 and detected bluehead sucker, roundtail chub, and flannelmouth sucker. The Bureau of Reclamation funded the installation of PIT antenna in the lower Dolores River in 2013 and 2014, which has documented the survival of bonytail. In efforts to determine better locations to stock bonytail such as quiet still waters, flooded bottomlands, and tributaries, bonytail were stocked 8 miles above the confluence with the Colorado River in 2014, 2016, 2018 and 2019. In 2019, over 3,500 bonytail were stocked into the Dolores River, upstream of the PIT-tag antenna arrays. The antennas detected fish stocked in 2019 as well as those stocked in previous years. Most of the bonytail stocked into the Dolores moved out of the river or perished, but survival of three years has been documented by the antennas. In addition, a tag inserted in a bonytail stocked into the Colorado River was documented to cross the Dolores antenna five years post stocking. Razorback sucker and Colorado pikeminnow were also detected on the antenna array each year from 2013 to 2017 (Speas 2018).

The Recovery Program will consider the need for additional recovery actions in the Dolores River as new information becomes available.

4.0 RECOVERY ACTION PLANS

The tasks in these Recovery Action Plans are prioritized by their schedules. Schedules are shown where they have been identified (if all the year columns for an activity are blank, then the activity has not yet been scheduled). If a completion date has been identified, it is shown under the appropriate fiscal year. Where specific dates have not

been identified, but an action is ongoing, beginning, or ending in a year, an "X" appears in that year's column. The "who" column identifies the lead responsible agency (listed first) and any cooperating agencies. The status column is used where additional narrative is needed to explain the duration, status, etc. of an activity. The caret ">" identifies those recovery actions which are expected to result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction. An asterisk (*) identifies those activities which will contribute to the RIPRAP serving as a reasonable and prudent alternative to the likely destruction or adverse modification of critical habitat.

The Recovery Action Plans are formatted in stepdown-outline tables. This is reflected in the numbering system and indentations. A glossary is provided at the end for all acronyms.

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APPENDIX: CRITICAL HABITAT ANALYSIS
September 8, 1994

BACKGROUND

The final rule determining critical habitat for the four endangered fishes was published in the Federal Register on March 21, 1994, and the final designation became effective on April 20, 1994. As stated in the Section 7 Agreement and in the RIPRAP, the Recovery Program is intended to serve as the reasonable and prudent alternative to avoid the likely destruction or adverse modification of critical habitat, as well as to avoid the likelihood of jeopardy to the continued existence of the endangered fishes resulting from depletion impacts of new projects and all existing or past impacts related to historic water projects with the exception of the discharge by historic projects of pollutants such as trace elements, heavy metals, and pesticides. Once critical habitat was designated, the Service reviewed the RIPRAP, and in coordination with the Recovery Program's Management Committee, developed modifications to fulfill this intent.

The Service's review concluded that many of the actions in the existing RIPRAP would not only contribute to allowing the Recovery Program to continue to serve as the reasonable and prudent alternative to avoid the likelihood of jeopardy to the continued existence of the endangered fishes, but also would avoid the likely destruction or adverse modification of critical habitat for the endangered fishes. Specifically, the RIPRAP already included several of the following kinds of habitat-related actions for each subbasin (except the Dolores River): instream-flow acquisition, legal protection, and delivery from modified reservoir operations; fish passage restoration; and flooded bottomland restoration. Thus, the critical habitat modifications to the RIPRAP were not extensive. They were primarily intended to provide further definition to recovery actions already in the RIPRAP and to provide increased certainty that the Recovery Program can continue to serve as the reasonable and prudent alternative for projects subject to Section 7 consultations. Since many historic projects will be required to reinitiate Section 7 consultation with the Service due to the critical habitat designation, the Service encouraged Recovery Program participants to complete these RIPRAP actions as quickly as possible to facilitate fish recovery.

Destruction or adverse modification of critical habitat is defined at 50 CFR 402.02 as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Section 7 consultation is initiated by a Federal agency when its action may affect critical habitat by impacting any of the primary constituent elements or reducing the potential of critical habitat to develop those elements. The primary constituent elements defined in the final rule as necessary for survival and recovery of the four Colorado River endangered fishes include, but are not limited to, 1) water (quantity and quality), 2) physical habitat (areas inhabited or potentially habitable, including river channel, bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas); and 3) biological environment (food supply, predation, and competition). The Service reviewed the RIPRAP to determine if it addressed these constituent elements and to identify existing and new actions that will

contribute to the RIPRAP serving as a reasonable and prudent alternative to the likely destruction or adverse modification of critical habitat. Then, in coordination with the Management Committee, the Service recommended additions needed to address all of the constituent elements, to better define the expected result of the recovery action, and to increase the certainty that the constituent elements of critical habitat would be protected.

MODIFICATIONS

1. Instream Flow Protection: Modifications were made under this recovery element to protect the water quantity constituent element.

    a. Adjudication of the instream-flow appropriations to be filed by the Colorado Water Conservation Board (on the Yampa, Little Snake, White, Colorado, and Gunnison rivers) was added since these instream-flow appropriation filings will not be legally protected until they are adjudicated in water court. Adjudication may take up to three years after filing, depending on the amount of litigation.

    b. To provide more immediate habitat improvements in the Grand Valley area via instream flows, a modification was made under water acquisition for the 15-mile reach to enter into an interim agreement for uncommitted water remaining in Ruedi Reservoir after Round II water sales are completed or commitments to contracts are agreed to. If flow recommendations for the 15-mile reach are met from other sources during this interim agreement (thereby causing the additional water from Ruedi to exceed the flow recommendations), Ruedi would be relieved of this additional obligation. At the end of the interim agreement (whether the flow recommendations have been met or not), Reclamation may pursue additional water sales; however, these sales would be subject to review under Section 7 of the Endangered Species Act.

2. Habitat Restoration: Modifications were made under this recovery element to protect the physical habitat constituent element.

    a. Access to historically inundated floodplain habitats is believed to be very important to recovery of the razorback sucker and Colorado pikeminnow. Although the Recovery Program has begun a program to evaluate and restore flooded bottomland areas, the fish's riverine habitat has been and continues to be so channelized by levees, dikes, rip-rap, and tamarisk, that broader floodplain restoration and protection (e.g., through mechanisms such as landowner incentives, conservation easements, and perhaps zoning) is needed. Recovery Program participants were not sure exactly how such mechanisms might be implemented, so an issue paper on restoration and protection of the floodplain has been developed. The issue paper first addressed what restoration and protection measures are needed and then how they might be accomplished. After completion of the issue

paper, viable options were identified and a restoration strategy developed for selected geographic areas (e.g. Grand Valley and Ashley Valley). Floodplain restoration activities may be implemented by the Recovery Program or by Recovery Program participants individually. Responsibilities of other agencies were identified in the issue paper, and actions were implemented consistent with authorities outside the Recovery Program.

b. The Recovery Program has been evaluating agricultural diversion structures in the Yampa River and has discovered that although not all of these structures impede Colorado pikeminnow passage, annual bulldozing in critical habitat in the river required to maintain many of these structures may destroy or adversely modify fish habitat. Upgrading these structures so that they are more secure would eliminate the need for annual bulldozing and consequent adverse modification of critical habitat.

c. Fish passage structures are planned for a number of diversion dams in the Upper Basin in the current RIPRAP. However, without screens or "entrainment preclusion structures," adult fish, especially razorback sucker, may go into the diversion canals. To keep fish in the more secure river habitat, a modification was made to include an entrainment preclusion structure on the proposed passage structure at the Grand Valley Project diversion (Roller Dam). Also, the need for an entrainment preclusion structure at Redlands diversion dam will be evaluated after construction of the fish ladder there.

3. Reduction of Negative Impacts of Nonnative Fishes and Sportfish Management Activities: Modifications were made under this recovery element to protect the constituent element of the fishes' biological environment.

a. Competition with and predation by introduced species is widely assumed to have played a role in the decline of the endangered fishes. The Recovery Program has been and continues to assess options to reduce negative impacts of problematic nonnative species, sportfish management, and angling mortality. Although we cannot yet fully predict the results of implementing some of these management options, we need to begin to implement the most viable ones. Therefore, actions have been added to implement (in cooperation with the States) viable measures which will decrease negative impacts of certain nonnative fishes, sportfish management, and angling mortality. Specific actions were added to selectively remove northern pike from the Yampa River and northern pike and centrarchids from the Gunnison River and possibly Paonia Reservoir.

Glossary

Explanation for Column D - Who

Term	Definition
ANL	Argonne National Laboratory
BR	U.S. Bureau of Reclamation
CO	State of Colorado
CDA	Colorado Department of Agriculture
CDOPR	Colorado Division of Parks and Outdoor Recreation (See also CPW)
CDOW	Colorado Division of Wildlife (See also CPW)
CPW	Colorado Parks and Wildlife (CDOPR & CDOW merged in 2011)
Contract	Private Contractor
CRWCD	Colorado River Water Conservation District
CUWCD	Central Utah Water Conservancy District
CWCB	Colorado Water Conservation Board
CDWR	Colorado Division of Water Resources
DWD	Denver Water Department
DOI	Department of Interior
FWS	U.S. Fish and Wildlife Service
FWS-FAC	U.S. Fish and Wildlife Service, Fisheries and Aquatic Conservation branch. This branch includes FWS Fisheries and Wildlife Conservation Offices and National Fish Hatcheries.
FWS-ES	U.S. Fish and Wildlife Service, Ecological Services branch. This branch includes ESA compliance offices.
FWS-NWR	U.S. Fish and Wildlife Service, National Wildlife Refuges branch
FWS-WR	U.S. Fish and Wildlife Service, Water Resources division. This division provides FWS with professional assistance in the areas of: hydrology, hydraulics, sediment transport, water quality, water rights, and water management.
IBAT	Interagency Biological Assessment Team (Duchesne River)
CSU/LFL	Larval Fish Laboratory, Colorado State University
NPS	National Park Service
NWCD	Northern Water Conservancy District
PD/PDO	Recovery Program Director/Program Director's Office
PI	Principal Investigator
States	Refers collectively to the States of Colorado, Utah and Wyoming
TBD	To be determined
TNC	The Nature Conservancy
UT	State of Utah
UDWR	Utah Division of Wildlife Resources
URMCC	Utah Reclamation Mitigation and Conservation Commission
USGS	U.S. Geological Survey
UTWR	Utah Division of Water Resources
WAC	Water Acquisition Committee
WAPA	Western Area Power Administration
WY	State of Wyoming
WYGF	Wyoming Game and Fish Department

Explanation for Column E - Status

Term	Definition
Complete	Action finished
Ongoing	Action currently occurring with no planned end date, such as nonnative fish removal; time period may be defined in the status as well. i.e ongoing every other year, etc.
In progress	Action currently occurring, with a defined end date, such as an expected report, etc.
Pending	Action either has been halted or hasn't started yet, but has the potential to resume/start if Program wishes
On hold	Action hasn't started yet or has been halted, and isn't expected to start/resume
Dropped	Action no longer expected to take place or need for action has been abandoned
As needed	*Used only as a qualifier with other term; Action only occurs in certain situations when the action is appropriate and feasible; This term can be applied to any term except complete.

Other Abbreviations

Abbreviation	Where Found	Definition
YS	Yampa River tab	Yampa River Nonnative Fish Control Strategy, 2008

Cell Color Coding

Color	Significance
Light blue	Denotes actions that are completed and need no additional attention.
Dark grey	Denotes header columns for activities detailed underneath - no cell content.
Bright green	Denotes cells with changes/updates from previous year proposed by PDO or technical committee. *only used during RIPRAP review process
Yellow	Flags cells that need additional attention before finalization. *only used during RIPRAP review process

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Evaluate methods for defining habitat-flow needs and select methods most appropriate to specific stream reaches.									
	I.A.1.	Review instream flow methodologies and assess the technical adequacy of current flow recommendations.	PD	Complete							
	I.A.2.	Develop recommendations for integrating geomorphology and food web studies into Recovery Program.	PD	Complete							
	I.A.3.	Evaluate CDOW's instream flow methodologies and flow recommendations for warm water native fishes (Anderson) as they relate to flows needed for endangered fish recovery.	FWS/PD	Complete							
	I.A.4.	Develop strategic plan for geomorphic research and monitoring.	Program	Complete							
	I.A.4.a.	Develop strategy and design for studies to address geomorphic research priorities. Peak Flow Technical Supplement (LaGory et al. 2015) approved in January 2016.	Geo. Work Group	Complete						We anticipate that endangered fish flow recommendations will be in final form by 2023. Ongoing geomorphic research is anticipated, but needs to be identified.	
	I.A.4.b.	Conduct needed geomorphic research and monitoring. See Williams et al. 2013 and I.A.4.a, above.									
	I.A.4.b.(1)	Periodically monitor future channel narrowing and compare to historic rates using aerial or satellite imagery in the Green River (between Yampa and White rivers), Gunnison River (Hartland Dam to Colorado River), and the Colorado River downstream of the Gunnison River (Peak Flow Tech Supplement priority).	Program	Pending	X	X	X	X	X		
	I.A.4.b.(2)	Monitor sediment mass balance in the middle Green River at Jensen and Ouray gages, Gunnison River downstream of Hartland Dam at Delta and Whitewater gages, and the Colorado River at Cameo and State Line gages above and below the confluence with the Gunnison River (Peak Flow Tech Supplement priority).	Program	Ongoing	X	X	X	X	X	Post-2023 Program will need to continue reviewing and prioritizing sediment monitoring needs among the Green River, Colorado River, and Gunnison River locations.	Middle Green River is the priority reach at this time (Peak Flow Technical Supplement). However, the Program should begin discussion of when similar work will be conducted on the Gunnison River per the 2009 PBO and Aspinall Study Plan. Since March 2017, USGS has been collecting 15-minute acoustic monitoring data to measure suspended sediment at both the Ouray and Jensen Green River gages (#09272400 and #09261000), for development of annual sediment budgets for this reach and to better understand Green River sediment dynamics. USGS collected these data throughout 2019, along with numerous suspended-sediment samples to calibrate and validate the acoustic monitoring measurements. For details of findings to date, see Activity 1.D.2.b.(2) under the Green River tab, and David Topping's annual report for Activity 85f.
	I.B.	Develop and select methods for modifiable protection of instream flows in Colorado.									
	I.B.1.	Develop, evaluate and select, as appropriate, options for interim protection of instream flows until uncertainty concerning habitat needs and water availability can be resolved.									
	I.B.1.a.	Colorado Attorney General review.	CO	Complete							
	I.B.1.b.	CWCB approval/recommended action.	CWCB	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.B.1.c.	Adopt legislation or regulation, if necessary.	CWCB	Complete							
	I.B.2.	Evaluate options for allocating Colorado's compact entitlement among the five subbasins, the implications for water available to recover the endangered fishes, and implications of full protection of recovery flow recommendations on development of Colorado's compact entitlement.	CWCB	Complete							
	I.B.3.	Assess need for retirement of senior conditional water rights.	CWCB/FWS	Dropped							
	I.C.	Develop an enforcement agreement between the FWS and appropriate State agencies to protect instream flows acquired under the Recovery Program for the endangered fishes.									
>*	I.C.1.	Colorado.	FWS/CWCB	Complete							
	I.D.	Develop tributary management plans (based in part on the tributary report, see V.F., pg. 23).									
	I.D.1.	Assess need for tributary management plans on a site specific basis.	PD	Complete							
	I.E.	Develop strategies for long-term flow protection	Program	In progress	X	X	X	X	X	Implement strategies via cooperative agreement. See General, VII.A.6.	The PDO met with flow protection experts in 2019 to begin identifying post-2023 flow protection priority needs, actions, and estimated costs in Colorado, Utah, and Wyoming. The results of those discussions, including various levels of potential flow protection actions, were summarized in the 'Post-2023 Selection Tool' and used by Program stakeholders to help conceptualize and identify a preferred post-2023 program.
	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Restore flooded bottomland habitats.									
	II.A.1.	Conduct inventory of flooded bottomland habitat for potential restoration.	FWS-FAC	Complete							
	II.A.2.	Screen high-priority sites for potential restoration/acquisition.	PD	Complete							
	II.B.	Support actions to reduce or eliminate contaminant impacts. [NOTE: Contaminants remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program]									Natalie Day (lead author, USGS), along with several USGS and USFWS peers, published a research article in PLoS ONE, January 2020, titled 'Mercury and selenium concentrations in fishes of the Upper Colorado River Basin, southwestern United States: A retrospective assessment". This report summarizes findings regarding Hg and Se in the tissues of 2,324 individual fish collected from seven major Colorado River tributaries from 1962 to 2011. It confirms that mercury concentrations in Colorado pikeminnow tissue frequently exceed risk threshold levels, and Hg levels collectively among all fishes are highest in the White-Yampa subbasin. Se concentrations in fish tissues were highest in the Gunnison, lower Green, and Colorado River headwater areas.
	II.B.1.	Evaluate effects of selenium.	FWS-ES	Ongoing	X	X	X	X	X		Basin-wide, various selenium evaluations are underway, as discussed in boxes below:

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	II.B.1.a.	Identify actions to reduce selenium contamination to levels that will not impede recovery.	FWS-ES	Ongoing	X	X	X	X	X		In the Green River basin, actions are underway to reduce or eliminate selenium impacts at Ashley Creek and Stewart Lake. BR is considering re-initiating the Biological Opinion at Stewart Lake to ensure alignment of operations for both razorback sucker rearing and selenium remediation. The new proposed action at Stewart Lake will evaluate selenium concentrations in sediment, water, and biota. BR is holding off on BA until better and more current selenium data become available for Stewart Lake. (See Green River tab II.D) In the Gunnison and Uncompaghre river drainages, BR continues to fund (through the Salinity Control Program) a significant selenium remediation effort as per the Gunnison PBO. The USGS five-year selenium report assessing dissolved selenium concentrations and loads in the lower Gunnison River basin was published in 2018. See Gunnison tab activity I.D.1.c for details. Also see Gunnison tab activity I.D.1.c and Colorado tab II.C.1 for additional description of USFWS involvement in those river basins with respect to selenium and salinity control.
	II.B.2.	Identify locations of petroleum-product pipelines and assess need for emergency shut-off valves.									US Department of Transportation hosts a GIS-based map of existing pipelines which has increased access for government employees (compared to public access).
>*	II.B.2.a.	Ensure that all new petroleum product pipelines have emergency shutoff valves.	FWS-ES	Ongoing	X	X	X	X	X	This should be a requirement of all Upper Basin State energy permitting offices and identified in post-Program cooperative agreements.	USFWS Ecological Services addresses this through Section 7 consultation, though not all pipeline approvals have a federal nexus resulting in consultation.
>*	II.B.2.b.	Identify locations of existing petroleum-product pipelines potentially affecting critical habitat and determine if they have emergency shutoff valves.	FWS-ES, States	Ongoing	X	X	X	X			See II.B.2.a
	II.B.3.	Review and recommend modifications to State and Federal hazardous materials spills emergency response programs.	FWS-ES	Ongoing	X	X	X	X			The EPA has developed a Sub-Area Spill Contingency Plan for the Green River and is now developing the same for the Colorado River drainage. EPA has posted the December 2015 draft on the website, but not the final.
	II.C.	Develop an issue paper on the desirability and practicality of restoring and protecting certain portions of the floodplain for endangered fishes and evaluate the floodplain restoration program.									Valdez & Nelson (2004, 2006) completed floodplain management plans for the Green and Colorado. The Program continues to evaluate habitats, identify priority sites, and recommend additional actions. See Green II.A.4 and II.A.5, and Colorado II.A.6.a. Speas et al. 2017 reviewed the state of knowledge with respect to floodplain management
	II.C.1.	Identify what restoration and protection are needed by addressing: 1) biological merits of restoring the floodplain with emphasis on endangered fish recovery; 2) priority geographic areas; and 3) integration of a broader floodplain restoration initiative into the current Recovery Program floodplain restoration program.	PROGRAM	Complete							
	II.C.2.	Identify how to conduct restoration and protection by addressing: 1) restoration and protection tools/approaches; 2) institutional options for floodplain restoration; 3) costs/funding strategy; and 4) implementation steps and schedule.	PD/CO/UT	Complete						Define roles and responsibilities for floodplain restoration and maintenance, in addition to costs	
	II.C.3.	Identify viable options and develop specific restoration strategies for selected geographic areas (e.g., Grand Valley, Green River).	PD	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative interactions between nonnative and endangered fishes.									
	III.A.1.	Where not already generally known, identify negative impacts (e.g., predation, competition, hybridization) of problem species.									NPS and USGS are applying for funding to support a risk assessment for grass carp in the Colorado River basin which would compile current knowledge, determine key data gaps, and guide future research and management. CSU and USGS are modeling temperature regimes of the rivers to assess possible spawning conditions for grass carp.
	III.A.1.a.	Determine role of nonnative fishes as potential competitors with bonytail and determine size-specific vulnerability of bonytail to nonnative fish predators.	UDWR	Complete							
	III.A.1.b.	Assess impact of northern pike predation on Colorado pikeminnow in the Green River.	UDWR	Complete							
	III.A.1.c.	Re-evaluate levels of hybridization with white sucker and assess effects on razorback sucker populations. (Program will monitor for evidence of hybridization as razorbacks increase in the system.)	FWS/UDWR / CSU	Ongoing	X	X	X	X	X	Continue to monitor hybridization as a threat to native fishes. States should control sources of white sucker when economically feasible.	Correct field ID of hybrids remain vital to understanding this issue. Hybridization between white sucker and native suckers is widespread, but apparently more problematic for flannelmouth sucker than other species. Preferred habitats of white sucker create increased opportunity for hybridization, such as the cooler water below Flaming Gorge dam (Kluender et al. 2017 Researchers Meeting presentation). Investigators raise concern that the level of white sucker hybridization in the White River is increasing, thus presenting a direct threat to the genetic integrity of the robust native catostomid community. White suckers still dominate the catch in the Yampa and Colorado rivers, but catch rates of hybrids remain lower.
>*	III.A.1.c.(1)	If necessary, implement actions to minimize hybridization between white sucker and razorback sucker.	FWS/UDWR / CSU	As needed	X	X	X	X	X	Continue to remove hybrids to minimize threat to native fishes.	The razorback sucker SSA determined genetic integrity of razorback sucker to be in medium condition. The risk of hybridization with white sucker and their hybrids remains. White sucker and their hybrids are removed where encountered in Yampa, Green, White, Colorado, and Gunnison rivers (See above). UDWR is planning to modify the Browns Park WMA to reduce white sucker reproduction in the WMA ponds. Permitting is ongoing and construction is planned for 2020.
	III.A.2.	Identify and implement viable active control measures.									
	III.A.2.a.	Identify options (including selective removal) to reduce negative impacts of problem species and assess regulations and options (including harvest) to reduce negative impacts on native fishes from nonnative sportfish.	PD	Complete							
	III.A.2.b.	Review options and develop agreement with appropriate States on strategies and locations for implementing control options. Develop Nonnative Fish Management Policy.	FWS/STATES	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
>*	III.A.2.c.	Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement an integrated, viable active control program.	Program	Ongoing	X	X	X	X	X	Maintain an active, robust nonnative fish removal program to suppress nonnative fish to levels sufficient to support healthy native fish populations.	**!** The Program continues to adjust nonnative fish control actions to those deemed most effective and efficient. Adult catch rates of smallmouth bass and northern pike show declines in many locations, despite variable catches of younger fish, demonstrating a removal effect. The Program judged removal efforts appropriately planned and implemented, with no need for large-scale changes and did not hold a nonnative fish workshop in 2019. The Program will consider having a workshop in spring 2021. Stakeholders have increased focus on reservoir escapement based on results of smallmouth bass (Breton et al. 2014) and northern pike syntheses (Zelasko et al. 2015), and increased walleye catches. Reservoirs of interest are guided by provenance study (Johnson et al. 2014). In-river removal continues to focus on disrupting spawning and removing adults. Smallmouth bass removal during spawning (the 'Surge') and northern pike backwater netting are primary efforts to reduce reproduction of these species. Walleye do not appear to be self-sustaining in the river. Walleye are removed during times of lower water temperature in the spring and fall. In-river removal efforts generally occur as long as conditions are safe for crews and catch rates are productive. **X** Current low densities of Colorado pikeminnow throughout the upper basin are linked in part to the persistence of nonnative predators. Large-bodied predatory species of concern appear to be expanding in other segments of critical habitat (e.g. walleye in Colorado pikeminnow nursery habitat).
	III.A.2.c.(1)	Project-level synthesis: synthesize data on each species/river nonnative fish control effort and concomitant native fish response (e.g., smallmouth bass in the Yampa River and native fish response in the Yampa River) (completed by PI's and identified as a task in individual scopes of work). (YS G-3) See Bestgen et al., 2007 for Yampa River native fish response report (2003-2006) and Skorupski et al 2012 for Middle Green River native fish response report (2005-2008).	PI's	Ongoing					X	Monitor native fish populations response to nonnative fish populations	CSU LFL will provide synthesis report on Yampa River native fish response and Lodore/Whirlpool Canyon fish community in 2020. Smallmouth bass early life history report (Bestgen and Hill 2016b) finalized in 2016 demonstrated that short duration increases in flow could disrupt smallmouth bass spawning on a landscape scale (see III.A.2.g.). Study plan for implementing such flow spikes developed (Bestgen 2018) and is being considered as part of the evaluation of flow recommendations for Flaming Gorge Dam. Experimentation with smallmouth bass flow spikes was included as a recommendation in the Program's review and evaluation of Muth et. al. 2000; that evaluation report (Lagory et. al. 2019; in review) was approved by the Technical Committees in late 2019.
	III.A.2.c.(2)	Programmatic synthesis: assimilate project-level data into a basin wide and population scale analyses of effectiveness of nonnative fish management. (Breton et al. 2013, 2014, Zelasko et al. 2015).(YS G-3)	PD	Complete					X	May need to reanalyze the effectiveness of nonnative fish removal efforts in future.	Northern pike and smallmouth bass syntheses demonstrated recruitment and immigration are offsetting removal efforts; therefore, Program must focus on reducing reproduction and reservoir escapement. Program can potentially revisit the results of these syntheses to determine effectiveness of updated removal strategies.

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	III.A.2.c.(3)	Develop one or more standardized nonnative fish datasets to facilitate data analyses and information tracking (one dataset will incorporate all tagging data, others may incorporate all movement, mark-recapture, removal data, etc.) (*YS G-1.) Relates to item V.A.1., Interagency Data Management.	Program	Ongoing	X	X	X	X	X	Store uniform data in a central location for further analysis of nonnative fish removal.	Ongoing. NNF PI's submit their standardized data sets to the PDO no later than March 15 each year. Nonnative fish collections are being stored in the broader STReaMS database effort. Incorporating nonnative fish data in a more integrated fashion is being explored. Walleye management report (project 123d) compiles and presents walleye catch across all removal projects, clarifying basin wide control efforts for that species. Potential for this type of comprehensive reporting exists in other locations (i.e. Yampa River specific, Northern Pike specific, etc.).
	III.A.2.c.(4)	Evaluate additional techniques to improve data analysis (e.g., advanced software, exploitation models, ecosystem response models). (YS M-1,2). See, for example, Haines and Modde, 2007.	Program	Ongoing	X	X	X	X	X		
>*	III.A.2.d.	Close river reaches to angling where and when angling mortality is determined to be significant. (See specific river reaches.)	STATES	Ongoing, as needed	X	X	X	X	X		
	III.A.2.e.	Increase law enforcement activity to decrease angling mortality.	STATES	Ongoing	X	X	X	X	X		
>*	III.A.2.f.	Develop control program for removal of small nonnative cyprinids in backwaters and other low velocity habitats. (Trammell et al. 2002 and 2005 complete, but development and implementation of a control program is on hold.)	STATES	On hold							Final report for project 158 (Assessment of Larval Colorado Pikeminnow Presence and Survival in Low Velocity Habitats in the Middle Green River) completed in 2019.
>*	III.A.2.g.	Evaluate other methods for controlling nonnative fishes, including manipulation of flow and temperature, use of fish attractants, pathogens, genetic modification, and chemical piscicides. See Johnson et al. 2014 (YS N-1,2,3,4), Bestgen and Hill 2016.	Program	Ongoing	X	X	X	X	X	Novel techniques for nonnative fish suppression will always be important to consider and may be the only method for long term native fish protection.	A flow-spike biological study plan has been completed (Bestgen 2018), and a physical channel monitoring plan is being prepared by NPS. Experimental flow spike releases could be tested in the Green River below Flaming Gorge Dam in coordination with Bureau of Reclamation as soon as 2021.
	III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.									
	III.B.1.	Implementation Committee approval of Interim Nonnative Fish Stocking Procedures.	PD	Complete							
	III.B.2.	Implement Interim Nonnative Fish Stocking Procedures.									
	III.B.2.a.	Develop scope of work for evaluation of Interim Procedures.	PD	Complete							
	III.B.2.b.	Evaluate and revise Interim Procedures.	PD	Complete							
	III.B.3.	Finalize revised Nonnative Fish Stocking Procedures.									
	III.B.3.a.	Complete Biological Opinion/NEPA compliance.	FWS-ES/ FAC	Complete							
	III.B.3.b	Implementation Committee approval of revised Nonnative Fish Stocking Procedures.	PD	Complete							
	III.B.3.c.	State wildlife commissions approval, as necessary.	STATES	Complete							
	III.B.3.d.	Execute memoranda of agreement between FWS and States.	FWS/STATES	Complete							
	III.B.4.	Incorporate final Procedures into State aquaculture permitting process.									
>*	III.B.4.a.	Colorado.	CDA/CDOW	Complete							
	III.B.4.a.(1)	Evaluate effectiveness of Colorado's stocking regulation.	CDOW	Complete							
>*	III.B.4.b.	Utah.	UDWR	Complete							
>*	III.B.4.c.	Wyoming.	WYGF	Complete							
	III.B.5.	Explore options for tribal acceptance of Nonnative Fish Stocking Procedures.	FWS-FAC	Complete							

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	III.B.6.	Review, evaluate, and revise as needed, the Nonnative Fish Stocking Procedures.	Program	As needed (to be reviewed in 2019)		X			X	Nonnative Fish Stocking Procedures should be followed and updated as needed.	Section VI.2 of the Nonnative Fish Stocking Procedures calls for a 10-year review of the document, scheduled for 2019, which is now overdue. Program partners should plan to review in FY21 after issue of sterility rate of stocked fish is negotiated.
	III.B.7.	Increase law enforcement activity to prevent illicit stocking.									
	III.B.7.a.	Develop plan	STATES	On Hold							States have no plans to develop a written document but they intend to develop and implement actions on this important issue.
>*	III.B.7.b.	Implement actions	STATES	Ongoing	X	X	X	X	X	Illicit stocking is a major impediment to successful fisheries management and needs to be prevented as much as possible. Strict penalties for convictions are one way to deter such actions.	Wyoming, Colorado, and Utah annual fishing regulations brochures call attention to the problem of and penalties for illegal stocking. Utah completed a review of collection, importation, and possession of any wildlife, which included a rewrite of the rule and how illicit stocking is being enforced.
	III.B.8.	Evaluate designation of native fish conservation areas	STATES	On Hold					X	Evaluate and propose native fish conservation areas as appropriate.	States and partners continue to manage specific areas for native fish communities, but designating and advertising these areas under a specific name is not being currently considered by any state.
	III.C.	Evaluate sources of nonnative fishes into critical habitat using isotope technology. See Johnson et al. 2014.	CSU	Ongoing					X	Novel introductions (new species or new locations) of nonnative fishes should be evaluated (e.g. isotopic analysis) to determine provenance.	CSU investigations resulted in otolith markers for water chemistry for reservoirs throughout the basin (Johnson et al. 2014). Program continues to collect & retain otoliths under specific guidance to assure potential for future analysis, if needed. FWS and USGS investigated using this technique to determine source of walleye in the lower Colorado and Green rivers. Initial results unable to distinguish Lake Powell makers from other locations; Report pending. This technique also has forensic potential for prosecuting cases of illegal fish transport or possession of live fishes in illegal stocking cases.
	III.D.	Finalize the UCR Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy (Basin wide Strategy), Martinez et al. 2014.	PD	Complete					X	Follow concepts in the Basin wide Strategy to prevent new introductions of nonnative species, respond to new introductions, and evaluate ways to reduce nonnative species.	Most recent version of the Basinwide Strategy is posted on the Recovery Program website (updated in 2015). List of compatible species (Appendix C of the Strategy) for stocking is updated as needed, and posted on website as stand-alone document.
	III.E.	Cease translocation of all nonnative predators to any fishery within the UCR.	States / Program	Complete						Translocations of nonnative fish have consistently been determined to be detrimental to native fish management and should not be employed.	

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	III.F.	The States will commit to remove northern pike and / or replace them with a Compatible (compatible with recovery) species (as identified in the Basin wide Strategy) throughout the UCR Basin. Specific waters will be targeted based on risk of escapement, opportunity and available resources.	States / Program	Ongoing	X	X	X	X	X	Continue to remove northern pike populations in the upper basin and replace them with compatible species.	States continue to remove and replace northern pike at specific reservoirs. CPW is removing northern pike at Lake Catamount, Kenney Reservoir and Crawford Reservoir, holding harvest tournaments that target northern pike at Elkhead and Stagecoach Reservoirs (see Yampa River), using Merwin trap at Mamm Creek gravel pit (see Colorado River), and has revised the Rifle Gap and Elkhead Reservoir LMPs to replace northern pike with other species. CPW approved harvest payments in Wolford and Green Mountain Reservoirs.
	III.F.1.	Implement 'must kill' regulations for northern pike throughout the UCR basin (exceptions may include waters where northern pike are being replaced by tiger muskie).	WY & UT	Complete					X	Utah and Wyoming will continue to enforce must-kill regulations	
	III.F.2.	Continue discussions concerning "must kill' regulations on northern pike throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Ongoing	X	X	X	X	X	CPW will continue to evaluate harvest regulations and enact appropriate regulations that appropriately respond to northern pike populations	Since 2016, CPW has convened a Nonnative Fish Workgroup of various Recovery Program stakeholders to discuss major topics for nonnative fish management, such as regulation changes, outreach, and angler incentives. CPW has implemented regulation changes which removed protections for northern pike in West Slope water, which went into effect April 1, 2016. CPW is not considering must-kill regulations at this time and instead focuses on angler removal through incentives and liberalized regulations. CPW is developing focus groups of west-slope anglers to determine the most significant issues for the anglers to promote endangered species conservation actions. A significant issue for the success of unlimited harvest regulations, the "catch and keep" strategy, and incentivized harvest is the ability of anglers to remove and keep fish they do not plan to consume. Therefore, a large portion of fish caught under unlimited harvest regulations and other incentive programs may be released back into the system by anglers, contrary to their intent. CPW will continue investigating modifications to fishing regulations to allow anglers to dispose of excess smallmouth bass and northern pike they don't plan to consume. CPW has provided freezers at select locations for the surrender of unwanted fish.
	III.G.	Remove smallmouth bass and / or replace them with a Compatible species (as identified in the Basin wide Strategy) everywhere they occur throughout the UCRB (exceptions = McPhee Res., Lake Powell Res., and upstream of Flaming Gorge Dam; and 'containment' may prove to be a viable management option for smallmouth bass at Starvation Res.). Specific waters will be targeted based on risk of escapement, opportunity and available resources.	States / Program	Ongoing	X	X	X	X	X	Continue to remove smallmouth bass populations where appropriate in the upper basin and replace them with compatible species.	States continue to remove, replace, and contain smallmouth bass at specific reservoirs. Starvation Reservoir is contained via temporary screen (See Duchesne River), Elkhead Reservoir is contained via screen and net (See Yampa River), and Ridgway Reservoir is contained via spill avoidance (See Gunnison River). Smallmouth bass in Elkhead Reservoir and Ridgway Reservoir are being reduced through angler harvest (See Yampa and Gunnison Rivers, respectively). The smallmouth bass population at Ridgway Reservoir continues to be unscreened, representing a large risk to the downstream native fish community in the Gunnison River. However, Tri-County has successfully avoided spilling since 2011 and a structure is scheduled for construction in 2021. See Gunnison III.A.3.a. Starvation Reservoir permanent screen construction was delayed in 2018, but a new location has been chosen and project is now progressing. See Duchesne III.A.3.b (3)

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	III.G.1.	Implement ‘must kill’ regulations for smallmouth bass throughout the UCR basin (see exceptions above).	UT	Complete						Utah will continue to enforce must-kill regulations	
	III.G.2.	Continue discussions concerning "must kill' regulations on smallmouth bass throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Ongoing	X	X	X	X	X	CPW will continue to evaluate harvest regulations and enact appropriate regulations that appropriately respond to smallmouth bass populations	See III.F.2. above regarding CPW nonnative fish workgroup, must-kill regulations, angler fish disposal, and angler survey. CPW has implemented regulation changes which removed protections for smallmouth bass in West Slope waters (excluding Navajo and McPhee reservoirs), which went into effect April 1, 2016. CPW is not considering must-kill regulations at this time and instead focuses on angler removal through incentives and liberalized regulations.
	III.H.	Reduce burbot numbers through all means practicable (including targeted removal) throughout the UCR Basin.	States / USFWS	Ongoing	X	X	X	X	X	Continue to work to prevent burbot establishment and will respond to any instance of burbot introduction.	Two burbot were captured in the Green River in 2019. Wyoming supports fishing derbies to remove burbot and conducts research on movement and life history patterns.
	III.H.1.	Implement ‘must kill’ regulations for burbot throughout the UCR basin.	WY & UT	Complete						Utah and Wyoming will continue to enforce must-kill regulations	
	III.H.2.	Continue discussions concerning "must kill' regulations on burbot (as a preemptive measure) throughout the UCR Basin to develop a proposal supported by law enforcement for regulatory consideration.	CO	Ongoing	X	X	X	X	X	It is illegal to export, import, transport, stock, sell, or release Burbot in Colorado, and it will continue to be.	Burbot is illegal to export, import, transport, stock, sell, or release in Colorado.
	III.I.	Reduce walleye numbers through all means practicable (including targeted removal) *in riverine habitats* throughout the UCR Basin.	States / USFWS	Ongoing	X	X	X	X	X	Continue to monitor and remove walleye as appropriate in the UCR basin.	Walleye-specific removal passes continue in the Green and Colorado rivers, focusing on specific times (early spring and late fall) and locations where catches are highest. Walleye removal is an ancillary component of Colorado pikeminnow population estimate work because the two species share niche overlap.

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	III.J.	Promote increased production of sterile gamefish (e.g., hybrids, triploids), as Compatible sport fish *in reservoirs*.	FWS / States / Program	Pending	X	X	X	X	X	Continue to investigate sterile gamefish (with appropriate containment) as an appropriate replacement for problematic nonnative species. Continue to investigate appropriate technology for triploidy induction and appropriate stocking strategies for triploidy populations.	Providing sterile gamefish is consistent with Basinwide Strategy and Nonnative Fish Stocking Procedures. The States and FWS are collaborating on this topic where appropriate and possible. Utah continues to stock 100% triploid walleye in Red Fleet Reservoir (see Green River). Colorado stocked triploid walleye in Rifle Gap Reservoir (see Colorado River). Utah and Colorado have agreed to share production of 100% triploidy if the other state cannot meet that threshold. Colorado and Utah are proposing stocking groups of fish with less than 100% triploidy to enhance the ease of stocking fish, but this has yet to be agreed upon by the signatories of the nonnative fish stocking agreement. UDWR and CPW are funding research projects to investigate many unknown aspects of walleye triploidy (spawning behavior, growth, survival, population dynamics, etc.). Utah is producing hybrid striped bass (wipers) for use in new LMPs and is researching the ability to produce sterile smallmouth bass.
	III.K.	Work with State Wildlife agencies and water user groups to increase awareness among States' legislatures and the courts of the ecological and financial ramifications of illicit introductions.	States and PD via Implementation Committee	Ongoing	X	X	X	X	X	Continue to provide information to legislatures and courts concerning the ecological and financial ramifications of illicit introductions.	
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A.	Genetics Management.									
	IV.A.1.	Develop and approve Genetics Management Guidelines.	PD	Complete							

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	IV.A.2.	Develop and implement Genetics Management Plan for all species and update as needed. Czapla 1999.	PD	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	Genetics management is implemented via breeding protocols at the various hatcheries that maintain broodstock for: razorback sucker (Ouray-Randlett and Grand Valley), bonytail (Southwest Native ARRC), and Colorado pikeminnow (Southwest Native ARRC). Upper Basin refuge populations of humpback chub are held at Ouray-Randlett (Desolation/Gray) and Grand Valley (Black Rocks). The PDO is currently exploring options for updating the Genetics Management Plan with program partners.
	IV.A.3.	Conduct genetic diversity studies (includes Gila taxonomy studies) and confirm presumptive genetic stocks based on all available information.									
	IV.A.3.a.	Razorback sucker.	BR	Complete							
	IV.A.3.b.	Bonytail and humpback chub.									
	IV.A.3.b.(1)	Morphological and allozyme analyses. (Draft 4/95)	PD	Complete							
	IV.A.3.b.(2)	Mitochondrial DNA analysis.	BR	Complete							
	IV.A.3.c.	Colorado pikeminnow.	PD	Complete							
>	IV.A.4.	Secure and manage the following species in hatcheries (according to the Genetics Management Plan).									
	IV.A.4.a.	Razorback sucker.									
	IV.A.4.a.(1)	Middle Green	FWS-FAC	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	Green River razorback sucker broodstock are currently maintained and in active use at Ouray National Fish Hatchery - Randlett.
	IV.A.4.a.(2)	Upper Colorado River.	FWS-FAC	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	Colorado River razorback sucker broodstock are currently maintained and in active use at Horsethief Canyon Native Fish Facility.
	IV.A.4.b.	Bonytail	UDWR/CPW	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	Upper basin bonytail broodstock are currently maintained and in active use at Southwest Native Aquatic Resources and Recovery Center (Southwest Native ARRC).

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	IV.A.4.c.	Humpback chub.									The final technical report (Bohn et al. 2019) analyzing humpback chub genetics across the lower and upper basins was finalized. Major conclusions included: -Upper basin populations are more diverse than lower basin populations, and lower basin fish should not be used for augmentation in the upper basin. -Upper basin stocks should be managed separately as Green River and Colorado River units. -There is some evidence of roundtail introgression into the Black Rocks population, which should be monitored, and this warrants keeping this population separate from the Desolation/Gray population. -Further investigation into localized genetic structure (perhaps due to spawning site fidelity) is recommended to capture unique alleles.
	IV.A.4.c.(1)	Black Rocks.	FWS-FAC	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	In August 2019, FWS GJ-FWCO brought an additional 10 small adult humpback chub in from Black Rocks to HCNFF, for a total of 37 wild fish. In 2019, the adult humpback chub being held at HCNFF once again spawned voluntarily. However, when the humpback chub refugia pond was drained (on 29 October 2019), hatchery staff discovered that an outbreak of "ich" (*Ichthyophthirius multifilis*) had occurred in this pond. As a result, only 14 (38%) of the wild humpback chub remained alive. The remaining, volunteer-spawned, young fish also had ich and were therefore removed. The remaining adults were treated in isolation and then replaced in the pond after it had been drained, thoroughly cleaned, and refilled with fresh water. Options for the remaining wild humpback chub being held will be discussed during winter 2019-2020.
	IV.A.4.c.(2)	Westwater Canyon.	UDWR	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	
	IV.A.4.c.(3)	Cataract Canyon. (Broodstock currently represented by wild fish in the river.)	UDWR	Ongoing	X	X	X	X			
	IV.A.4.c.(4)	Yampa Canyon. (Broodstock had been considered represented by wild fish in the river; however, population appears to have declined and Recovery Program was unable to establish a refuge stock.)	FWS-FAC	Dropped							See Yampa River tab IV.A.1.c
	IV.A.4.c.(5)	Desolation/Gray Canyons. (Broodstock currently represented by wild fish in the river; however, population appears to have declined and Recovery Program is establishing a refuge stock.)	UDWR	Ongoing	X	X	X	X	X	Maintain genetic refuge for each of the species.	25 humpback chub from Desolation Canyon were brought into Ouray NFH in 2009. Twelve remain at Ouray NFH-Randlett. Program may consider bringing in additional fish in future years. See IV.A.4.c.
	IV.A.4.d.	Colorado pikeminnow.									
	IV.A.4.d.(1)	Upper Colorado River Basin (Broodstock currently represented at Southwest Native ARRC and by wild fish in the river.)	FWS	Ongoing	X	X	X	X	X	It is important to maintain a broodstock of Colorado pikeminnow for genetic integrity.	*X* In 2019, USFWS personnel from SNARRC alerted the Recovery Program of the severity of their concerns over the genetic diversity of the Colorado pikeminnow broodstock held at that facility. The Biology Committee agree with their recommendations that augmenting the genetic diversity of that broodstock was among our highest priorities.
	IV.B.	Conduct annual fish propagation activities.									
	IV.B.1.	Identify species needs for refuge, research, augmentation, and information and education.	PD	Ongoing	X	X	X	X	X		
	IV.B.2.	Implement revised integrated stocking plan (Integrated Stocking Plan Revision Committee 2015); supersedes all earlier stocking plans, including species-specific and individual basin plans.	FWS, UDWR, CPW	Ongoing	X	X	X	X	X		Hatcheries continue to stock 35,000 bonytail and 12,000 razorback sucker annually at the increased size recommended by this plan. See the Assmt-Gen Stocking worksheet. Bonytail are now stocked in habitats thought to enhance post-stocking survival, such as floodplains, tributary mouths, and backwaters.
	IV.B.3.	Conduct NEPA compliance and develop biological opinion on disposal of excess captive- reared endangered fish.	FWS-ES/FR	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	IV.C.	Operate and maintain facilities.									As facilities age Reclamation suggests that the Recovery Program may want to consider establishing a replacement reserve fund.
	IV.C.1.	Ouray NFH: Randlett Unit.	FWS-FAC	Ongoing	X	X	X	X	X	Operate and maintain facilities for genetic refuge	Consideration for aging facilities needs to be part of future planning, including installation of two more replacement wells within approximately four years and replacement of bird netting and pond liners within the next few years.
	IV.C.2.	Ouray NFH: Grand Valley Unit.	FWS-FAC	Ongoing	X	X	X	X	X	Operate and maintain facilities for genetic refuge	Consideration for aging facilities needs to be part of future planning.
	IV.C.3.	Wahweap.	UDWR	Ongoing	X	X	X	X	X	Operate and maintain facilities for genetic refuge	Consideration for aging facilities needs to be part of future planning.
	IV.C.4.	Mumma.	CPW	Ongoing	X	X	X	X	X	Operate and maintain facilities for genetic refuge	Consideration for aging facilities needs to be part of future planning.
	IV.D.	Plan, design, and construct needed facilities.									
	IV.D.1.	Develop Coordinated Hatchery Facility Plan based on revised State stocking plans.	PD	Complete							
	IV.D.2.	Design and construct appropriate facilities.									
	IV.D.2.a.	Ouray NFH: Randlett Unit.	FWS/BR	Complete							
	IV.D.2.b.	Wahweap.	UDWR/BR	Complete							
	IV.D.2.c.	Ouray NFH: Grand Valley Unit.	FWS/BR	Complete							
	IV.D.2.c.(1)	Construct ponds at Grand Valley to maintain secondary bonytail broodstock, humpback chub from Black Rocks, Westwater and Cataract Canyons, and additional rearing space for razorback sucker (leased ponds being discontinued).	FWS/BR	Complete							
	IV.D.2.d.	Acquire ponds for growout of endangered fishes.									
	IV.D.2.d.(1)	23 acres of growout ponds in the Green River basin.	FWS/STATES	Complete							
	IV.D.2.d.(2)	100 acres of growout ponds in the Colorado River basin.	FWS/STATES	Complete							
	IV.E.	Conduct monitoring to evaluate effectiveness and continuation of endangered fish stocking.								Will be a function of post Program monitoring	Razorback sucker stocking success is evaluated using data collected during Colorado pikeminnow population estimates. See Green River V.D.1 and Colorado River V.E.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	IV.E.1.	Assess the monitoring needed to evaluate the contribution to recovery of endangered fish stocking over relevant reaches, life stages, and generations. Assessment addressed in 2001 and 2004 workshops (Upper Colorado River Endangered Fish Recovery Program 2002, 2006); continued assessment ongoing.	LFL/ States	Ongoing	X	X	X	X			
	IV.E.2.	Evaluate endangered fish stocking and revise augmentation plans, as needed. Initial evaluation complete: Zelasko et al. 2009, 2011.	FWS/LFL/ States/PD	Ongoing	X	X	X	X			! Wahweap, Mumma, Ouray NFH - Randlett and Ouray NFH - Grand Valley completed Health Condition Profiles to document condition of bonytail and razorback sucker (if applicable) prior to release. ! Wahweap, Mumma, Ouray NFH - Randlett and Ouray NFH - Grand Valley all participated in diet studies using either a commercially-available diet or experimental diets formulated by the Bozeman Fish Technology Center. Diets were assessed using multiple age classes of bonytail and results are forthcoming in 2020. Post stocking survival of bonytail still does not meet expectations, however stocking locations at or near PIT-tag antennas are being utilized to gain information on movement and survival of bonytail.
	IV.E.3	Modify stocking plans to ensure successful stocking.	Program	Ongoing	X	X	X	X			Recommendations by Zelasko et al. 2009, 2011 were incorporated into the Revised Integrated Stocking Plan. The plan was finalized and is being implemented (see Assessment-Gen Stocking worksheet).
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									
	V.A.	Measure and document population and habitat parameters to determine status and biological response to recovery actions.									
	V.A.1.	Conduct interagency data management program to compile, manage, and maintain all research and monitoring data collected by the Recovery Program.	FWS-FAC	Ongoing	X	X	X	X	X		STReaMS continues to improve and stores data on ~1.3 million individual fish. Additional query tools have been added along with storage capacity for nonnative fish data and assessments.
	V.A.1.a.	Develop basin wide razorback monitoring program (implementation to be reflected in sub-basin worksheets). Bestgen et al. 2012.	LFL	Complete							
	V.A.1.a.(1)	Standardize light trap sampling	LFL	Ongoing							Additional tests were conducted at Leota Bottom to assess light trap efficiency in the field. Results are pending and will be part of Cat de Vlaming's (CSU-LFL) masters thesis. Initial findings presented at the Researchers Meeting indicate light trapping is an effective tool, may represent a reasonable index of larval abundance, and LED light traps may be more effective than chemical glow sticks.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	V.A.1.a.(2)	Investigate improving recapture rates through passive PIT tag monitoring, nets, etc. to improve population abundance estimates.	ALL	Ongoing	X	X	X	X	X	Continue to use all appropriate data to analyze the population dynamics for each population.	Stationary and portable PIT tag antennas continue to be used throughout the basin to add detections to the database and support population estimates. PIT antennas under two programs (169 and 172) detected thousands of unique razorback sucker in the Green River at known spawning locations; 2019 detections were double in magnitude as previous years. Colorado pikeminnow, bonytail and other native species were also detected.
	V.A.1.b.	*Ensure antennas installed in the upper basin are maintained on a regular basis and data is routinely collected and made available.*	*PD / USBR*	*Ongoing*	*X*	*X*	*X*	*X*	*X*	*Permanently installed antennas will need maintenance and periodic replacement to continue providing data.*	A SOW has been developed and funded by USBR to address the maintenance needs at permanent antenna arrays. Data from most arrays currently updates automatically through STReaMS. In 2019, all 3G cellular connections were replaced with 4G connections and data connections will be updated to reflect new data.
	V.A.2.	Evaluate population estimates.	PD	Ongoing	X	X	X	X	X	Continue to evaluate population estimates.	The Program is investigating including antenna data in population estimates.
	V.A.3.	Collect and submit data according to standard protocol (e.g., location, PIT tag #, length, weight, etc.) on endangered fish encountered in all field activities in order to provide annual information on population status outside of formal population estimates.	ALL	Ongoing	X	X	X	X	X	Continue collecting data in all field activities outside of formal population estimates.	All data is collected and submitted to STReaMS on an annual basis using standardized protocols.
	V.B.	Conduct research to acquire needed life history information.									
	V.B.1.	Identify significant deficiencies in life history information and needed research.	PD	Ongoing	X	X	X	X			
	V.B.1.a.	Develop Research Framework (Valdez and Bestgen, 2011)	PD	Complete							
	V.B.1.a.(1)	Implement climate change initiative that outlines a strategy for dealing with the effects of drought.	Program	Pending							Impacts of climate change are considered in each individual program element and action. The effects of climate change were considered in the SSAs for humpback chub and razorback sucker, and was determined to be a significant stressor in long-term time frames. No climate initiative is planned at this time.
	V.B.2.	Conduct appropriate studies to provide needed life history information.	FWS-FAC/ STATES	Ongoing	X	X	X	X			Recommendations for new information are being accomplished through various projects, such as projects 115, 158, and 163.
	V.B.2.a.	Evaluate need for imprinting based on reintroduction plans.	FWS-FAC	Complete							
	V.B.2.b.	Investigate age-0 and age-1 humpback chub mortality (especially in Black Rocks/Westwater and Desolation canyons) as recommended in the Research Framework.	TBD	Ongoing	X	X	X	X			Hoop nets are being incorporated into sampling efforts to document young Gila in all populations.
	V.C.	Develop and enhance scientific techniques required to complete recovery actions.									
	V.C.1.	Conduct marking study of young-of-the-year Colorado pikeminnow.	FWS-FAC	Complete							
	V.D.	Establish sampling procedures to minimize adverse impacts to endangered fishes.									
	V.D.1.	Assess electrofishing injury impacts to endangered fishes.	LFL	Complete							
	V.D.2.	Implement scientific sampling protocols to minimize mortality for all endangered fishes.	FWS-ES/ STATES	Ongoing	X	X	X	X	X	Continue to implement sampling protocols to minimize mortality.	Electrofishing guidelines were finalized and published in 2018 (Martinez and Kolz 2018). No further research is planned at this time.
	V.E.	Provide for long-term care, cataloging, and accessibility of preserved specimens.	PROGRAM	Ongoing	X	X	X	X	X	Continue to provide long-term care for preserved specimens.	The Larval Fish Lab continues to collect, identify, process and store larval specimens from across the UCRB.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	V.F.	Assess relative biological importance of tributaries and their potential contributions to endangered fish recovery.	Contract	Complete							
	V.G.	Reevaluate overutilization for commercial, recreational, scientific or educational purposes and identify actions to ensure adequate protection.	FWS-ES	Ongoing	X	X	X	X			Overutilization for commercial, recreational, scientific, and educational purposes are considered during FWS species status reviews. Completed SSAs and 5year reviews concluded that overutilization was not a significant stressor for humpback chub or razorback sucker. Upcoming SSAs and 5-year reviews will review this topic for Colorado pikeminnow and bonytail.
	V.H.	Reevaluate effects of disease and parasites and identify actions to ensure adequate protection.	FWS-ES	Ongoing	X	X	X	X			Diseases and parasites are considered during FWS species status reviews. Completed SSAs and 5-year reviews concluded that diseases and parasites were not a significant stressor for humpback chub or razorback sucker. Upcoming SSAs and 5-year reviews will review this topic for Colorado pikeminnow and bonytail.
	VI.	**INCREASE PUBLIC AWARENESS AND SUPPORT FOR THE ENDANGERED FISHES AND THE RECOVERY PROGRAM. (Includes integration with San Juan River Recovery Implementation Program.)**									
	VI.A.	Conduct survey to measure public awareness of and attitudes toward endangered Colorado River fishes and the Recovery Program.	PD	Complete 1995.							
	VI.B.	Plan and implement information and education and public involvement activities for all significant Recovery Program actions (e.g. presentations, public meetings~~,~~ etc.).	PROGRAM	Ongoing	X	X	X	X	X	Consider continuing some presence at water user trade shows to educate and inform partners and the public about post-Program endangered fish conservation.	Attended various trade shows: Colorado Water Congress, Utah Water Users, Colorado Water Workshop, Rocky Mountain Coal Mining Institute Annual Conference, and CRWUA. Attended Ute Water Children's Water Festival, and Endangered Species Day, May, 2019 at the Denver Aquarium. Had display at Grand Junction, CO Farmer's Market, Palisade Peach Festival, Palisade, CO. Did not attend a razorback sucker release to photograph students or get out on the river this field season. Outreach is a powerful way to provide our message to local communities; engagement with local citizens is generally very positive and citizens learn a lot from our presentations and handouts. Partners and volunteers provide a substantial workforce to staffing these outreach events.
	VI.B.a	Plan and implement education activities for children, schools, and classrooms	Program	Ongoing	X	X	X	X	X		UDWR educates 4th grade classes about native fish. The Recovery Program provides them with outreach materials. Approximately 1,500 students are reached. Between February 2019 through February 2020, Ouray NFH Grand Valley Unit provided 39 tours and/or presentations about endangered fish and the 24 Rd. hatchery facility which included roughly 3532 people. Of these 39 tours and presentations given, they included 33 school groups and 6 professional or community groups. Aside from the hatchery tours and endangered fish presentations, Ouray NFH Grand Valley Unit also provided endangered fish for 4 community events/festivals reaching roughly 18,050 visitors. Additionally, Ouray NFH Grand Valley Unit provided endangered fish for 2 permanent fish tank exhibits which were seen by an estimated 20,050 visitors. Furthermore, Ouray NFH, Grand Valley participated in 2 parades passing out I & E information to over 950 children and young adults reaching an estimated 7,000 parade goers The total estimated participants reached from our outreach efforts from Feb 1, 2019 - Feb 28, 2019 (13 months) was roughly 49,207 people.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	VI.C.	Promote technical publication of study results.	PD	Ongoing	X	X	X	X	X		The Program supports authors' publishing their technical reports in professional journals (may use Program funds for publishing costs).
	VI.D.	Produce, distribute, and evaluate information and education products (such as Field Report, brochures, public website, social media, etc.); manage media relations, including contacting reporters, producing news releases, fact sheets, etc.	PD	Ongoing	X	X	X	X	X	Consider continuing these kinds of outreach to educate and inform partners and the public about post-Program endangered fish conservation.	"Swimming Upstream" field report is now an 8.5" x 11" booklet in full color. Field report is well received and distributed widely. Briefing Book has been redesigned to serve as an overview of the programs. The redesign reduced the document from 24 pages down to 20 and offers more color pages. Produced four new inserts for the Briefing Book which will be annual updated, including "On the Path to Recovery" for distribution to Congressional aides to highlight progress made in the recovery of the endangered fishes, a Briefing Summary, Financial Updates and a new nonnative fish impact brochure. Multiple news articles were produced, including regional and national outlets; many of the news articles covered the humpback chub proposed downlisting action both before and after publication. Nonnative fish removal artwork has been developed for the Lil' Suckers beverage holders and have been produced. This product will be distributed to field crews, river runners and angling guides for distribution to people encountered on the river. Sets of 5x7 inch note cards have been developed with species pictures on the front one of the five elements of recovery highlighted on the back. Trading cards for students have been redesigned with species pictures to be distributed to classrooms. Temporary fish tattoos are packaged with trading cards. Vinyl outdoor mini-bumper stickers have been manufactured and are in distribution.
	VI.E.	Participate in development and circulation of interpretive exhibits about the Recovery Program and the endangered fish.	PD	Ongoing	X	X	X	X	X	Consider continuing interpretive exhibits to educate the public about post-Program endangered fish conservation.	Providing support and supplies to live endangered fish exhibits in Grand Junction, CO. and an aquaculture facility at Palisade High School. Provide aquarium supplies for the "Razorback in the Classroom" project in Colorado and Utah. 40 signs for UDWR were designed and manufactured in 2018. Installation of signs continues along the Green and Colorado rivers.
	VI.F.	Maintain Recovery Program technical library and library web page.	PD	Ongoing	X	X	X	X	X	Partners will need to discuss whether CWCB Laserfiche site should become an archive for Recovery Program reports, or remain a living directory to which partners may continue to submit technical reports related to the endangered Colorado River fishes.	Program website is up to date with annual reports, scopes of work, technical reports, and meeting summaries. All new documents posted will be 508 compliant to support access from all individuals. CWCB laserfiche library serves as an archive of Program documents.
	VII.	**PROVIDE PROGRAM PLANNING AND SUPPORT (PROGRAM MANAGEMENT)**									
	VII.A.	Determine actions required for recovery.									
	VII.A.1	Assure consistency of RIPRAP with currently approved recovery plans.	PD	Ongoing	X	X	X	X			Existing recovery plans need to be updated; RIPRAP incorporates new information annually. The USFWS is enacting a new recovery planning process, called Recovery Implementation Strategy, which parallels with the RIPRAP.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	VII.A.2.	Recognize the role of the Upper Colorado River Recovery Program in revised recovery plans.	FWS	Ongoing	X	X	X	X			SSAs and 5-year reviews for razorback sucker and humpback chub recognized the important role that the Recovery Program plays in managing resources for the fish. Future conditions for the two species were heavily based on continued implementation of the Recovery Program actions.
	VII.A.3.	Update, refine, and prioritize recovery actions (RIPRAP) annually.	PD	Ongoing	X	X	X	X			PDO coordinates RIPRAP updates annually. RIPRAP reviewed by all Program partners and all Program committees.
	VII.A.4.	Develop Interim Management Objectives (IMOs) for each species and presumptive stock and an index to population status.	PD	Complete							
	VII.A.4.a.	Public and external peer review of IMOs.	FWS	Complete							
	VII.A.4.b.	Implementation Committee review and approval of IMOs.	ALL	Complete							
	VII.A.5.	Develop specific recovery goals.									
	VII.A.5.a.	Convene Recovery Team.	FWS	Complete							
	VII.A.5.b.	Develop recommended recovery goals.	PD/Contract	Complete							
	VII.A.5.c.	Biology Committee review of recommended recovery goals.	Program	Complete							
	VII.A.5.d.	Finalize recovery goals.	FWS/PD	Complete							
	VII.A.5.d.(1)	Update recovery goals and then revise recovery plans.	PD/FWS	In progress	X	X	X				USFWS completed a 5-year review for bonytail in 2019, which recommended retaining the species as endangered. ! USFWS published a proposed downlisting rule for humpback chub on January 22, 2020. USFWS is continuing work on reclassification documents and will convene recovery teams in the near future to renew recovery plans for all species where revision of recovery plans is recommended. An SSA for Colorado pikeminnow will be competed in 2020, followed by a 5-year review. After completion of these two documents, the draft recovery plan will be revised as needed. Population Viability Analysis for Colorado pikeminnow was completed in 2018. The PVA determined that Colorado pikeminnow populations in the Green and Colorado subbasins had declined in recent years, regardless of the model used (single or dual phase). Models predicting future adult abundance showed continued declines in the Green subbasin under the status quo, and either future declines or stabilized population for the Colorado subbasin, depending on the magnitude of "spawning spikes." Meeting summer base flow recommendations, controlling nonnative fishes, reducing adult mortality, and preventing canal entrainment produced improvements to the populations whether modeled individually or in combination. A 5-year review for bonytail will be completed in 2019.
	VII.A.5.e.	Conduct species status review every 5 years. See U.S. Fish and Wildlife Service 2011 a&b, 2012 a&b at http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-goals.html.	FWS/ Program	Ongoing				X	X		See VII.A.5.d.(1)
	VII.A.6.	Identify elements of conservation plans to ensure long-term management and protection post-Program.	Program	Ongoing	X	X	X	X	X		
	VII.A.7.	Monitor and assess Recovery Program accomplishments annually.	PD	Ongoing	X	X	X	X			Recovery Program accomplishments are annually tracked in the Sufficient Progress memo and the Program Highlights briefing book.
	VII.A.8.	Develop biennial work plan to address priority needs.	PD	Ongoing	X	X	X	X			Biennial workplan was completed in 2019, setting budgets for 2020 and 2021. Budget cuts were enacted as the list of projects continues to grow.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	VII.B.	Actively participate in Recovery Program committees and secure funding for annual work plan and larger projects (e.g., water acquisition, capital construction, and long term operation and maintenance) in accordance with the recovery actions and milestones (Utah, Colorado, Wyoming, Bureau of Reclamation, Fish and Wildlife Service, Western Area Power Administration, Water Users, Environmental Groups, Colorado River Energy Distributors Association and the National Park Service).	PD	Ongoing	X	X	X	X			Program stakeholders and Program Director's Office hold committee meetings at appropriate time intervals.
	VII.B.1.	As defined in PL 106-392, prepare joint report with San Juan River RIP on the utilization of power revenues for base funding, including recommendations regarding the need for continued base funding after 2011 that may be required to fulfill the goals of the Recovery Programs. Report was due to the committees of the U.S. Senate and House of Representatives 9/30/08 (submitted April 2010). Second, abbreviated report submitted December 2016 (Secretary of the Interior, 2016).	Program	Complete (2010); second report completed in 2016.							
	VII.B.2	Secure annual funding for the Programs (Upper Colorado and San Juan), 2020 through 2023.	Program	Complete						Post 2023 recovery actions and associated funding amounts and sources will be described in a Report to Congress; due by the end of FY21.	Non-federal stakeholders drafted PL 106-392 reauthorization language in 2017. ! PL 116-9 was signed by the President on March 12, 2019 authorizing the use of appropriations (up to $10M for both programs annually) through FY23. Language in the FY20 Energy and Water Appropriations bill changed the funding source back to hydropower revenues for the current year.
	VII.B.3.	As defined in PL 116-9, prepare a joint report with San Juan River RIP summarizing program accomplishments, species status and future needs post-2023.	Program	Ongoing	X	X					In 2019, the Program held several meetings to discuss the scope and actions of the Program after 2023. The resulting recommendations were submitted through the committees to form a preliminary recommendation considered by funding parties. The PDO, in coordination with the San Juan Program office, is currently using this information to draft a Report to Congress which will be submitted to the DOI bureaus in Headquarters by the end of FY20. As per language in PL 116-9 the SOI will submit the report to Congress by the end of FY21. Discussions are ongoing to determine a final recommended scope and format of
	VII.C.	Manage, direct, and coordinate Recovery Program activities.	PD	Ongoing	X	X	X	X	X	Program partners will determine what post-Program coordination should look like.	Program Director's Office coordinates recovery actions by working with Program stakeholders, committee members, principal investigators, and field personnel. PDO is currently working without one position. Full staffing is important to complete important recovery documents, plan for post-2023, and continue to coordinate activities.
	VII.C.1.	Review Information and Education program (Management Committee).	PD	Complete							

Fish produced and stocked by facility in 2019				
Facility	**Species**	**Target**	**Stocked**	**Percent**
Grand Valley (USFWS)	razorback sucker	6,000	7,535	126%
	bonytail	10,000	11,306	113%
Ouray Randlett	razorback sucker	6,000	8,579	143%
	bonytail	10,000	18,645	186%
Wahweap (Utah)	bonytail	10,000	10,797	108%
Mumma (Colorado)	bonytail	5,000	6,058	121%

Razorback sucker stocked by river 2019

Facility	**River**	**Stocked**
Grand Valley	Upper Colorado	4,444
	Gunnison	3,087
	White River	4
Ouray Randlett (USFWS	Green River	8,579

Bonytail stocked by river 2019

Facility	**River**	**Stocked**
Grand Valley	Colorado River	11,304
	White River	2
Ouray Randlett (USFWS	Green River	15,051
	White River	3,594
Wahweap	Colorado River	3,561
	Price River	3,572
	Dolores River	3,664
Mumma	Colorado River	2,620
	Yampa River	2,850
	Salt Creek	588

Total Numbers of Fish Stocked in the Upper Colorado River Basin Since 1995
Razorback Sucker Stocking in the Upper Colorado River Basin

		Colorado and		Middle Green River		Lower Green River	
Year	**Stocking Goal**	**# Stocked**	**% Target**	**# Stocked**	**% Target**	**# Stocked**	**% Target**
1995	Upper Colorado River experimental stocking plan (13,100 in	316	2%				
1996	13,100 in various size ranges	1,112	9%				
1997	13,100 in various size ranges	2,926	22%				
1998	26,200 in various size ranges	606	2%	387	No Plan		
1999	58,600 in various size ranges	6,155	11%	1,357	No Plan		
2000	104,800 in various size ranges	29,826	29%	224	No Plan		
2001	104,800 in various size ranges	6,199	6%				
2002	State Stocking Plans (CO = 16,440 300+ mm; UT = 18,500 >	11,374	69%			274	2%
2003	Integrated Stocking Plan (9,930 per reach)	5,541	56%	8,446	85%	2,377	24%
2004	Integrated Stocking Plan (9,930 per reach)	6,153	62%	9,619	97%	5,957	60%
2005	Integrated Stocking Plan (9,930 per reach)	10,284	104%	4,850	49%	4,231	43%
2006	Integrated Stocking Plan (9,930 per reach)	10,726	108%	5,021	51%	15,188	153%
2007	Integrated Stocking Plan (9,930 per reach)	10,064	101%	7,749	78%	8,549	86%
2008	Integrated Stocking Plan (9,930 per reach)	12,949	130%	11,677	118%	10,161	102%
2009	Integrated Stocking Plan (9,930 per reach)	17,975	181%	14,983	151%	5,017	51%
2010	Integrated Stocking Plan (9,930 per reach)	9,926	100%	10,926	110%	10,040	101%
2011	Integrated Stocking Plan (9,930 per reach)	12,019	121%	9,036	91%	12,496	126%
2012	Integrated Stocking Plan (9,930 per reach)	10,506	106%	11,191	113%	10,193	103%
	Total by River	164,657		95,466		84,483	
	Total	**344,606**					

		Facility					
		Ouray			Grand Valley		
Year	**Stocking Goal**	**# Stocked**	**% Target**	**Avg Size**	**# Stocked**	**% Target**	**Avg Size**
2013	Draft Revised Integrated Stocking Plan (6,000 per facility)	10,606	177%		10,061	168%	
2014	Draft Revised Integrated Stocking Plan (6,000 per facility)	6,601	110%	367.5	6,062	101%	367
2015	Revised Integrated Stocking Plan (6,000 per facility)	5,892	98%	373	3,165	53%	427
2016	Revised Integrated Stocking Plan (6,000 per facility)	2,322	39%	329	5,617	94%	382
2017	Revised Integrated Stocking Plan (6,000 per facility)	8,186	136%	340	7,420	124%	387
2018	Revised Integrated Stocking Plan (6,000 per facility)	8,583	143%	385	7,423	124%	365
2019	Revised Integrated Stocking Plan (6,000 per facility)	8,579	143%	373	7,535	126%	330
	Total by Facility	50,769			47,283		
	Total	**98,052**					

Total Numbers of Fish Stocked in the Upper Colorado River Basin Since 1995
Colorado pikeminnow Stocking in the Upper Colorado River Basin

		Colorado River		Gunnison River	
Year	**Stocking Goal**	# Stocked	% Target	# Stocked	% Target
2003	Integrated Stocking Plan (1,125 150+ mm per reach)	2,405	214%	1,051	93%
2004	Integrated Stocking Plan (1,125 150+ mm per reach)	1,809	161%	1,200	107%
	Total	**4,214**		**2,251**	

Total Numbers of Fish Stocked in the Upper Colorado River Basin Since 2000
Bonytail Stocking in the Upper Colorado River Basin

Year	Stocking Goal	Colorado/Gunnison Rivers # Stocked	Colorado/Gunnison Rivers % Target	Middle Green River # Stocked	Middle Green River % Target	Lower Green River # Stocked	Lower Green River % Target
2000	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	36274	223%			69192	425%
2001	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	37,968	233%	--		45522	280%
2002	State Stocking Plans (CO = 12,000 200+ mm; UT = 16,280 μ=200 mm)	16,464	101%	17713	1.09	8000	49%
2003	Integrated Stocking Plan (5,330 200+ mm per reach)	6303	118%	16927	3.18	3043	57%
2004	Integrated Stocking Plan (5,330 200+ mm per reach)	3,985	75%	3,500	0.66	3100	58%
2005	Integrated Stocking Plan (5,330 200+ mm per reach)	6,067	114%	5980	1.12	3100	58%
2006	Integrated Stocking Plan (5,330 200+ mm per reach)	5,554	104%	5045	0.95	3270	61%
2007	Integrated Stocking Plan (5,330 200+ mm per reach)	5,570	105%	5409	1.01	5404	101%
2008	Integrated Stocking Plan (5,330 200+ mm per reach)	5,896	111%	7,641	143%	5,336	100%
2009	Integrated Stocking Plan (5,330 200+ mm per reach)	5,085	95%	5,347	100%	5,403	101%
2010	Integrated Stocking Plan (5,330 200+ mm per reach)	2,450	46%	2,813	53%	5,347	100%
2011	Integrated Stocking Plan (5,330 200+ mm per reach)	5,454	102%	5,526	104%	--	0%
2012	Integrated Stocking Plan (5,330 200+ mm per reach)	5,452	102%	2,831	53%	2,695	51%
2013	Integrated Stocking Plan (5,330 200+ mm per reach)	2,934	55%	8,503	160%	0	0%
	Total by River	145,456		87,235		159,412	
	Total	**392,103**					

		Facility											
		Ouray			Grand Valley			Wahweap (UT)			Mumma (CO NASRF)		
Year	Stocking Goal	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size	# Stocked	% Target	Avg Size
2013	Draft Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	6,087	61%			0%			0%		5,400	108%	
2014	Draft Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	15,196	152%	280.4	9,529	95%	254	15,671	157%	235.5	5,441	109%	321.9
2014	Untagged fry into CDOT pond, Debeque, Colorado							40,238					
2014	Untagged fry into the Dolores River, Utah at Rio Mesa Center							5,923	River, Utah				
2015	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	10,131	101%	267	11,594	116%	274	13,427	134%	241.3	5,493	110%	320.6
2016	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	11,202	112%	269.2	10,324	103%	264	8,208	82%	252.5	6,027	121%	327
2017	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	12,802	128%	229	10,501	105%	250	11,046	110%	254.7	5,172	103%	313
2017	Untagged fish into Leota 4	9,413		<230 mm									
2017	Untagged fish into Lake Powell							33,454					
2017	Untagged fry into Johnson Bottoms and entrance canal	36,232											
2018	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	11,939	119%	250	11,360	114%	244	10,333	103%	262	5,859	117%	315
2018	Untagged fish into Lake Powell							37,182					
2019	Revised Integrated Stocking Plan (10,000 per facility; Mumma = 5,000; μ=250 mm)	18,645	186%	273	11,306	113%	236	10,797	108%	258	6,058	121%	272
	Total by Facility	131,647			64,614			186,279			39,450		
	Total	**421,990**											

		ACTIVITY	WHO	STATUS	FY 20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Green River above Duchesne River									
	I.A.1.	Initially identify year-round flows needed for recovery while providing experimental flows.									
	I.A.1.a.	Summer/fall.	FWS-ES	Complete							
	I.A.1.b.	Winter/spring.	FWS-ES	Complete							
	I.A.1.c.	Review summer/fall flow recommendation.	FWS-ES	Complete							
	I.A.2.	State acceptance of initial flow recommendations.									
	I.A.2.a.	Summer/Fall.	UT	Complete							
	I.A.2.b.	Winter/Spring.									
	I.A.2.b.(1)	Review scientific basis.	UT	Complete							
	I.A.2.b.(2)	Assess legal and physical availability of water.	UT	Complete							
	I.A.3.	Deliver identified flows.									
>*	I.A.3.a.	Operate Flaming Gorge pursuant to the 1992 Biological Opinion to provide summer and fall flows.	BR	Complete							
>*	I.A.3.b.	Operate Flaming Gorge to supply winter and spring test flows for research.	BR	Complete							
	I.A.3.c.	Complete NEPA and issue Record of Decision on reoperation of Flaming Gorge pursuant to Biological Opinion.	BR	Complete							
>*	I.A.3.d.	Operate Flaming Gorge Dam to provide winter and spring flows and revised summer/fall flows, pursuant to the new Biological Opinion and Record of Decision.	BR	Ongoing	X	X	X	X	X	Program will continue to coordinate with Reclamation on annual Flaming Gorge operations, including providing annual requests for releases to benefit endangered species, and possibly to experiment with releases within sideboards of the Reclamation's FG ROD and other authorities. New guidelines or agreements for Colorado River management may be established among the basin states and Reclamation, including options for endangered fish flow management.	Unregulated Apr-July flow into Flaming Gorge Reservoir in 2020 was approximately 120% of the 1981-2010 average. Flaming Gorge releases were ramped-up to power plant capacity (~4500 cfs) on June 3, with an additional bypass release between 1,000 and 4,000 cfs from June 4 through June 19, as requested by the Program, in order to boost larval razorback sucker entrainment into Stewart Lake and other floodplain wetlands. ! Combined with natural flows out of the Yampa River, mean daily flows at the Jensen, UT gage exceeded 18,600 cfs (approximate bankfull) for about nine days in June after larval razorback sucker were detected, filling all key wetlands identified in the LTSP except for Baeser Bend, all of which were dry or otherwise 'reset' prior to 2019 -- see I.D.2.b.(4)(a) and II.A.5.a. The peak mean daily flow at Jensen of 20,800 cfs occurred on June 11, compared to a 18,600 cfs Muth et al. target under a "average" hydrologic condition (30% to 70% exceedance). Flow at Jensen was brought down to a base flow of less than 3,000 cfs by July 29 and sustained between about 2,190 and 2,650 cfs from Aug 6 through the end of September, establishing more favorable conditions for drifting pikeminnow larvae. Average August and September baseflows recorded at the Jensen gage (Reach 2) were 2,454 cfs and 2,259 cfs respectively. These flows fell within a preferred experimental base flow range for an average year (2,000-2,600 cfs; Bestgen and Hill 2016). Water temperature differences: see II.C.2 below. For additional details, see the 2019 Hydrologic Conditions Summary RIPRAP supplement.

		ACTIVITY	WHO	STATUS	FY 20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.A.3.d.1.	Conduct real-time larval razorback and Colorado pikeminnow sampling to guide Flaming Gorge operations.	LFL/FWS	Ongoing	X	X	X	X	X		The first larval razorback sucker was detected on May 21 at Cliff Creek (RM 302.8), but relatively delayed, elevated, cold runoff, and slow larval emergence led the FGTWG to recommend some delay in ramping-up FG releases to maximize larval entrainment into floodplain wetlands. Full ramp-up began June 3.
	I.A.4.	Legally protect identified flows.									
	I.A.4.a.	Protect Summer/Fall flows.									The Bureau of Reclamation continues to operate Flaming Gorge Reservoir in the summer and fall in compliance with the 2006 ROD. In March 2019 Reclamation and Utah signed the 'Green River Block' water rights exchange contract, which would allow Reclamation to exchange water out of Flaming Gorge Reservoir to offset most new depletions in Reach 1 and Reach 2 associated with Utah's development up to 72KAF of new water downstream. That contract is currently under legal challenge by several conservation groups. Reclamation also proposes a second contract with the State of Utah for the exchange of water out of Lake Powell to service the proposed Lake Powell Pipeline project. Exercise of that contract will protect ~86KAF of water annually downstream of Flaming Gorge for delivery to Lake Powell. No change in current Flaming Gorge operations is anticipated as a result of this contract.
	I.A.4.a.(1)	Hold public meeting to establish future appropriation policy.	UT	Complete 10/94							
	I.A.4.a.(2)	Adopt and implement new policy (new appropriations subject to flow criteria).	UT	Complete 11/94							
>*	I.A.4.a.(3)	In 1994 the Utah State Engineer adopted a policy to protect flows required for the endangered fish on the Green River between Flaming Gorge Dam to the confluence of the Duchesne River by subordination of post-1994 applications to appropriate water and water right change applications during June 22 to November 1. To meet future needs new diversions totaling 20 cfs are exempt.	UT	Completed in 1994							
	I.A.4.a.(4)	Implement and evaluate effectiveness of policy.	UT	Ongoing	X	X	X	X	X		Policy is being implemented and has not been challenged. Evaluation of the effectiveness of this policy likely will take place if a challenge arises or if a large project is proposed.
	I.A.4.b.	Protect Winter/Spring flows.									
	I.A.4.b.(1)	Hold public meeting to establish future appropriation policy.	UT	Complete							
	I.A.4.b.(2)	Identify legal and technical process and schedule for streamflow protection.									
	I.A.4.b.(2)(a)	Develop work plan (Utah Department of Natural Resources 2010)	UT	Complete							
	I.A.4.b.(2)(b)	Identify issues, concerns and timeframe.	UT	Complete							
	I.A.4.b.(2)(c)	Prioritize potential methods and criteria for flow protection.	UT	In progress							
	I.A.4.b.(2)(d)	Amalgamate technical information needed to model and resolve modeling issues.	UT	Complete							
	I.A.4.b.(2)(e)	Develop model to analyze historic and future scenarios	UT	Complete							

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	I.A.4.b.(2)(f)	Analyze model results	UT	In progress	X	X					Utah has completed a draft technical report on the GRUWAT modeling efforts. Finalization of that report is on hold until there is a better understanding of the modeling implications associated with (1) the two proposed 'Ultimate Phase' contracts between Reclamation and the State of Utah (see I.A.4.a), and (2) FWS's perspectives on legal protection of flows in Utah.
	I.A.4.b.(2)(g)	Establish internal policy committee to work with Program partners to explore flow protection options.	UT	In progress	X	X					
	I.A.4.b.(2)(*h*)	As necessary, obtain additional authority to protect flows	UT	In progress	X	X					
	I.A.4.b.(2)(i)	Provide annual progress report to Management Committee (mid-November with other Program annual reports)	UT	In progress	X	X					No annual progress report was prepared in 2019, as Utah's Green River Utah Water Acquisition Team (GRUWAT) was not active during the year. James Greer of Utah is working with Reclamation to acquire updated modeling information. Discussion of possible long-term Green River flow protection strategies continue between Utah, FWS, TNC, USBR, and others. Implementation of two proposed agreements between USBR and the State of Utah will help ensure the protection of base flows in Reaches 1 and 2, and to some extent Reach 3, under most reasonably foreseeable new water development scenarios along the Green River in Utah. Specifically: 1. A Flaming Gorge Reservoir Exchange Contract ("Green River Block Exchange Contract") to service ~72 kaf of Utah's 'Ultimate Phase' water rights with water exchanged out of Flaming Gorge. This contract was signed in March 2019 but has been legally challenged by several envirionmental organizations alleging inadequate environmental review. 2. A Lake Powell Pipeline (LPP) Exchange Contract, which would ensure that water associated with development of the remaining ~86 kaf of Utah's Ultimate Phase water remains in the Green River upstream Lake Powell, as this water would be delivered to Lake Powell before withdrawal by LPP for delivery to Washington County. (Currently undergoing NEPA evaluation.)
>*	I.A.4.b.(3)	Implement legal streamflow protection.	UT	Pending	X	X					Completion date will depend on how Utah ends up protecting flows.
	I.B.	Green River below the Duchesne River									
	I.B.1.	Initially identify year-round flows needed for recovery while providing experimental flows.	FWS-ES	Complete							
	I.B.2.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).									
	I.B.2.a.	Review scientific basis.	UT	Complete							
	I.B.2.b.	Assess legal and physical availability of water from Green River and tributaries.	UT	Complete							
	I.B.3.	Legally protect identified flows (dependent on development of initial flow recommendations).									
	I.B.3.a.	Hold public meeting to establish future appropriation policy.	UT	Complete							
	I.B.3.b.	See I.A.4.b.(2-3), above. (As necessary, obtain additional authority to protect flows and Implement legal streamflow protection.)	UT	In progress							
	I.C.	Price River									
	I.C.1.	Determine endangered fish spring through autumn use of the Price River.	UT	Complete							

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	I.C.2.	Determine winter use and seasonal flow needs for Colorado pikeminnow in the Price River.	UT/FWS	Complete							
	I.C.3.	Work with State of Utah and local water users to develop a plan to provide and enhance summer base flows (either increase average daily flows thresholds or increase the frequency that those flows occur) in the lower Price River that are conducive to pikeminnow use. For example, consider securing an emergency pool of water to avoid periods of dewatering in the lower Price River.	PD/UT/ Water users	In progress	*X*	*X*	*X*	*X*	*X*		! In August 2019 TNC and the Carbon Canal Company (CCC) signed a Water Infrastructure and Supply Agreement directing CCC to manage their system in a way that delivers excess carrier water to Olsen Reservoir in exchange for funding for system efficiencies such as head gates and measuring devices. TNC will pay $10/AF to CCC for water delivered to Olsen Reservoir which will thereby become available for base flow augmentation in the lower Price River. ! Funding under NRCS's Watershed Protection and Flood Prevention Act (PL-566) was secured to complete an Environmental Assessment of the Olsen Reservoir project (enhancing storage for environmental flows) and associated watershed plan. Jones and DeMille Engineering was selected to develop the EA, with finalization expected March 2021. ! In December 2019, the USFWS (Utah Field Office) signed an MOU with BLM, USBR, UDWR, USU, CCC, TNC, and TU whose purpose is to advance cooperation and coordination between these parties to create, restore, and enhance wildlife habitat on public lands along the lower Price River.
>	I.C.4.	Implement plan to provide and enhance summer base flows (in the lower Price River).	PD/UT/ Water users	Pending	~~X~~	X	X	X	X		
	I.D.	Green River (Flaming Gorge to Colorado River)									
	I.D.1	Evaluate and revise as needed, flow regimes to benefit endangered fish populations. See Kitcheyan and Montagne 2005, Bestgen et al. 2006.	FWS/ Program	Ongoing	X	X	X	X	X		See I.D.2.i. below
	I.D.2.	Develop study plan to evaluate flow recommendations.	FWS/BOR/ WAPA	Complete							
	I.D.2.a.	Evaluate survival of young and movement of subadult razorback suckers from floodplains into the mainstem in response to flows. See Hedrick et al. 2012 and Speas et al 2017.	UDWR	Ongoing	X	X	X	X	X		See II.A.5. below
	I.D.2.b.	Evaluate recent peak flow studies related to floodplain inundation and entrainment of larval razorback suckers.									
	I.D.2.b.(1)	Complete final report on entrainment of larval razorback suckers in floodplains.	UDWR/LFL	Complete							

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	I.D.2.b.(2)	Monitor changes in the magnitude, timing, and size distribution of sediment. (Data series summarizing 2005-2008 daily sediment sampling on Gunnison, Green and Duchesne rivers [Williams et al. 2009] and scientific investigations report [Williams et al. 2013] completed.) See General I.A.4.b.(2).	USGS	In progress	X	X				See General I.A.4.a	Throughout FY19 the USGS collected 15-minute, two-frequency acoustical suspended-sediment measurements at the Green River above Jensen, UT, station and the Green River above Ouray, UT, station, approximately 69.5 river miles apart. In addition, 57 calibrated-pump suspended-sediment samples were collected at the above Jensen station and 110 calibrated-pump suspended-sediment samples were collected at the above Ouray station, and 4 and 5 EWI measurements (measurements made using depth-integrating samplers deployed across the entire cross section) were made at each of these stations, respectively. Based on these measurements, USGS estimates that during FY19, between 610 and 370,000 metric tons of silt and clay were eroded from the segment of the Green River between these stations, whereas between 84,000 and 360,000 metric tons of sand were deposited. All measurements and user-interactive sediment budgets for FY19 are available at the USGS website at either: www.gcmrc.gov/discharge_qw_sediment or cida.usgs.gov/gcmrc/discharge_qw_sediment. Sediment budgets for this river segment can be constructed on demand by clicking on "Uintah Basin." This data collection will continue through FY21 to help establish sediment transport relationships and clarify whether/how a sediment balance/imbalance in this Jensen-to-Ouray reach is propagating downstream.
	I.D.2.b.(3)	Opportunistically collect aerial photography during the peak flows to determine area of floodplain inundation at floodplain sites (Valdez and Nelson 2006)	BR / NPS	Ongoing as needed					X		NPS partners with others to collect data when funding and conditions allow. Aerial photography was collected by Reclamation (w/ Recovery Program funds) during the high peak flow period in 2011.
	I.D.2.b.(4)	Synthesize physical and biological data from recent peak flow studies related to floodplain inundation and entrainment of larval razorback suckers.	LFL	Complete							
	I.D.2.b.(5)	Develop a Larval Trigger Study Plan (LTSP) to experiment with timing Flaming Gorge releases to be coincident with the presence of wild produced larval razorback sucker, as recommended in Bestgen et al. 2011.	PD	Complete							
	I.D.2.b.(5)(a)	Implement LTSP	BR/ FWS / WAPA	In progress	X	X	X	X	X	We expect BRwill use observed and/or predicted larval emergence to schedule spring releases from Flaming Gorge Reservoir.	The first razorback sucker larvae in the middle Green River were detected on May 21 at Cliff Creek (RM 302.8), but relatively delayed, elevated, and cold runoff led the FGTWG to recommend some additional delay in ramping-up Flaming Gorge releases to maximize larval entrainment into floodplain wetlands. USBR increased Flaming Gorge releases to ~8,600 cfs on June 3-4, and maintained elevated releases through June 19. Combined with natural flows out of the Yampa River, mean daily flows at the Jensen UT gage exceeded 18,600 cfs (approximate bankfull) for about nine days in June, filling all key wetlands identified in the LTSP except for Baeser Bend. The peak mean daily flow at Jensen of 20,800 cfs occurred on June 11.
	I.D.2.b.(5)(b)	Integrate and synthesize LTSP reports for evaluation and recommended revision of flow and temperature recommendations.	PDO/USBR/ ANL/LFL	In progress							LTSP synthesis was performed as part of the GREAT review and 2019 report, see I.D.2.i.

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	I.D.2.c.	Develop baseflow and flow-spike study plan. *Bestgen 2018.*	PDO/USBR/ ANL/LFL	In progress							Study plans to evaluate the (a) biological effects of elevated base flows and (b) effects on channel vegetation and morphology of proposed baseflow and flow-spike experiments are under development and expected to be finalized for BCand WAC review in early 2020.
	I.D.2.c.(1)	*Opportunistically collect aerial photography during base flows to monitor channel width and complexity and to serve as base maps for habitat mapping.*	*BR / NPS*	*Ongoing as needed*					*X*		NPS partners with others to collect data when funding and conditions allow. Aerial photography was collected by Reclamation (w/ Recovery Program funds) during the base flow period in 2008.
	I.D.2.c.(2)	Implement plan	PDO/USBR/ ANL/LFL/NPS	*In progress*	X	X	X	X	X		
	I.D.2.d.	Monitor larval razorback suckers in mainstem, and synthesize information on drift as related to flows and other conditions.									
	I.D.2.d.(1)	Conduct annual monitoring of larval razorback suckers and analyze historic monitoring data.	FWS/LFL/UDWR	Ongoing	X	X	X	X	X		Project 22f. See V.d.1.
	I.D.2.e.	Determine relationship of backwater development to sediment availability and peak flows in Reach 2. To be combined with I.D.2.f (4). Grippo et el. 2017.	LFL/ANL	*Complete*							
	I.D.2.f.	Evaluate effect of base flow variability on backwater maintenance and quality.	*NPS / PDO*	*Pending*	*X*	*X*	*X*	*X*	*X*		See I.D.2.c -- a study plan to evaluate the geomorphic / physical habitat effects of modifying baseflows and implementing flow-spikes is under development. This plan should be available for Program partner technical committee review in early 2020.
	I.D.2.f.(1)	Conduct annual monitoring of larval Colorado pikeminnow.	*LFL*	Ongoing	X	X	X	X	X		Project 22f. See V.c.4.
	I.D.2.f.(2)	Monitor age-0 Colorado pikeminnow in backwaters.	UDWR	Ongoing	X	X	X	X	X		Project 138. See V.C.3.
	I.D.2.f.(3)	Evaluate response of native fish to nonnative predator removal	UDWR	On hold							Evaluating fish response to predator removal has been removed from Project 138 to priortize Colorado pikeminnow broodstock collection.
	I.D.2.f.(4)	Integrate biological and physical data on backwaters.	LFL/ANL	Ongoing							
	I.D.2.f.(5)	Periodically monitor surface area and number of backwater habitats in the Green River using aerial or satellite imagery (Peak Flow Tech Supplement priority).	WAPA/ ANL	Ongoing	X						Surveys were conducted by WAPA and Argonne in FY17, and a summary report is anticipated in 2020. Additional work is pending, based on results in the forthcoming report.

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	I.D.2.g.	Determine influence of flow and temperature recommendations on entire fish community with emphasis on nonnative fish life history in lower Reach 1 and upper Reach 2.	LFL/FWS	Ongoing	X						Technical Report for project FR-115 "Effects of Flaming Gorge Dam releases on the Lodore and Whirlpool Canyon fish communities" expected in 2020. Native fishes were only 35% of all fishes captured in the Lodore Canyon reach, continuing a declining trend. Formerly abundant bluehead sucker are declining in this reach. Brown trout exceeded native flannelmouth sucker in 2019 and smallmouth bass catch increased (n=25) compared to 2018 (n=10). Native fishes were more abundant in downstream Whirlpool Canyon, where 67% of all fishes collected by electrofishing were native in 2019, which was substantially higher than in upstream Lodore Canyon. A main difference was higher abundance of bluehead sucker and lower abundance of brown trout, white sucker, and common carp in Whirlpool Canyon. In Brown's Park, native fishes only accounted for 14.5% of the total catch in 2019, the second lowest proportion in the last five years of sampling. Of the nonnative fishes captured, white suckers and white sucker x flannelmouth sucker hybrids totaled 79% of the total catch. These trends indicate a recolonization of the reach by white suckers and their hybrids in particular.
	I.D.2.h.	Determine escapement (see also Green River Study Plan) of nonnative fish at Flaming Gorge Dam.	UDWR	Ongoing	X						Program relies on UDWR tailrace surveys coupled with Project FR-115 and other studies conducted farther downstream to monitor escapement. UDWR provides annual data to nonnative fish coordinator. Reclamation has determined that spills will not occur to meet fish flows which makes a previously requested risk assessment somewhat obselete. Two burbot were captured in the Green River in 2019. See III.A.4.g. below
	I.D.2.i.	Integrate and synthesize reports for evaluation and recommended revision of flow and temperature recommendations.	PD/FWS	Ongoing							! A final draft of Green River flow and temperature recommendations ("Evaluation and Suggested Revisions of Flow and Temperature Recommendations for Endangered Fish in the Green River Downstream of Flaming Gorge Dam", LaGory et al. 2019) was approved by the program technical committees in November 2019. The final draft was submitted to the MC for final approval in December 2019. The MC agreed to allow time for WAPA to work with Reclamation to conduct a preliminary hydropower impact analysis before they will take up the report for final approval. This culminates several years of work by a team of technical experts, and includes responses to technical reviews and comments from the WAC, the BC, and two
	I.E.	San Rafael River									
	I.E.*1.*	Assess need for tributary management plan for San Rafael River.	BLM/Utah	Complete							
	I.E.*2.*	Estimate future water demands on San Rafael River.	PD/Utah	Complete							
	I.E.*3.*	Develop tributary management plan for San Rafael River. Laub 2013.	BLM/Utah	Complete							
	I.E.4.	Conduct appropriate Section 7 and NEPA compliance to implement tributary management plan.	BLM/Utah	Complete							
	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Restore and manage flooded bottomland habitat.									
	II.A.1.	Conduct site restoration.									
	II.A.1.a.	Old Charlie Wash.									
v*	II.A.1.a.(1)	Construct water control structure and fish kettle.	BR	Complete							

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	II.A.2.	Acquire interest in high-priority flooded bottomland habitats between Ouray NWR and Jensen to benefit endangered fish.									
	II.A.2.a.	Identify and evaluate sites.	FWS-FAC	Complete							
	II.A.2.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete							
	II.A.2.c.	Conduct appraisal/NEPA compliance.	PD	Complete							
>*	II.A.2.d.	Negotiate acquisition and acquire.	PD	Complete							
	II.A.2.e.	Evaluate effectiveness of land acquisition activities and provide recommendations.	PD	Complete							
	II.A.3.	Implement levee removal strategy at high-priority sites.									
	II.A.3.a.	Preconstruction (contaminants screening, floodablility assessments, environmental compliance, design, and engineering).	PD/BR	Complete							
>*	II.A.3.b.	Construction (levee breeching). [NOTE: Subject to review and approval for depression wetlands.]	BR	Complete							
>*	II.A.3.c.	Operate and maintain.	BR/FWS	Complete							
	II.A.3.d.	Evaluation.	FWS	Complete							
	II.A.4.	Develop Green River Subbasin Floodplain Management Plan (Valdez and Nelson 2004).	Program	Complete							
>*	II.A.4.a.	Implement, validate and refine Green River Subbasin Floodplain Management Plan (Valdez and Nelson 2004)									Speas et al. 2017 white paper updates findings from recent floodplain management and identifies priorities for the future.
	II.A.4.a.(1)	Survey levee breaches and associated connection channels for floodplain wetlands along the Green River between the Yampa and White Rivers.									
	II.A.4.a.(1)(a)	Conduct surveys following high-magnitude peak flows (e.g., > 20,000 cfs) to ensure continued connection in average years (similar to those conducted in 2012 and 2014) (Peak Flow Tech Supplement priority).	Program/ ANL	Complete							The GREAT (Lagory et al. 2019; in review) incorporated 2012-2016 survey information into their review of Muth et al. (2000).
	II.A.4.a.(1)(b)	Conduct new surveys of lower elevation downstream levee breaches and associated connection channels following lower magnitude peak flows that normally connect these channels (e.g., 12,000 to 15,000 cfs) (Peak Flow Tech Supplement priority). LaGory et al. 2017.	Program/ ANL	Complete							The GREAT (Lagory et al. 2019; in review) incorporated 2012-2016 survey information into their review of Muth et al. (2000).
	II.A.5.	Manage and/or modify priority floodplain sites for nursery habitat for endangered fish (as identified in Floodplain Synthesis, LTSP, etc.) Bestgen et al. 2011, Speas et al. 2017.									

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	II.A.5.a.	Stewart Lake	Program /UDWR	Ongoing	X	X	X	X	X	Ongoing site management by UDWR	! Investigations into Stewart Lake razorback encounters revealed 4 fish that have been captured or detected as age-3, and one age-2 fish recaptured during fyke netting. Four of the fish were from the 2014 year class that re-entered the wetland in spring of 2015. The other was from the 2016 year class. At least 417 age-0 razorback sucker were released from the wetland in October. The first razorback sucker larvae in the middle Green River were detected on May 21 in Cliff Creek. Flaming Gorge releases for LTSP began June 3, and UDWR opened the outlet gate June 4-19. The inlet gate was then opened from June 17-28. The wetland depth achieved a maximum of 7.5 feet. River flows did overtop levee breaches, which were netted to prevent nonnative fish entry. These nets failed for a short time, but were repaired and kept in place. Light traps confirmed larval entrainment June 10-13, but suitable sampling sites were limited. Supplemental water deliveries extended from July 18 through Sept 24. Draining occurred Sept 30-Oct 30. Unseasonably cold conditions complicated draining and led to closure of the Burns Bench pipeline, therefore no water pulses were available to assist in draining. The wetland also froze, leading to expedited draining and the release of large numbers of razorback sucker that were not counted. 2 presumptive age-0 bonytail were also captured, in addition to 6 adult bonytail. Carp were removed using nets from within the wetland in the early filling period. Carp will be removed from the outlet canal during tributary netting for northern pike in spring. A MarshMaster treatment to reduce cattails was completed in December 2019.
	II.A.5.b.	Johnson Bottom	Program/ FWS-NWR	Ongoing	X	X	X	X	X	Ongoing site management by FWS.	The wetland connected through uncontrolled breaches, which allowed adult nonnative fishes to enter. Attempts to screen the main breach were unsuccessful due to high flows. Despite nonnative fish densities, four age-0 razorback sucker were collected from the wetland and returned to the Green River in October.
	II.A.5.c.	Old Charley Wash.	Program/ FWS-NWR	Ongoing	*X*	*X*	*X*	*X*	X	Ongoing site management by FWS.	Collaborative efforts between ONWR, ONFH, and the FWCO led to water control improvements at the site prior to the spring peak. The wetland was operated under the LTSP model, but some uncontrolled breaches allowed water and nonnative fishes to access the wetland. ! 172 age-0 RZB were produced at this site and released to the river.
	II.A.5.d.	Sheppard Bottom	Program/ FWS-NWR	Ongoing	X	X	X	X	X	Ongoing site management by FWS.	Sheppard Bottom filled and the interior unit was operated under the LTSP model. Sixteen age-0 RZBs were collected during August netting. Since the wetland cannot be drained, fish were left in the wetland to assess overwinter survival. Supplemental water from Pelican Lake was directed into the wetland to maintain water levels leading into winter.
	II.A.5.e.	Stirrup	PDO / BR/ BLM / UDWR	Ongoing	X	X	X	X	X		Larval razorback sucker were confirmed in the Stirrup via light trapping and seining. Autumn netting produced 12 age-0 razorback sucker in the wetland. Since it cannot be drained, the site will be evaluated for overwinter survival in spring 2020. USBR has developed drawings for the Stirrup site which include a water control structure and fish kettle, which were modified in autumn 2019 after a site visit by a project manager. The USBR Force Account crew cannot complete the work in 2020, so the project has been delayed until 2021. Reclamation is tracking $709K in capital funds for this project in FY21.

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	II.A.5.f	Other sites	Program/ various	Ongoing, as needed	X	X	X	X	X	Ongoing site management (various agencies).	Leota: Summer netting produced 10 age-0 razorback sucker from L-7 and one adult bonytail. The wetland will be sampled for overwinter survival in 2020. Above Brennan: Larval razorback sucker were confirmed in this wetland in June 2019. Age-0 fish were not captured in subsequent netting but 4 adult razorback sucker from the hatchery were collected. Additional sampling is scheduled for spring 2020.
	II.B.	Restore native fish passage at instream barriers.									
	II.B.1.	Assess and make recommendations for fish passage at low flows at Tusher Wash.	FWS-FAC/ WR/BR	Complete							
	II.B.1.a	Maintain fish passage at Tusher Wash Diversion	USBR / Green River Canal Company	Ongoing	X	X	X	X	X	Maintain fish passage through O&M contract with local water users	X Fish passage continues to remain clogged with debris, and the Program has not received a SOW for the O&M contract. Preliminary analyses suggest Colorado pikeminnow transition rates have not changed with the fish passage issues. No analysis has been conducted for other species.
	II.B.2.	Screen Green River Canal to prevent endangered fish entrainment.									
	II.B.2.a.	Assess need.	Program	Complete							Canal salvage in 2018 yielded five humpback chub, one bonytail, and one razorback sucker, plus numerous native fishes. This was the last year of canal salvage since a fish screen and weir wall were installed in spring 2019.
	II.B.2.b.	Design.	BR	Complete							
>*	II.B.2.c.	Construct.	BR	Complete							! Construction completed in spring 2019.
>*	II.B.2.d.	Operate and maintain.	BR/GRCC	*In progress*	X	X	X	X	X	Maintain fish screen through O&M contract with local water users	! Antennas within the canal (downstream from screen) did not detect any tagged fish. The screen and weir wall appear to be working as designed.
	II.C.	Enhance water temperatures to benefit endangered fishes.									
	II.C.1.	Identify options to release warmer water from Flaming Gorge Reservoir to restore native fish habitat in the Green River.	BR	Complete							
	II.C.2.	Meet temperature targets pursuant to Flaming Gorge ROD.	BR	Ongoing	X	X	X	X	X	BR operates selective withdrawal structure at Flaming Gorge and monitors downstream temperature.	For 2019, temperature equipment at Gates of Lodore appears to have been malfunctioning. Based on a separate set of data collected by USGS in the vicinity of the malfunctioning Gates of Lodore gauge (D. Topping, USGS Southwest Science Center), mean daily temperatures in the Gates of Lodore area exceeded 18 deg C for a total of 37 days (5.3 weeks) following detection of CPM larvae on July 12, 2019 The USGS is replacing the equipment. The temperature difference between the Green and Yampa rivers at the confluence (Reach 2) only exceeded 5°C for a few days in June, before Colorado pikeminnow larvae were detected (July 12). The Reach 2 temperature objective was achieved for the duration of larval pikeminnow drift.

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	II.D.	Support actions to reduce or eliminate selenium impacts at Ashley Creek and Stewart Drain. [NOTE: selenium remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program.]	FWS-ES	Ongoing	X	X	X	X	X	BR will continue to meet selenium remediation requirements under the latest Biological Opinion.	Final draft report on the "Selenium Uptake by Endangered Fish at Stewart Lake, Utah" was submitted to Utah DEQ in 2018. The report demonstrated that individual selenium concentrations in razorback sucker declined from 2013 to 2015, but slightly increased in 2016. Whole body selenium concentrations appear to be related to year tested and corresponding wetland inundation time rather than body size or exposure time. The report recommended continued use of the site for endangered fish rearing and continued biological monitoring. The report also recommended a comprehensive selenium report be authored, using biological data along with water and sediment data, prior to reinitiation of a section 7 consultation. BRis considering re-initiating the Biological Opinion at Stewart Lake to ensure alignment of operations for both razorback sucker rearing and selenium remediation. The new proposed action at Stewart Lake will evaluate selenium concentrations in sediment, water, and biota. BR is holding off on BA until better and more current selenium data become available for Stewart Lake.
	III.	**REDUCE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative impacts to endangered fishes from sportfish management activities.									
	III.A.1.	Determine relationship between Flaming Gorge test flows and the fish community in Lodore Canyon.	UDWR	Complete							
>*	III.A.2.	Control escapement of nonnative fishes from Ouray National Wildlife Refuge originating from Pelican Lake.	FWS-NWR	Complete							
>*	III.A.3.	Identify and control sources of catfish and centrarchids in the middle Green River.	UDWR	Complete							
	III.A.4.	Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify required levels of control. Each control activity will be evaluated for effectiveness, and then continued as needed. See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.									
>*	III.A.4.a.	Northern pike in the middle Green River.	UDWR/ FWS	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	The total captures of northern pike (n=83) and catch rate increased from 2018. Spring tributary electrofishing and fyke netting continued to yield higher catch rates than other methods.
	III.A.4.b.	Nonnative cyprinids and centrarchids in nursery habitats.									
>*	III.A.4.b.(1)	Small nonnative cyprinids from backwaters and other low-velocity habitats in the lower Green River. Trammell et al. 2005.	UDWR	On hold							
>*	III.A.4.b.(2)	Small nonnative cyprinids from backwaters and other low-velocity habitats in the middle Green River.	UDWR/ FWS	On hold							Project 158 report finalized in early 2019, see Breen and Jones 2019.

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>*	III.A.4.b.(3)	Smallmouth bass in middle and lower Green River.	UDWR/FWS	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Echo-Split: Catch rates for smallmouth bass >100mm were higher than 2018 and twice that of 2017, but were still much lower than 2013 and 2014. The majority captured were likely produced in the Yampa River in 2017 and 2018 based on distribution of age 0 collected those years. Middle Green River: Total smallmouth bass catch rates declined from 2018. Smallmouth bass in the 100-199 mm length class continued to make up the largest component of the catch, but bass recruiting to the 200 mm and above length class led to an increase in the proportion of adults captured. Desolation Canyon: Catch rates were similar to the last four years, and much reduced compared to the large 2014 rates. Smallmouth bass from multiple size classes were present, with individuals between 100 - 199 mm comprising 63% of the catch.
>*	III.A.4.c.	Channel catfish (e.g. Deso./Gray Canyons) to protect humpback chub populations, and in the middle Green River to protect razorback sucker and Colorado pikeminnow. On hold pending development of more efficient techniques.	FWS/UDWR	On hold						If other nonnative species are reduced will we redirect attention back to catfish?	Crews removed 1 catfish >450mm in Desolation Canyon and 30 in Echo-Split.
>*	III.A.4.d.	Walleye in the middle and lower Green River	Program	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Crews removed 229 walleye throughout the Green River subbasin (a 15% decrease from 2018), with 84% of the catch immediately below Tusher Diversion. Targeted efforts on the lower Green River achieved the highest CPUE in the basin with catch rates in excess of 3.4 fish/hour (up from 1.66 fish/hour in 2018). Targeted efforts on the middle Green River yielded substantially lower catch rates (0.15 fish/hour).
	III.A.4.e.	Develop lake management plan for Red Fleet Reservoir to address walleye escapement.	UDWR	Complete							The Red Fleet LMP (2015) is being implemented. UDWR meets with anglers annually to evaluate. The current fish community includes abundant yellow perch and black crappie as forage and wipers as the dominant predator. Multiple species are below optimal relative weights. Previous sterile walleye stocking was not very effective; none were stocked in 2019. In 2020, 2-inch fish will be stocked in an attempt to increase survival.
>*	III.A.4.f.	Install & operate permanent fish barrier at Red Fleet Reservoir.	UDWR	Ongoing	X	X	X	X	X	Maintain integrity of barrier long term.	Design is complete for a coanda-type screen on Big Brush Creek below the dam outlet and temporary stilling basin. The reservoir spills infrequently. Construction is scheduled for May-July 2020; NEPA is complete, O&M contract is ready for execution. Estimated project total cost = $665,000+.
>*	III.A.4.g.	Other emerging nonnative fishes.	UDWR/FWS	Ongoing	X	X	X	X	X	Monitor fish community of the Green River and respond appropriately to any new introductions or proliferation of nonnative species.	X Two burbot were captured in the Green River in 2019, the first year with multiple captures of this species. X There were 4 grass carp caught in the lower Green.
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A.	Augment or restore populations as needed, and as guided by the Genetics Management Plan.									
	IV.A.1.	Develop integrated stocking plan for the four endangered fishes in the Green River.									
	IV.A.1.a.	Prepare plan.	UDWR	Complete							
	IV.A.1.b.	Program acceptance.	UDWR	Complete							

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>	IV.A.1.c.	Implement plan. Superseded by Revised Integrated Stocking Plan (2015), see General IV.B.2.	UDWR	Ongoing	X	X	X	X	X		In 2019, Ouray Randlett (USFWS) stocked 8,579 razorback sucker and 15,051 bonytail in the Green River.
	IV.A.1.c.(1)	Conduct high-priority lab/field studies identified in bonytail reintroduction plan. *(Draft not accepted)*	UDWR	Dropped							
	IV.A.1.d.	Evaluate stocking success as identified in monitoring plan for stocked fish. Zelasko et al. 2018	LFL/FWS/ STATES/ PD	Ongoing	X	X	X	X		Evaluations will be on basinwide scale and may not occur in every river. See General IV.E	See General IV.E. for bonytail and razorback sucker stocking evaluation efforts. ! For the second consecutive year, antennas in the middle Green River (Project 172) yielded encouraging numbers of native fish encounters, including 2,761 unique razorback sucker and 54 bonytail. Antennas at Razorback Bar detected 49 bonytail and 3,389 razorback sucker in 2019. More razorback sucker were detected at Razorback Bar in 2019 than in any year prior (Project 169), with detected individuals representating every stocking year since 2003.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									
	V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.									
	V.A.1.	Verify additional Colorado pikeminnow spawning areas in lower Green.	UT	Complete							
	V.A.2.	Identify additional razorback sucker spawning areas in lower Green.	UT	Complete							
	V.B.	Conduct population estimate for humpback chub.									
	V.B.1.	Desolation/Gray. (Sampling occurs in September and October, overlapping fiscal years. Sampling is conducted for 2 years, followed by no sampling for 2 years, with report write-up in the first year following sampling, then sampling resumes in September of the second year). See Jackson and Hudson 2005, Badame 2012. Howard and Caldwell 2018.	UDWR	Ongoing	X	X	X	X	X	Continue to estimate abundance of humpback chub in Desolation/Gray canyons.	UDWR returned to Desolation / Gray canyons to complete humpback chub population estimates in fall 2019 (paired with 2018). Number of sites was reduced (four sites were sampled in 2019 as opposed to six sites in 2018) so effort could be doubled at two sites, to increase adult recapture rates and improve abundance estimate precision. Mean catch per unit effort (CPUE) for humpback chub captured via trammel nets at all sites sampled was 0.07 fish per net hour and ranged from 0.01 to 0.18. Mean CPUE was similar to previous years when sampling occurred during fall. Hoop nets resulted in documentation of juvenile chub. The proportion of first year adult humpback chub captured was 8% and was similar to 2006 – 2015 but lower than 2018. Antennas detected 20 individual chubs. Population estimates were calculated for all sites. Three of the four sites met the previously set criteria for reliable estimates. Site population estimates ranged from 32 to 137 chub. The PI recommends continuing the recently increased hoop net effort; working with biometricians to glean as much demographic information as possible from the PIA detection data; planning for multiple sampling nights at all sites sampled in order to meet modeling criteria; and considering revision of the Recovery Goal demographic criteria for this population to incorporate information on a variety of life stages and to rely less on the canyon wide M/R population estimates.
	V.C.	Conduct population estimate for Colorado pikeminnow. Sampling is conducted for 3 years, followed by no sampling for 2 years.									
	V.C.1	Middle Green River (including Yampa and White rivers). See Bestgen et al. 2005, 2010, *and 2018* .	LFL/UDWR/ FWS	Ongoing	X	X	X	X	X	Continue to estimate abundance of Colorado pikeminnow in Middle Green River.	X Preliminary estimates have been produced for adult Colorado pikeminnow in the Green River basin. These estimates indicate a continued decline since 2000 and fewer than 1,000 adults in the entire Green River basin.

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	V.C.2	Lower Green River. See Bestgen et al. 2005, 2010, *and 2018* .	LFL/UDWR/ FWS	Ongoing	X	X	X	X	X	Continue to estimate abundance of Colorado pikeminnow in Lower Green River.	See above.
	V.C.3	Monitor age-0 Colorado pikeminnow in backwaters.	UDWR	Ongoing	X	X	X	X	X	Continue monitoring age-0 Colorado pikeminnow.	Age-0 pikeminnow monitoring conducted as per protocols identified in Project 138. Annual monitoring has occurred since 1979. **X** UDWR captured no age-0 pikeminnow in the middle Green River and below median numbers in the lower Green River (n=113, CPUE=4.3 fish/100m^2). UDWR collected an additional 115 age-0 pikeminnow during broodstock collection, mostly in the reach near Green River, UT. Catch rate was slightly lower than ISMP CPUE. FWS collected 130 age-0 fish for broodstock (CPUE=1.22 fish/100m^2, long term mean is 5) in the middle Green River after ISMP Sampling.
	V.C.4	Monitor larval Colorado pikeminnow.	CSU/FWS	Ongoing	X	X	X	X	X	Continue monitoring larval Colorado pikeminnow.	The first larval pikeminnow was captured from the lower Yampa River on July 12, a relatively late date but expected given cool, high flows. Abundance of larvae was again below average in 2019, and could reflect declining adult abundances.
	V.D.	Complete monitoring plan in FY 11 (based, in part, on recommendations from evaluation of stocked razorback report). See Bestgen et al. 2012.	LFL/PD	Complete							
	V.D.1.	Implement razorback sucker monitoring plan. See *Bestgen et al. 2012* , Webber and Beers 2014.	LFL, UDWR, FWS	Ongoing	X	X	X	X	X		2019 samples are still being identified and processed. Results have been reported from 2018 and indicate 1,384 razorback sucker larvae were captured in 2018, considerably higher than any year 2013-2017. This may be due to low flows concentrating larvae for capture. PIT antennas under two programs (169 and 172) detected thousands of unique razorback sucker in the Green River at known spawning locations. There were 3,389 razorback sucker detected in project 169 and 2,761 from downstream in project 172. Approximately 50% of the fish detected in project 172 were also detected in 169. Both projects nearly doubled the number of unique RZBs detected compared to previous years. Antennas at Razorback Bar detected razorback sucker that had been outside of the Green River basin at some previous time. One fish was encountered in the Colorado River, 4 in Lake Powell, and one originally stocked into the Gunnison River.

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	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Basin-wide activities									
	I.A.1.	Identify fish habitat and flow needs									
	I.A.1.a.	Complete Phase II feasibility study.	CRWCD/ CWCB/BR	Complete							
	I.A.1.b.	Revise and update estimates of basin water needs.	CRWCD /FWS	Complete							
	I.A.1.c.	Evaluate and recommend low flow and passage needs (also relates to restoration of fish passage, if needed -- Recovery Element II).	CDOW/FWS/ CRWCD	Complete							
	I.A.1.d.	Provide hydrology support to develop and evaluate flow augmentation alternatives.	CWCB	Complete							
	I.A.1.e.	Report synthesizing the results of water demand, low flow recommendations and hydrologic analyses.	FWS	Complete							
	I.A.1.f.	Install, operate, and/or maintain stream flow monitoring gages.	Program / USGS / CO / WY	Ongoing	X	X	X	X	X	Continue gage O&M.	
	I.A.1.g.	Install, operate, and/or maintain sediment monitoring gages to support the Yampa River Management Plan (I.A.2 below).		Complete							NPS continues to monitor sediment transport and sediment budgets at the Maybell gage location. Results through 2017 can be reviewed in: Topping, D. J., Mueller, E. R., Schmidt, J. C., Griffiths, R. E., Dean, D. J., & Grams, P. E. (2018). Long-term evolution of sand transport through a river network: Relative influences of a dam versus natural changes in grain size from sand waves. Journal of Geophysical Research: Earth Surface, 123. https://doi.org/10.1029/2017JF004534
	I.A.2.	Develop and implement Yampa River management plan (Roehm 2004).									
	I.A.2.a.	Negotiate a Cooperative agreement to implement the Yampa River management plan.	Program	Complete							
	I.A.2.a.(1)	Develop a biological assessment for the management plan; initiate intra-Service Section 7 consultation based on the Service intent to enter into the Cooperative Agreement.	FWS	Complete							
	I.A.2.a.(1)(a)	Complete intra-Service consultation, resulting in a programmatic biological opinion (PBO) for the Yampa Basin.	FWS	Complete							
	I.A.2.a.(2)	Fulfill NEPA requirements for the management plan.	FWS	Complete							
	I.A.2.b.	Sign Cooperative Agreement to implement the management plan.	FWS/Program / Colorado/ CRWCD	Complete							
	I.A.3.	Develop public involvement plan.	FWS/CDOW	Complete							
	I.A.3.a	Implement public involvement plan.	FWS/CDOW	Complete							
	I.A.4.	Evaluate and revise as needed flow regimes to benefit endangered fish populations.	FWS/Program	Ongoing	X	X	X	X	X		
	I.B.	Yampa River above the Little Snake River									
	I.B.1	Initially identify year-round flows needed for recovery.	FWS-FAC	Complete							

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	I.B.2	Provide augmentation of low flows.									
	I.B.2.a	Identify and acquire water source(s).									
	I.B.2.a.(1)	Steamboat Lake.									
	I.B.2.a.(1)(a)	Change decree.	CDPOR	Complete 5/97							
>*	I.B.2.a.(1)(b)	Lease up to 2,000 af. to augment late summer flows.	FWS-WR	Complete							
	I.B.2.a.(1)(c)	Quantify transit losses.	CDWR/ CWCB	Complete							A report providing an analysis and updated determination of transit losses to assign to water deliveries from Elkhead Reservoir down the Yampa River is expected from the Colorado Division Water Resources in 2020. See I.D.2.d.(1)
	I.B.2.a.(2)	Elkhead Reservoir									
	I.B.2.a.(2)(a)	Identify and evaluate water supply alternatives for up to 7,000 af of stream flow augmentation.	Program	Complete							
	I.B.2.a.(2)(b)	Complete all necessary administrative, legal, environmental compliance, institutional and financial arrangements needed for development of Elkhead Reservoir enlargement.									
	I.B.2.a.(2)(b)i)	Complete environmental compliance.	CRWCD	Complete							
	I.B.2.a.(2)(b)ii)	Complete funding agreement.	CRWCD/ CWCB	Complete							
	I.B.2.a.(2)(b)iii)	Construct	CRWCD	Complete							
>*	I.B.2.a.(2)(c)	Deliver water for endangered fish.	Program	Ongoing	X	X	X	X	X	Continue delivering Elkhead flows.	In anticipation of delayed, elevated summer runoff in the Yampa River, the PDO opted not to lease any 'short term water' from Elkhead Reservoir in 2019 beyond the 5,000 AF permanent pool available annually. Weekly Yampa River flow coordination calls began Aug 7. The base flow target for the Yampa River at Maybell was informally set at 200 cfs for the months of Aug through Oct. Releases of Elkhead water to augment instream flow began Aug 28 and continued through Oct 17. *!* All 5,000 AF were released for endangered fish from the permanent pool. Flow at the Maybell gage fell short of the 200 cfs wet-year target on 32 days, but stayed above the average-year target of 134 cfs on all but one day (133 cfs was the seasonal minimum mean daily flow, observed Aug 31). Accounting suggests that flows would have declined to a seasonal minimum of about 83 cfs on Sept 6, if not for the supplemental releases from Elkhead Reservoir. The Division 6 Engineer assessed transit losses of 0.1% per mile on Elkhead Reservoir releases in 2019, a figure that may change in 2020 pending finalization of a transit loss analysis undertaken with CWCB. Prior to 2018, tranist losses were calculated at 0.5% per mile. For additional details, see the 2019 Hydrologic Conditions Summary RIPRAP supplement.
	I.B.3.	Evaluate need for instream flow water rights.									
	I.B.3.a	Review scientific basis.	CWCB/ CDOW	Complete							
	I.B.3.b	Assess legal and physical availability of water.	CWCB	Complete							
	I.B.3.c	Assess compact considerations.	CWCB	Complete							
	I.B.3.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB	Pending, if needed							

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	I.B.3.e.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/ WAC	Pending				X	X	Long-term flow protection agreements to ensure maintenance of adequate flows post-Program.	Yampa flow protection is in the form of a PBO, which could become invalid if the Program expires. USFWS's position is that downlisting the endangered fish must presume current flow protections remain in place, and longer-term protections would be established. ! Separate from the Recovery Program (spearheaded by TNC), a Yampa River Fund was established in 2019 as a collaborative community-based "tool for bringing together water users, providers and communities to plan for a secure and healthy water future and then to fund and implement the activities that will make that future a reality." The Fund, which already enjoys a seven-figure endowment, will likely be used in the future for (among other activities) leasing water to strategically augment Yampa River instream flows. The USFWS will participate on the Fund's technical advisory board as a non-voting member. In addition, the Yampa-White-Green Basin Roundtable is in early stages of developing an Integrated Water Management Plan for the Yampa River Basin. The Roundtable has invited the PDO to participate in those discussions where there may be opportunities to productively align the IWMP efforts with post-2023 Program planning.
	I.B.4.	Provide a depletion accounting report as outlined in the Yampa River PBO; including 1) calculation of past depletions every 5 years as a 10-year moving average as determined by CWCB and reported to FWS & the Program; 2) a back-casted baseline of current depletions that can be used in projecting the impact of significant new depletions; and 3) a recommendation and justification regarding whether or not additional instream flow filings or other flow protection mechanisms should be considered in light of projected future depletions and other factors.	CWCB/FWS	In progress				X	X		! In 2019, Colorado and Wyoming each provided depletion accounting reports for the Yampa River through 2015 that were (1) reviewed and recommended for acceptance by a WAC technical workgroup in Sept 2019 and (2) accepted by the USFWS Western Colorado Ecological Services Field Office on Oct 3, 2019 as meeting the requirements of the Yampa PBO through 2015. Another five-year review is required after 2020. Both states' reports concluded there were no net new depletions to the Yampa River, on average, over the time periods evaluated, relative to the baseline period of 1975-1998 in the Yampa PBO.
	I.C.	Little Snake River (Colorado and Wyoming)									
	I.C.1.	Evaluate importance of Little Snake to endangered fishes and develop management action plan. (Determine if habitat exists to protect under Colorado's instream flow program.)	BR/LFL	Complete							
	I.C.2.	Initially identify year-round flows needed for recovery (needed).									
	I.C.2.a.	Develop work plan.	BR/LFL	Complete							
	I.C.2.b.	Identify flows.	FWS-WR	Complete							
	I.C.3.	Evaluate need for instream flow water rights.									
	I.C.3.a.	Review scientific basis.	CWCB/CDOW	Complete							
	I.C.3.b.	Assess legal and physical availability of water.	CWCB	Complete							
	I.C.3.c.	Assess compact considerations.	CWCB	Complete							

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	I.C.3.d.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/ WAC	Pending				X	X		The Yampa PBO includes coverage for new water development in the Little Snake River basin. As noted under I.B.(4), a 2019 analysis of water development in the basin through 2015 suggests there have been no net new Snake River depletions relative to the 1975-1998 PBO baseline. In WY, efforts continue toward development of a 'West Fork Reservoir' in the Little Snake drainage. In 2018, $4.7 million was appropriated to “cover anticipated expenses over next two years” as the state seeks to obtain title to ~100 acres USFS property plus some private land. West Fork would be a 8,500-10,000 AF reservoir managed in tandem with the existing High Savery Reservoir (22,433 AF). Yield would be approx 6,500 AF irrigation water annually. Assuming no more than 50% depletion, this may represent ~3,250 AF/yr of new depletions, likely encompassed within coverage provided by the Yampa Basin PBO.
	I.C.3.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB/ Wyoming	Pending							
	I.C.4.	Assess Wyoming's current and future water needs.	Wyoming	Complete							
	I.D.	Yampa River below Little Snake River									
	I.D.1.	Initially identify year-round flows needed for recovery.	FWS-FAC	Complete							
	I.D.1.a.	Modify based on revisions to environmental baseline.	FWS-WR	Complete							
	I.D.1.b.	Update flow recommendations to include flows from the Little Snake River.	FWS	Complete							
	I.D.2.	Evaluate need for instream flow water rights.									
	I.D.2.a.	Review scientific basis.	CWCB/CDOW	Complete							
	I.D.2.b.	Assess legal and physical availability of water.	CWCB	Complete							
	I.D.2.c.	Assess compact considerations.	CWCB	Complete							
	I.D.2.d.	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS/ WAC	Pending				X	X		See I.B.3.e.
	I.D.2.d.(1)	If necessary, evaluate how identified flows will be legally protected.	CWCB	Pending							Further legal protection of Yampa flows is not currently identified as necessary. In 2018, unusually low flows and the first-ever administrative call on the lower Yampa River prompted the Division Engineer to re-evaluate transit losses assessed on storage releases. In 2019, losses were provisionally reduced from 0.5% per mile to 0.1% per mile. Finalized adjustments to transit losses are anticipated in 2020 based on a detailed Colorado Division of Water Resources study.
	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Yampa River from Dinosaur National Monument to Craig, Colorado									
	II.A.1.	Restore native fish passage at instream barriers and reduce impacts of maintaining diversion structures. Note: disturbance of fish habitat related to maintenance of diversion structures was evaluated and found to be minimal based on the limited area and duration of the disturbance.									
	II.A.1.a.	Inventory potential barriers.	CRWCD	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	II.A.1.b.	Determine threshold (passage) flows between Craig and Dinosaur National Monument (low- flow dependent).	CDOW/FWS	Complete							
	II.A.1.c.	Develop guidelines to facilitate fish passage at new diversion structures.	PD/FWS-ES	Complete							
	II.A.2.	Reduce/eliminate entrainment of Colorado pikeminnow at diversion structures.								*Re-evaluate entrainment risk once Colorado pikeminnow populations recover in the Yampa River*	
	II.A.2.a.	Identify and evaluate existing diversion structures for entrainment of Colorado pikeminnow. Hawkins 2009, Speas et al. 2014.	PD/FWS-ES	Complete							
>*	II.A.2.b.	Develop and implement remedial measures, as necessary, to reduce or eliminate entrainment.	PD/CPW/ FWS	On hold							
	II.A.2.c.	Develop guidelines to reduce or eliminate entrainment at new diversion structures, if necessary.	PD/CDOW/ FWS	Complete							
	II.A.3.	Review NPS/USGS report to assess potential for negative impacts of elevated pH to endangered fish.	Program	Complete							
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Develop guidance documents and revise as needed.									
	III.A.1.	Develop aquatic management plan (Colorado) to reduce nonnative fish impacts while providing sportfishing opportunities. CDOW 1998, 2010.	CDOW	Complete							
	III.A.2.	Develop Yampa River Nonnative Fish Control Strategy (Program)	Program	Complete							
>*	III.B.	Implement CPW Yampa Basin aquatic wildlife management plan and the Recovery Program's Yampa River Nonnative Fish Control Strategy. Each control activity will be evaluated for effectiveness and then continued as needed. See also III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.	Program/ CPW	Complete							
	III.B.1.	Prevent nonnative fish introduction; reduce invasion and recruitment.									
	III.B.1.a.	Identify potential conflicts between present fisheries management in existing Elkhead Reservoir and endangered fishes and formulate Elkhead Lake Management Plan.	CDOW	Complete							
	III.B.1.a.(1)	Evaluate nonnative fish escapement and control options at Elkhead Reservoir (during and after Elkhead expansion construction). See Miller et al. 2005, Breton et al. 2013.	FWS-FAC/ CPW	Complete						Escapement prevention must be maintained as long as smallmouth bass and northern pike continue to reside in Elkhead Reservoir.	The spillway net seemed to operate as designed in 2019, even with high inflow and outflow over the spillway. CPW monitored the reservoir behind the spillway net. No fish were captured at the spillway site during pre-spill or post-spill sampling.

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>*	III.B.1.a.(2)	Implement control measures as needed to control escapement (during and after Elkhead expansion construction). Post-construction: monitor and maintain Elkhead screens (YS C-1).	Program	Ongoing	*X*	*X*	*X*	*X*	*X*	CPW will monitor and maintain Elkhead net per agreement with Program; CRWCD will maintain outlet screens.	Additional thorough cleaning of the spillway net likely contributed to its effectiveness as an anti-fish escapement device. CPW managed four total spillway net cleanings and inspections by local contractors. The hot summer and lack of precipitation facilitated algal growth. ! Costs of cleaning ($13K) exceeded CPW's commitment ($10K); they will not seek reimbursement and consider this in-kind to the Program.
	III.B.1.a.(2)(a)	Establish compatible sportfishery in Elkhead Reservoir	CPW	Ongoing	X	X	X	X	X	CPW will continue to stock Elkhead Reservoir with replacement fisheries pursuant to the LMP and continue to manage against smallmouth bass and northern pike.	CPW held the fourth Elkhead Classic harvest tournament in 2019. Anglers removed 419 northern pike and 492 smallmouth bass. Anglers have reduced the adult smallmouth bass population in Elkhead Reservoir from an estimated 3,590 fish prior to the 2017 tournament to an estimated 1,883 fish after the 2019 tournament. The adult northern pike population was estimated at 3,419 prior to the 2019 tournament and 3,135 after the tournament (this is the first year population estimates have been available for northern pike).
	III.B.1.a.(2)(a)(i)	Revise Lake Management Plan	CPW	Complete							
	III.B.1.a.(2)(a)(ii)	Install screen	CRWCD	Complete							
	III.B.1.a.(2)(a)(iii)	Develop / Implement Communications Plan	CPW / Program	Complete						CPW continues outreach about nonnative fish at Elkhead Reservoir through the harvest tournament and news media.	
	III.B.1.a.(2)(a)(iv	Complete any necessary environmental compliance	CPW / CRWCD	Complete							
	III.B.1.a.(2)(v)	Identify and secure sources of replacement compatible sport fish.	CPW	Complete							
	III.B.1.a.(2)(a)(*vi*	Stock compatible sport fish.	CPW	Ongoing	X	X	X	X	X	CPW will stock replacement fisheries until populations no longer warrant stocking.	CPW stocked largemouth bass (500K fry; 20K fingerlings; 25 13-inch; 70 brood), bluegill (26K fingerlings), and black crappie (16K fingerlings) in accordance with the LMP. In total, CPW has stocked over 56,000 black crappie, more than one million largemouth bass and 168,000 bluegill in Elkhead Reservoir since 2015.
>*	III.B.1.a.(2)(a)(*vi*	Evaluate reservoir and associated habitats in the upper Elkhead Creek drainage / treat if necessary.	CPW / Program / CRWCD	Pending						Treatment of Elkhead Reservoir is still an option if smallmouth bass population cannot be adequately reduced or contained with the current net and LMP.	Habitats in the upper Elkhead drainage should be investigated when feasible (landowner permission) to determine the extent of actions needed upstream of Elkhead Reservoir.
	III.B.1.b.	Address escapement of northern pike from upstream reservoir sources.	Program	Ongoing	X	X	X	X	X	Continue addressing nonnative fish escapement at upstream reservoirs in the Yampa Basin through maintenance of escapement prevention devices and control actions.	CPW performed a rotenone treatment of Chapman Reservoir in November 2018, but the treatment was not fully successful. CPW treated it again in 2019. Sampling indicated that there were no pike remaining after the 2019 treatment, thus indicating a successful treatment in 2019.
>*	III.B.1.b.(1)	Convert and extend the ongoing Stagecoach Reservoir northern pike escapement study to a removal effort of northern pike and walleye.	CPW / Program	Pending							CPW removed 92 northern pike, 35 walleye, and one smallmouth bass during standard sampling (representing all that were caught). *X* The smallmouth bass was the first confirmed occurrence of that species in the reservoir. CPW updated signage encouraging harvest, and provided a chest freezer for anglers to turn in fish of these three illegally introduced species if they don't wish to keep the fish. CPW continues to support harvest tournament at Stagecoach, and requires removal of illegally introduced fish species.

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	III.B.1.b.(2)	Install escapement prevention at Lake Catamount	CPW / Program	Ongoing	X	X	X	X	X		CPW has continued work at Catamount to reduce the northern pike population. CPW removed 2,349 northern pike in 2019 (1,230 in spring netting and 1,119 in fall electrofishing). Reflecting a strong cohort produced in 2018, a majority of pike removed were age-1. X A working group to hear local stakeholder concerns and plan for potential alternatives did not meet in 2019 (PDO has prioritized other reservoir screening projects). Working group should be convened in 2020.
	III.B.1.c	Identify and evaluate natural and artificial spawning/nursery habitats for northern pike in the Yampa River for exclusion devices.	CDOW	Complete							
>*	III.B.1.c.(1)	Implement remedial measures to reduce pike reproduction in Yampa River.	Program/ CPW	Ongoing	X	X	X	X	X		! CPW and FWS removed 2220 northern pike in six weeks of netting in 2019. Only 6% of mature female northern pike had spawned prior to capture. ! 2019 Abundance estimate for Hayden - Craig reach was lowest since removal began in 2004.
	III.B.1.c.(1)(a)	Evaluate feasibility of habitat modification at Walton Creek to eliminate / reduce northern pike spawning habitat. Bidelspach and Fairley 2015.	CPW / Program / BR	Complete							
>*	III.B.1.c.(1)(b)	Modify Walton Creek habitat as indicated through feasibility investigations. *(Program will not participate in construction of project because of potential liability for downstream conditions)*	Colorado	Pending							Project implementation on hold until local stakeholders and CPW negotiate a preferred option and ways to fund (estimated costs exceed $1M).
	III.B.1.d	Review proposed new structures to minimize creation of habitat suitable for pike spawning/nursery.	CPW, FWS	Ongoing	X	X	X	X	X	States, FWS, and local governments will continue to require nonnative fish management as a key component of floodplain modifications.	CPW and FWS consider pike habitat during project permitting review (404 permits, ESA section 7 consultation, etc.). ! A known northern pike reproduction area at the Ghost Ranch (a gravel pit that was connected to the river during high flows in 2019) was closed off to pike as the result of a 404 permit.
	III.B.1.e	Other emerging nonnative species	Program	Ongoing	X	X	X	X	X	Monitor fish community of the Yampa River and respond appropriately to any new introductions or proliferation of nonnative species.	White sucker are removed when encountered in the Yampa River
	III.B.2.	Control nonnative fishes via mechanical removal									

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	III.B.2.a.	Estimate nonnative abundance, status, trends & distribution (YS I-3)	Program	Ongoing	X	X	X	X	X	Monitor nonnative fish populations to track trends and distribution.	CSU marked and released smallmouth bass in Little Yampa Canyon to preserve this long term dataset and estimate abundance. See III.B.2.e. below. CSU estimated 175 northern pike inhabited the 18.7 mile reach between KOA campground and Hayden pumphouse in 2019. Although this point estimate is lower than 2015 (215), the confidence intervals overlap, suggesting no significant change in the population. Most northern pike reside in a 1-mile section with many backwaters. Because electrofishing catch rates of northern pike have declined subsequent to backwater gill-netting (see III.B.2.d and d.(1) below), Program performed a mark-recapture estimate of northern pike in the Hayden to Craig reach (98b) in order to more accurately quantify changes in the northern pike population after implementation of recommendations from Zelasko et al. (2015). The 2019 estimate demonstrated that the downward trend in northern pike beginning in 2015, based on number of fish captured and catch-effort statistics, was a legitimate trend.
	III.B.2.b.	Develop and refine nonnative fish removal criteria (YS K-1)	Program	Ongoing	X						
	III.B.2.c.	Identify and evaluate gear types and methods to control nonnative fishes (YS I-5)	Program	Ongoing	X	X	X	X	X	Continually evaluate new gear for nonnative removal.	CPW and FWS continue to use gill nets to remove northern pike. CSU LFL continues to use multiple gear types to remove smallmouth bass.
>*	III.B.2.d.	Remove (formerly "and translocate") northern pike from Yampa River designated critical habitat. See Hawkins et al. 2005. (YS J-1)	CPW/FWS/ LFL	Ongoing	X	X	X	X	X	CPW will monitor and continue removal actions at appropriate levels.	Northern pike electrofishing catch rate increased compared to 2018 and reverses a trend of decreasing catch rate each year since 2015. Increases are primarily a result of juvenile fish spawned in 2019 and captured in late-season passes.
>*	III.B.2.d.(1)	Remove northern pike and smallmouth bass above designated critical habitat (Craig, CO) (YS C-3)	CPW/FWS/ LFL	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	More northern pike were removed from the Hayden to Craig reach in 2019 than 2018, likely from increased effort. Overall catch rates were similar to 2018, but were the highest of any year since 2013. In the Steamboat to Hayden reach, crews handled 264 northern pike; most fish were large piscivores (>450mm).
>*	III.B.2.e.	Remove (formerly "and translocate") smallmouth bass in Yampa River designated critical habitat. (YS J-1)	CPW/LFL/ FWS	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	In Little Yampa Canyon, the estimated adult and subadult abundance increased. Higher abundance of sub-adult smallmouth bass in 2019 reflects strong year classes in the prior two years. However, even with occasional strong year classes, the adult population of smallmouth bass in Little Yampa Canyon remains low compared to almost all prior years. In the middle Yampa River, the number of smallmouth bass captured in 2019 was similar to the total number captured in 2018 by boat electrofishing (n=9,911). Very few (n=31) large, piscivore-sized smallmouth bass (> 325 mm TL) were captured and in 2019 they comprised 0.3% of the electrofishing catch. Catch rates support that our removal efforts are highly effective at reducing these larger, highly predatory sizes. In Yampa Canyon, the catch rate for bass >100mm increased slightly from 2018. A large year class produced in 2017 was apparent, but production from 2018 appears low. Smallmouth bass show a distribution shifted downstream into the lower half of the canyon, suggesting reproduction within the reach.
	III.B.2.f.	Control channel catfish in Yampa Canyon by removing fish >400mm. (Previous focus shifted to smallmouth bass with catfish >400 mm removed during smallmouth bass removal.)	FWS	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	GRBFWCO removed 36 channel catfish larger than 400mm, about half of what was captured in 2018.
	III.B.2.g.	Develop and refine native fish response criteria (YS K-2)	Program	Complete							

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	III.B.2.h.	Monitor native and endangered fish response (YS L-2)	Program	Ongoing	X	X	X	X	X	Monitor endangered fish populations under a monitoring plan.	Native fishes continue to be common within Yampa Canyon, with native suckers and chub comprising approximately 75% of the fish community. Native fish species richness increased from 2003 until a peak of 2011, but has declined and remained low through 2018. Likewise, the frequency of samples with native fish increased through 2011, showed a decline, and has remained relatively stable at a moderate level from 2013-2018. Roundtail chub exhibited a delayed response to large year classes of smallmouth bass produced in 2012 and 2013, and declined in 2013-2018. Roundtail chub captures in 2018 were the lowest in the 15 year history of the project. A synthesis report is expected for Project 140 in 2020.
	III.B.2.i.	Remove bag and possession limits on warm water nonnative sportfishes within critical habitat in Colorado.	CDOW	Complete							
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A.	Yampa River in Dinosaur National Monument									
	IV.A.1.	Augment or restore populations as needed, and as guided by the Genetics Mgmt. Plan.									
	IV.A.1.a.	Develop integrated stocking plan for bonytail in the Yampa River.	CDOW	Complete							
>	IV.A.1.a.(1)	Implement stocking plan.	FWS/CPW	Ongoing	X	X	X	X			In 2019 Colorado's Mumma (NASRF) State Hatchery stocked 2,850 bonytail into the Yampa River in Dinosaur National Monument.
	IV.A.1.b.	Research the survivability of young-of-year Gila species in transport and hatcheries.	FWS/CDOW	Complete							
	IV.A.1.c	Evaluate feasibility of-reintroducing humpback chub to Yampa River	NPS / WAPA / CO / UT / BR/ PDO	Ongoing							Stakeholders are developing a proposal to reintroduce humpback chub under Project 175. A recent genetics report (Bohn et al. 2019) provided guidance that will inform future efforts.
	IV.A.1.d	Evaluate stocking success as identified in monitoring plan for stocked fish. Superseded by Basinwide Integrated Stocking Plan (2015), see General IV.B.2.	LFL/FWS/ CO / UT /PD	Ongoing	X	X	X	X			Gila are monitored under project 110. Project 169 (PIT antennas) detected 3 bonytail at Echo Park. Two of these fish were stocked in 2018 at Rainbow Park and one at Echo Park in 2015.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									Adult Colorado pikeminnow population estimation efforts in the Yampa River are a component of the Green River abundance estimates and are reported there. The results of annual larval pikeminnow monitoring in the lower Yampa River are also discussed in the Green River tab (V.C.4.). Fish community monitoring in the middle Yampa River and in Yampa canyon are secondary objectives of nonnative fish removal activities and are referenced under that program element (see above). PIT antennas deployed in the Yampa River between April and July documented the presence of 84 unique Colorado pikeminnow, one razorback sucker, 3 bonytail, and other native species.

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	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Assess need for tributary management plan for the White River.	PD	Complete							White River Management Plan needed and in development
	I.A.1.	Estimate future water demands on the White River.	TBD	In progress							In 2017 and 2018, Wilson Water Group used a modified, daily-timestep version of StateMod to model current hydrologic conditions and a range of possible future water demand scenarios in the White River basin relative to provisional flow targets. In 2019 the White River Planning Team began defining a future development scenario(s) to model for the Management Plan. The PDO expects to finalize those scenarios with the Planning Team in early 2020.
	I.B.	Initially identify year-round flows needed for recovery.									
	I.B.1.	Develop work plan.	FWS-FAC	Complete							
	I.B.2.	Identify flows. Initial report complete (Haines et al. 2004).	FWS-FAC	In progress							! The report "Review of Fish Studies with Interim Flow Recommendations for Endangered Fishes of the White River, Colorado and Utah" was approved by the BC, WAC, and MC in 2019, with the understanding that specific information gaps associated with these interim recommendations will be identified during the White River Management Plan process and incorporated into future study plans.
	I.B.3.	Develop and implement a White River management plan	Program	Pending	X	X					In 2019. CWCB distributed an RFP seeking a consultant to help with developing this plan; with the help of the White River Planning Team ERO Resources was selected from among six proposals received. In 2020, FWS and the White River Planning Team will be working with the consultant hired by CWCB (ERO Resources) on a White River Management Plan.
	I.B.3.a.	Conduct programmatic Section 7 and NEPA compliance on recovery actions and a level of future water demand.	FWS	Pending	X	X					FWS expects to eventually prepare a PBO based on the White River Management Plan. Timing of that PBO depends upon the timing of developing the Management Plan (see I.B.3). Tentatively, per the draft scope of work for the consultant's assistance with this effort, a PBO is expected sometime in 2021-2022. The FWS Western Colorado Ecological Services Field Office became engaged in the Planning Team's discussions of possible Management Plan contents and strategies in 2018, and remains engaged in these ongoing discussions.
	I.C.	Evaluate how identified flows will be legally protected.	CWCB	Pending							See I.B.3
	I.D.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).									
	I.D.1.	Review scientific basis, dependent on development of flow recommendations by FWS.	UT/CO	Pending							See I.B.2
	I.D.2.	Assess legal and physical availability of water.	UT/CO	Complete							
	I.D.3.	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.D.4	CWCB notice of intent to appropriate (in Colorado).	CWCB	On hold							
	I.E.	Legally protect identified flows (dependent on development of initial flow recommendations).									
	I.E.1.	Protect flows in Colorado.								Long term conservation flows will be identified in the White River Management Plan. This Management Plan (and the mechanism that implements it) could serve as a component of a future post-Program cooperative agreement.	
	I.E.1.a	Appropriate.									
	I.E.1.a.(1	CWCB approval to appropriate.	CWCB	On hold							
>*	I.E.1.a.(2	Colorado Attorney Generals Office file date.	CWCB	On hold							
>*	I.E.1.a.(3	Water court adjudication (litigation dependent).	CWCB	On hold							
	I.E.2.	Protect flows in Utah.								Long term conservation flows will be identified in the White River Management Plan. This Management Plan (and the mechanism that implements it) could serve as a component of a future post-Program cooperative agreement.	
	I.E.2.a.	Hold public meeting to establish future appropriation policy.	UT	Complete							
	I.E.2.b.	Identify legal and technical process and schedule for streamflow protection.	UT	Ongoing	*X*	*X*					
>*	I.E.2.c.	Implement process for streamflow protection.	UT	Pending							
	I.F.	Evaluate and revise as needed flow regimes to benefit endangered fish populations.	FWS/ Program	Ongoing	X	*X*	*X*	*X*			
	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Restore native fish passage at instream barriers.									
	II.A.1.	Assess and make recommendations for fish passage at Taylor Draw.	PD	Complete							
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative interactions between nonnative and endangered fishes.									
	III.A.1.	Monitor nonnative fishes in Kenney Reservoir and upstream. Initial assessment complete (Elmblad 1998).	CPW	Ongoing	X		X		X	CPW will continue to monitor fish communities upstream of Taylor Draw Dam.	Following discovery of illegally introduced northern pike in 2018, CPW conducted four weeks of mechanical removal utilizing gill nets and electrofishing. 31 pike were removed during this effort. CPW also coordinated with Rio Blanco Water Conservancy District to provide a harvest incentive to anglers and a freezer for fish to be turned in. In 2019, 64 northern pike were turned in for a $20 per fish incentive.
	III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.									
	III.B.1.	Assess adequacy of current regulations and options (including harvest) to reduce negative impacts on native fishes from nonnative sportfish and options to reduce angling mortality on native fishes below Kenney Reservoir.	CDOW	Complete							
	III.B.1.a.	If necessary, assess management options to reduce escapement of black crappie from Kenney Reservoir.	CDOW	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	III.B.2.	Preclude new nonnative species introductions, translocations or invasions to preserve native species dominance within critical habitat.	Program	Ongoing	X	X	X	X	X	Monitor and implement appropriate actions.	X More green sunfish were caught in 2019 than in any year since 2012. Since green sunfish inhabit Kenney Reservoir and more were caught in the 1.7 mile reach immediately downstream of this dam, it seems likely that many of these fish were reservoir escapees. Regardless of the source, these increased numbers warrant attention in future removal efforts. White sucker hybridization is an ongoing concern. Four northern pike were caught in the White River in 2019. Two were caught in the most upstream reach, one below Douglass Creek, and one in Utah. In the past, no more than two northern pike have been caught per year in the White River.
	III.B.2.a.	Determine and implement an adequate level of mechanical removal to reduce smallmouth bass.	CPW/UDWR /Program	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels.	X Smallmouth bass continue to successfully spawn and recruit in the White River. Overall catch rates in 2019 were lower than in 2018, but because effort was increased, total catch was the highest to date. Similar to years past, adult (> 200 mm) bass catch rates peaked in the reach immediately downstream of Taylor Draw Dam; adults comprised 28.8% of bass captures in Colorado and 5.6% in Utah. Adult, juvenile (100-199 mm TL), and smallmouth bass less than 100 mm TL were caught in 2019, demonstrating that successful reproduction and survival have occurred in this system for at least the past three years. The size structure of bass caught in 2019 revealed one dominant size class that appears to correspond to fish spawned in 2018 and, in Colorado, more representation by fish up to 275 mm TL than what has been observed in the past. The Recovery Program continues to discuss opportunities for flow spikes from Kenney Reservoir (similar to one conducted in 2018 to control algal growth) to disadvantage smallmouth bass spawning in the tailrace.
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A	Implement stocking plan.	FWS/CPW/UDWR	Ongoing	X	X	X	X			In 2019, Ouray Randlett stocked 3,594 bonytail in the White River at the Enron boat ramp. In June 2019, Ouray Grand Valley Unit stocked 4 razorback sucker and 2 bonytail in the White River as part of an outreach event.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.									
	V.A.1.	Determine relative abundance and fate of Colorado pikeminnow congregation below Kenney Reservoir.	FWS-FAC	Complete							
	V.A.2.	Monitor the White River fish community downstream of Kenney Reservoir to determine long-term effects of mainstream impoundment on the White River.	FWS-FAC	Complete							In 2019, the PIT antenna at Bonanza detected tags implanted in 106 bonytail and 27 Colorado pikeminnow. All but two of the bonytail were stocked in 2019 by Ouray NFH-Randlett, one fish was stocked in 2014 by Wahweap and one in 2018 by Ouray NFH-Randlett. Adult Colorado pikeminnow population estimation efforts in the White River are a component of the Green River abundance estimates and are reported there.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Identify initial year-round flows needed for recovery.	FWS-ES	Complete							
	I.A.1.	Conduct hydrology/water availability study.	UT	Complete							
	I.A.2.	Conduct follow-up study to evaluate and refine flow recommendations.	FWS/UT	Complete							
	I.B.	State acceptance of initial flow recommendations (dependent on development of initial flow recommendations).									
	I.B.1.	Review scientific basis.	UT	Complete							
	I.B.2.	Assess legal and physical availability of water. See Central Utah Water Conservancy District 2013.	UT, CUWCD, FWS	Ongoing	X	X	X	X	X		Central Utah Water Conservancy District has drafted a Lower Duchesne Water Management Report covering the 2012-2018 period (these reports are to be provided every five years). A final version of that report is expected in 2020.
	I.C.	Legally protect and deliver identified flows.	UT, CUWCD, FWS	Ongoing	X	X	X	X	X	Lower Duchesne River Workgroup stakeholders, primarily Central Utah Water Conservancy District, will continue to supply flows according to the 2005 Biological Opinion.	The Duchesne River Basin April-July runoff at the Randlett gage was 181% of average -- an unusually wet year. Wet year flow recommendations call for maintaining a long-term average of 7,000 cfs-days (similar to temperature degree day calculations) above a threshold of 4,000 cfs at the Randlett gage; 22,880 cfs-days above this threshold were recorded in 2019, yielding an annual average of 9,529 cfs-days since Duchesne flow management began in 2004. The 'Priority 1' target at the Randlett gage through the low-flow season was 50 cfs; mean daily flows exceeded this threshold on all but 8 days (the second-best base flow conditions in the last 8 years). The 'Priority 4' target was 115 cfs at the Randlett gage from March to June; mean daily flows exceeded this threshold on all but 18 days (also the second-best conditions of the last 8 years). For additional details, see the 2018 Hydrologic Conditions Summary
	I.C.1.	Strawberry Valley Project.									
	I.C.1.a.	Determine amount of water available from the Strawberry Valley Project for fish use. (BR/CUWCD completed coordinated reservoir operations model in 2003. Task completion part of I.D.1) (This is part of the coordinated reservoir operation in I.D.)	USBR/DOI/ PD/ Strawberry Water Users	In progress	*X*	*X*	*X*	*X*	*X*		Temporary Sec 207 contracts for up to 1,500 AF of water are in place for the 2016-2020 delivery seasons. In 2019, 1,173 AF of Sec 207 water was released from Big Sand Wash Reservoir under this contract to support Duchesne River base flows.
	I.C.2.	Management of Daniels Transbasin Diversion.									
	I.C.2.a.	Determine the amount of water available from the Daniels Diversion for endangered fish use and pattern and location for delivery. (BR/CUWCD completed coordinated reservoir operations model in 2003. Task completion part of I.D.1)	DOI/IBAT/FWS/ URMCC/ CUWCD/ Ute Tribe	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
>*	I.C.2.b.	Develop agreements if feasible to deliver and protect water available from the Daniels Diversion.	UT/IBAT /FWS/DOI/ URMCC/ CUWCD	Ongoing	X	X	X	X	X	Lower Duchesne River Workgroup stakeholders, primarily Central Utah Water Conservancy District, will continue to fulfill agreements. If deemed necessary, Utah State Engineer may need to determine additional ways to protect flows.	Daniels Replacement Project water (2,900 AF) is available to support Duchesne flows. Once released from Starvation Reservoir, this water is protected by agreement among the CCAA/SHA parties (as opposed to Utah State water law). CUWCD must internally manage this water in accordance with Central Utah Project Completion Act (CUPCA) provision (Public Law 102-575), project purposes as given in the congressionally-approved Supplement to the 1988 Definite Plan Report for the Bonneville Unit (DPR), and other CUWCD contracts. 2,900 AF of Daniels Replacement Project water was released in 2019 to support Duchesne River base flows.
	I.D.	Coordinate reservoir operation.									
	I.D.1.	Determine feasibility and benefits of coordinated reservoir operation.	BR/CUWCD/ DOI	Complete							
>*	I.D.2.	Develop agreements if feasible to coordinate reservoir operations and protect flows to the Green River.	BR/CUWCD/ UT/Ute Tribe	Ongoing	X	X	X	X	X	Lower Duchesne River Workgroup stakeholders will continue to investigate ways to protect water to Green River. If deemed necessary, Utah State Engineer may need to determine additional ways to protect flows.	The CCAA/SHA agreement protects flows to the Myton Diversion, but not all the way to the Green River. If the CCAA/SHA is successful, FWS recommends investigating how it might be modified to add water users between Myton and Green River, to protect flows all the way to the confluence. The flows currently appear to be protected in practice, but not legally.
>*	I.D.2.a.	Rehabilitate Myton Town diversion.	BR/ CUWCD /UT/Ute Tribe	Complete							Under unusually high spring runoff conditions, such as those seen in 2019, no effective system exists to sample fish passing the Myton Diversion. Thus, 2019 sampling was inadequate to provide useful fish counts. DWR plans to work with engineers and Ute Tribe representatives over coming months to to identify possible solutions for this high-flow fish count problem.
	I.E.	Examine the feasibility of other options for obtaining water.	BR/DOI/PD/ Ute Tribe	Ongoing	X	X	X	X	X	Lower Duchesne River Workgroup stakeholders will continue to investigate additional options for obtaining water until 50 cfs base flow is easily met in most water years.	Water delivery continues to supply base flows at a much improved rate compared to pre-2005 operations, however available volumes and delivery constraints curb the ability to consistently meet base flow targets, especially during the summer in drier years. Since 2005, flows have fallen short of the 50 cfs minimum flow target an average of 37 days/year (maximum 108 days in 2018). Additional sources of water should continue to be investigated.
	I.F.	Determine need and feasibility of additional gaging.	BR/FWS/ UT	Complete							
	I.F.1.	Construct additional gages, as needed.	TBD	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.G.	Evaluate and revise as needed, flow regimes to benefit endangered fish populations	FWS/ Program	Pending		X					Utah DWR sampled fish at the Myton Diversion fish passage structure. During 24 days of operation, 65 individual fish were encountered, the majority invasive species (89.2%) including six brook stickleback, 26 fathead minnow, 10 red shiner, and eight redside shiner. Other invasive species included brown trout, channel catfish, sand shiner, white sucker, and a white x flannelmouth sucker hybrid. The six native fish encountered were all speckled dace. Complementary sampling via barge electrofishing from Myton to Knight diversions, and jon boat electrofishing downstream of the Myton Diversion to the confluence with the Green River were not conducted because access was not granted in 2019. None of the four endangered species were found. It is unlikely that enough new data have been gathered, at this point, to suggest revisions to the current Duchesne River flow regime.
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative interactions between nonnative and endangered fishes.									
	III.A.1.	Identify most damaging nonnative fishes.	UDWR	Complete							
	III.A.2.	Assess options to control negative interactions from nonnative fishes from the Duchesne River to benefit Colorado pikeminnow and razorback sucker young-of-the-year.	UDWR	Complete							
	III.A.3.	Implement and evaluate the effects of viable measures to control negative interactions from nonnative fishes. (See III.A.3. under Green River Mainstem Action Plan.)									
	III.A.3.a.	Evaluate feasibility of screen on Bottle Hollow Reservoir to control nonnative fish escapement and explore alternative funding sources.	FWS-FAC/Ute Tribe/BOR	Complete							
>*	III.A.3.a.(1)	If feasible and necessary, screen Bottle Hollow Reservoir	Ute Tribe	Complete							
	III.A.3.b.	Evaluate escapement of nonnative fishes from Starvation Reservoir and the feasibility of screening.	UDWR	Complete							
	III.A.3.b.(1)	If feasible and necessary, screen Starvation Reservoir	UDWR/ USBR/ CUWCD	Ongoing (see below)							
	III.A.3.b. (2	Develop a management strategy to address escapement of walleye (and smallmouth bass) from Starvation Reservoir. UDWR 2014.	UDWR	Complete							

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>*	III.A.3.b (3)	Implement recommendations from the escapement strategy.	UDWR/ CUWCD/ USBR/ Program	Ongoing	X	X	X	X	X	UDWR will maintain the Starvation escapement screen and continue to implement the lake management plan.	A modular, hard wire temporary barrier screem has been in place during spills since 2015. Stilling basin treatments have taken place to remove fish that are present post-spill. Location of permanent barrier is planned for downstream of the Primary Jurisdiction Zone. Design has been approved by stakeholders. Construction will be scheduled after other higher priority projects, as the temporary solution is currently working.
>*	III.A.3.c.	Remove nonnative fish (smallmouth bass, walleye, and northern pike). See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.	FWS-FAC/ Ute Tribe/ UDWR	Ongoing when possible	X	X	X	X	X	UDWR and FWS will work with the Ute Tribe to implement removal at appropriate levels.	Ute Tribe fisheries department sampled the lower Duchesne River in July 2019. Catch was dominated by channel catfish (44%) and smallmouth bass (33%). Crews removed 82 smallmouth bass (mean 181 mm) and three walleye (mean 600 mm). These sizes are similar to those seen in the middle Green River, corresponding to a 2018 smallmouth bass cohort and larger walleye.

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	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Colorado River above Gunnison River									
>*	I.A.1.	Develop, issue and implement PBO.	FWS	Complete							
	I.A.2.	Initially identify year-round flows needed for recovery.									
	I.A.2.a.	Rifle to Roller Dam.	FWS-FAC	Complete							
	I.A.2.b.	Roller Dam to 15-Mile Reach.	FWS-FAC	Complete							
	I.A.2.c.	15-Mile Reach.	FWS-FAC	Complete							
	I.A.3.	Provide a depletion accounting report as outlined in the 15-Mile Reach PBO.									
	I.A.3.a.	Collect data.	CWCB/FWS-ES/BR	Ongoing	X	X	X	X	X		
	I.A.3.b.	Develop consumptive use and losses report with CRDSS model to verify level of depletions.	CWCB	Complete							
	I.A.3.c.	Calculate new depletions every 5 years (2006-2010, etc.) and record within the depletion report the Program and WAC determination regarding whether or not additional instream flow filings or other flow protection mechanisms should be considered.	CWCB	In progress	*X*		*X*		X		! In 2019, CWCB provided a draft analysis/report of depletions for the 2006-2010 and 2011-2015 periods. The PDO and the WAC reviewed the report in 2020. A final version was accepted by the USFWS in early 2020. Results show net new depletions during both studied periods remain considerably less than the 50,000 AF threshold that would trigger a closer evaluation of impacts to endangered fish. In 2021, CWCB should begin work on the depletion report for 2016-2020.
	I.A.4.	Evaluate need for instream flow water rights.									
	I.A.4.a.	Rifle to Roller Dam (Dependent on initial flow recommendations).									
	I.A.4.a.(1)	Assess legal and physical availability of water.	CWCB	Complete							
	I.A.4.a.(2)	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete							
	I.A.4.a.(3)	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS		X			X	X		X The 2015 draft 15-Mile Reach PBO Review distributed to the BC and WAC in August 2016 has yet to be finalized. Water user and environmental interests provided comments on the 2016 draft, but finalization was delayed awaiting CWCB delivery of their depletions report for the basin. CWCB provided that draft report in fall of 2019 (see I.A.3.c), and the PDO now expects to move ahead with a final draft PBO Review for partner review in 2020. Any determination for additional flow protections rests with the Program and WAC. The WAC discussed this in July and November 2011 and determined that additional permanent protection in the form of instream flow filings is not necessary at this time. CWCB indicates that there have not been significant new net depletions in the Colorado River since that time.
	I.A.4.a.(3)(a)	If necessary, evaluate how identified flows will be legally protected.	CWCB	On hold							
	I.A.4.b.	Roller Dam to 15-Mile Reach (Dependent on initial flow recommendations).									
	I.A.4.b.(1)	Assess legal and physical availability of water.	CWCB	Complete							
	I.A.4.b.(2)	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete							
	I.A.4.b.(3)	Revisit the need for instream flow filings or other flow protection mechanisms at least every 5 years.	CWCB/FWS	Pending					X		
	I.A.4.b.(3)(a)	If necessary, evaluate how identified flows will be legally protected.	CWCB	On hold							
	I.A.4.c.	15-Mile Reach.									
	I.A.4.c.(1)	Instream flow water right secured - 581 cfs (July - September).		Complete							

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	I.A.4.c.(2)	Irrigation season return flows legally protected - 300 cfs.		Complete							
	I.A.5.	Provide and legally protect instream flows pursuant to Colorado River PBO.								Ensure that current water supply sources, agreements, and actions to augment flows in the 15-Mile Reach (including those that will expire, are based on voluntary participation, or are tied to a Program PBO) are either maintained for the long-term beyond 2023 or replaced with satisfactory long-term agreements.	Apr 1 snowpack in the upper Colorado River basin in 2019 was above average, with CBRFC projecting 118% of average Apr-Jul runoff at the Cameo gage location. Coordinated Reservoir Operations (CROS) were implemented during the peak runoff period (June 2019) for the fourth time in the last five years. Details provided under I.A.5.g.(2). FWS set an Aug-Oct base flow target for the 15-Mile Reach of between 1240 and 1630 cfs. Mean flow Aug-Oct 2019 was 1624 cfs. Daily mean flows fell below the 1240 cfs threshold on 50 days during this period; flows never fell below the 810 cfs dry-year target. ! A total of 88,321 acre-feet were released from endangered fish accounts at Ruedi, Granby, Green Mountain and Wolford Mountain reservoirs between Aug 19 and Oct 31 to support base flows. This included 2,676 ac-ft of maintenance releases from Wolford Mountain Reservoir by the Colorado River District that were protected to and through the 15-Mile Reach, and 299 ac-ft from Ruedi Reservoir leased in fall 2018 by the Roaring Fork Conservancy which was surplus to their winter release needs, and therefore available to the Program. An additional 327 ac-ft was leased and released from Ruedi Reservoir by the Colorado Water Trust for the benefit of the Grand Valley Power Plant and the 15-Mile Reach in late August.
>*	I.A.5.a.	Pursuant to Ruedi Biological Opinion (and subsequently, the 15-Mile Reach PBO), deliver 5,000af annually & an additional 5,000af 4 out of 5 years (ongoing and protect by short-term agreement).	BR/CWCB	Ongoing	X	X	X	X	X	Continue to deliver available water. (For example, extend the CWCB contracts for these 10,000 AF of water, which are currently set to expire in 2030.)	The 88,321 AF of 2019 Program water releases mentioned under 1.A.5 includes 5,000 AF of water from the annual Ruedi environmental account + 5,000 AF of water delivered from the "4 out of 5 year" account.
>*	I.A.5.b.	Execute lease (through 2012) for Reclamation's 10,825 af from Ruedi Reservoir.	BR/FWS/ CWCB	Complete							This lease expired in 2012 and has been replaced with a Colorado River District contract (in perpetuity) for the delivery of 5,412.5 AF of Ruedi Reservoir water to the 15-Mile Reach. This represents the West Slope's contribution to the 10,825 AF commitment. All 5,412.5 AF of this water (minus transit losses) was delivered to the 15-Mile Reach in 2019.
>*	I.A.5.b.(1)	Provide water annually pursuant to long-term lease.	BR/CWCB	Complete							! In each year since 2015, CWCB and Ute Water have implemented a short-term lease that makes an additional 6 KAF to 12 KAF of water available for flow augmentation from Ruedi Reservoir. This lease supplements the other longer-term Ruedi Reservoir agreements that provide fish water for the 15-Mile Reach. The Ute lease in 2019 provided 4,687 AF of augmentation water, bringing total 2019 Ruedi releases to benefit 15-Mile-Reach baseflows to 20,399 ac-ft. CWCB is seeking to renew its agreement with Ute Water through 2025 to enter into more future leases.
	I.A.5.c.	East and West slope water users provide 10,825 af pursuant to 15-Mile Reach PBO									
	I.A.5.c.(1)	Provide 10,825 af on an interim basis from Wolford and Williams Fork reservoirs.									
	I.A.5.c.(1)(a)	Execute 10-year agreement for delivery of 5,412.5 af by West Slope water users. Extend agreement through 2013.	CRWCD/FWS	Complete							
>*	I.A.5.c.(1)(a)(i)	Provide and protect water deliveries by West Slope water users.	CRWCD/ CWCB	Complete							
	I.A.5.c.(1)(b)	Execute 10-year agreement for delivery of 5,412.5 af by East Slope water users. Extend agreement through 2013.	DWD/FWS	Complete							
>*	I.A.5.c.(1)(b)(i)	Provide and protect water deliveries by East Slope water users.	DWD	Complete							

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	I.A.5.c.(2)	Provide permanent delivery of 10,825 af in late summer/early fall to meet base flow needs.									
	I.A.5.c.(2)(a)	Identify options.	Water Users	Complete							
	I.A.5.c.(2)(b)	Select preferred alternative for delivery.	Water Users	Complete							
	I.A.5.c.(2)(c)	Sign agreement(s) for permanent delivery of 10,825.	Water Users	Complete							
>*	I.A.5.c.(2)(d)	Deliver and legally protect flows.	Water Users	Ongoing	X	X	X	X	X	Continue to deliver available water and protect instream flows	
	I.A.5.d.	Evaluate options for use of uncommitted Ruedi Reservoir water following Round II sales.	BR	Complete							
	I.A.5.e.	After Ruedi Round II water sales are completed, or commitments to contracts agreed to, resolve the disposition of remaining uncommitted water from Ruedi Reservoir.	BR/CWCB/ FWS	Complete							
>*	I.A.5.f.	Pursuant to Wolford Mountain (Muddy Creek) Biological Opinion, deliver up to 6,000 acre-feet of water.	CRWCD/FW S/ CWCB	Ongoing	X	X	X	X	X	Continue to deliver available water	See I.A.5. In 2019, 6,000 AF of dedicated fish pool water was released from Wolford Mountain Reservoir to augment irrigation season base flows in the15-Mile Reach. ! In addition, CRWCD released 2,676 AF from Wolford Reservoir in August and September for reservoir maintenance purposes that were timed in part to maximize endangered fish benefits, and which were protected to and through the 15-Mile Reach.
	I.A.5.g.	Coordinated reservoir operations (CROS).									
	I.A.5.g.(1)	Evaluate (final report). Implementation plan finalized 2/28/06.	BR	Complete							
>*	I.A.5.g.(2)	If available, deliver additional peak flows, evaluate process & hydrology, and provide annual report.	BR	Ongoing	X	X	X	X	X	Continue to deliver available water	! Voluntary Coordinated Reservoir Operations (CROS) were implemented in 2019 for the fourth time in the last five years. In 2019, the decision was made to focus on extending the duration of the spring peak flow in the 15-Mile Reach rather than increase the peak flow magnitude. 15-Mile Reach flows were augmented from about June 16 to June 24 with approximately 39,156 ac-ft of combined bypasses/releases from Green Mountain, Williams Fork, Ruedi, Windy Gap, and Homestake reservoirs. This is estimated to have provided more than 2,000 cfs of additional flow to the 15-Mile Reach from June 18 to 23. Peak mean daily flow at the Palisade gage was 21,900 cfs on June 22.
	I.A.5.h.	Collbran Project.									
	I.A.5.h.(1)	Evaluate.	BR	Complete							
	I.A.5.h.(2)	Make recommendations	BR	Complete							
	I.A.5.i.	Silt Project.									
	I.A.5.i.(1)	Evaluate.	BR	Complete							
	I.A.5.i.(2)	Make recommendations.	CDOP/BR	Complete							
	I.A.5.j.	Grand Valley Water Management Project.									
	I.A.5.j.(1)	Evaluate.	BR	Complete							
	I.A.5.j.(2)	Complete Draft Grand Valley Water Management Environmental Assessment. The agreement to deliver Green Mountain Reservoir water to the Grand Valley Power Plant, pursuant to the Orchard Mesa Check Settlement, will also be covered in this draft environmental assessment.	BR	Complete							
>*	I.A.5.j.(3)	Design and construct features of the Grand Valley Water Management Project.	BR	Complete							

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	I.A.5.j.(4)	Execute agreement for delivery of surplus Green Mountain Reservoir water up to the excess capacity of the Grand Valley Power Plant pursuant to the Orchard Mesa Check Settlement.	BR	Complete							
	I.A.5.j.(5)	Execute agreement (municipal water contract) to deliver additional Orchard Mesa Check Settlement water and Grand Valley Water Management Plan water to benefit endangered fish.	BR/City of Grand Jct.	Complete						Expires in 2055 and will likely need to be renewed.	
	I.A.5.j.(6)	Assess options and legally protect only additional Orchard Mesa Check Settlement water and Grand Valley Water Management Plan water.	BR	Complete							
	I.A.5.k.	Orchard Mesa Irrigation District (OMID) Canal Automation Project									
	I.A.5.k.(1)	Secure site for re-regulating reservoir	CRWCD	Complete							
	I.A.5.k.(2)	Develop acceptable cost-sharing agreement for escrow account to fund O&M costs.		Complete							
	I.A.5.k.(3)	Conduct environmental assessment	USBR	Complete							
>*	I.A.5.k.(4)	Design and construct features of the OMID project	BR	In progress	X						Totals of $440,636 and $34,595 were spent in 2018 and 2019, respectively, on the OMID re-regulating reservoir completion activities. Plans are to install an automated gate on the outflow valve at the reregulating reservoir in early 2020 so that those flows may be monitored and adjusted remotely, allowing for quicker response.
	I.A.5.l.	Water Division 5 Coordinated Facilities Study (CFOPS).									
	I.A.5.l.(1)	Evaluate options for providing and protecting additional peak flows to the 15-Mile Reach. Phase I completed 2001; Phase II completed 2003 (Brown and Caldwell 2003).	Water Users	In progress	X						In 2018, Water Consult Engineering and Planning submitted a draft Phase III CFOPS report to the Recovery Program, incorporating comments received from the Program Office and others, and including additional input from the Bureau of Reclamation concerning Ruedi Reservoir options. Water Consult plans to distribute this document in 2020 to the Program's technical committees for comment.
>*	I.A.5.l.(2)	Deliver additional peak flows as determined feasible in the evaluation.	TBD	Ongoing	X	X	X	X	X	Continue to deliver available water	
	I.A.6.	Review implementation of RIPRAP items to determine timely compliance with applicable schedules (every 2 yrs. beginning in 2003).	FWS	Ongoing		X		X	X		See I.A.4.a.(3) above; a draft 2015 15-Mile Reach PBO Review is being revised based on comments received in 2016 and results of the draft depletions analysis provided by Colorado in fall of 2019 and now being finalized.
	I.B.	Colorado River from the Gunnison to the Colorado-Utah State line (Includes the 18-Mile Reach)									
	I.B.1.	Initially identify year-round flows needed for recovery.	FWS-FAC	Complete							
	I.B.2.	Evaluate how identified flows will be legally protected.	CWCB	On hold							
	I.B.3.	State acceptance of initial flow recommendations.									
	I.B.3.a.	Review scientific basis, dependent on development of flow recommendations by FWS.	CWCB/CPW	Pending							
	I.B.3.b.	Assess legal and physical availability of water.	CWCB	Complete							

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	I.B.3.c	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete							
	I.B.3.d.	CWCB notice of intent to appropriate (in Colorado).	CWCB	On hold							
	I.B.4.	Legally protect identified flows.									
>*	I.B.4.a.	Acquire (see Colorado River above Gunnison and Gunnison River).									
	I.B.4.b.	Appropriate.									
	I.B.4.b.(1)	CWCB approval to appropriate.	CWCB	On hold							
>*	I.B.4.b.(2)	Colorado Attorney Generals Office file date.	CWCB	On hold							
>*	I.B.4.b.(3)	Water court adjudication (litigation dependent).	CWCB	On hold							
	I.B.4.c.	Deliver and legally protect flows from Aspinall (see Colorado River above Gunnison and Gunnison River).									
>*	I.B.4.c.(1)	Operate Aspinall to provide test flows.	BR	Complete							
>*	I.B.4.c.(2)	Continue annual coordination meetings.	BR	Ongoing	X	X	X	X	X		Reclamation holds three Aspinall Operations meetings annually with stakeholders (January, April, August).
	I.B.4.c.(3)	Operate Aspinall to provide flows pursuant to biological opinion and record of decision.									See Gunnison River tab, I.C.3.e
	I.B.4.c.(3)(a)	Determine if change in water right and/or contract is needed.	BR	Complete							
	I.B.4.c.(3)(b)	Enter into contract if needed.	BR	Complete							
>*	I.B.4.c.(3)(c)	Deliver flows.	BR	Complete							
	I.B.5.	Develop study plan to evaluate flow recommendations (Aspinall Study Plan)	Program	Complete							(see comment on General I.A.4.b.(2)) - Program needs to determine when/if geomorphic studies of the Aspinall Study Plan will be conducted, and a timeframe for evaluating effects of the endangered fish flows should be identified.
	I.B.5.a.	Monitor Physical Response in the Colorado River to the Proposed Action									
	I.B.5.a.(1)	Opportunistically collect aerial photography during the peak flows to determine area of floodplain inundation at floodplain sites (Valdez and Nelson 2006)	BR / NPS	Ongoing as needed					X		NPS partners with others to collect data when funding and conditions allow. Aerial photography was collected by Reclamation with Program funds during the high peak flow period in 2011.
	I.B.5.a.(2)	Opportunistically collect aerial photography during base flows to monitor channel width and complexity and to serve as base maps for habitat mapping.	BR / NPS	Ongoing as needed					X		NPS partners with others to collect data when funding and conditions allow. Aerial photography was collected by Reclamation with Program funds during the base flow period in 2008.
	I.B.5.a.(3)	Repeat depth-to-embeddedness surveys in the 18-mile reach.	Program	Pending							
	I.B.5.b.	Monitor Biological Responses in the Colorado River to the Proposed Action									
	I.B.5.b.(1)	Initiate a fish community monitoring study in Colorado River main channel and floodplain habitats (focus on 18-mile reach)	CPW/FWS	Ongoing	X	X	X	X	X		Monitoring of the fish community response in the lower Gunnison and upper Colorado rivers (18-mile reach) occurs annually under Project 163. In 2019, five razorback sucker and two bonytail were captured in the 18-mile reach. The native fish communities are monitored using CPE data, which has been relatively consistent since 2011 (also see Gunnison I.D.1.b.(1) and V.A.3). PDO has received an interim summary report (Project 163), currently under review.
	I.B.5.b.(2)	Assess primary and secondary productivity in cobble bars (runs and riffles)	TBD	Pending							
	I.B.5.b.(3)	Continue ongoing fish community monitoring (CPM and HBC pop estimation; CPM Age-0 monitoring)	FWS/UDWR	Ongoing	X	X	X	X	X		see Program Element V. Monitor Populations, below

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	I.B.6.	Integrate and synthesize information to evaluate and revise the endangered fish flow recommendations as necessary.	Program	Pending					X		
	I.C.	Colorado River from Colorado-Utah State line to Green River									
	I.C.1.	Initially identify year-round flows needed for recovery.	FWS-FAC	Complete							
	I.C.2.	State acceptance of initial flow recommendations.									No need for action on items I.C.2 until such time as major water development is proposed along this reach.
	I.C.2.a.	Review scientific basis.	UT	Pending							
	I.C.2.b.	Assess legal and physical availability of water.	UT	Pending							
	I.C.3.	Legally protect identified flows.	UT	Pending							
	I.C.3.a.	Hold public meeting to establish future appropriation policy.	UT	Pending							
	I.C.3.b.	Adopt and implement new policy (new appropriations subject to flow criteria).	UT	Pending							
>*	I.C.3.c.	Prepare and execute contracts with water users as required to subordinate diversions associated with approved and/or perfected rights.	UT	Pending							
	I.D.	Colorado River below Green River									
	I.D.1.	Initially identify year-round flows needed for recovery.	FWS	Pending							After evaluation of flow recommendations in the Gunnison, Colorado, and Green rivers is completed, the FWS needs to determine if combination of Colorado and Green River flows below the confluence are adequate for recovery.
	I.D.2.	Assess adequacy of combined flows from Colorado and Green rivers to provide fish habitat (and meet recovery goals) in the Cataract Canyon reach of the Colorado River.	FWS	Pending							See comment under 1.D.1.
	I.E.	Evaluate and revise as needed flow regimes to benefit endangered fish populations. See also 1.B.5.	FWS/Program	Ongoing	X						
	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Restore and manage flooded bottomland habitat.								Some level of O&M will be necessary depending on number of floodplain sites that are developed	
	II.A.1.	29-5/8 Road Gravel Pit (became part of larger “Hot Spot Complex” in 2003.)									
	II.A.1.a.	Develop and approve management plans.	FWS-FAC	Complete							
	II.A.1.b.	Site design/complete environmental compliance.	BR	Complete							
>*	II.A.1.c.	Construct.	BR	Complete							
>*	II.A.1.d.	Operate and maintain.	BR	Pending, as needed							
	II.A.1.e.	Monitor and evaluate success; modify as needed.	FWS-FAC	Pending, as needed							
	II.A.2.	Adobe Creek.									
	II.A.2.a.	Develop and approve management plans.	FWS-FAC	Complete							
	II.A.2.b.	Site design/complete environmental compliance.	BR	Complete							

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>*	II.A.2.c.	Construct.	BR	Complete							
>*	II.A.2.d.	Operate and maintain.	BR	Pending, as needed							
	II.A.2.e.	Monitor and evaluate success; modify as needed.	FWS-FAC	Pending, as needed							
	II.A.3.	Walter Walker.									
	II.A.3.a.	Develop and approve management plans.	FWS-FAC	Complete							
	II.A.3.b.	Site design/complete environmental compliance.	BR	Complete							
>*	II.A.3.c.	Construct.	BR	Complete							
>*	II.A.3.d.	Operate and maintain.	BR/FWS/ CDOW	Pending, as needed							
	II.A.3.e.	Monitor and evaluate success; modify as needed.	FWS-FAC	Pending, as needed							
	II.A.4.	Develop and implement levee removal strategy at high-priority sites.									
	II.A.4.a.	Preconstruction (contaminants screening, floodability assessments, environmental compliance, design & engineering.	BR/FWS	Complete							
>*	II.A.4.b.	Construction (levee breaching) [NOTE: Subject to review and approval for depression wetlands.]	BR	Complete							
>*	II.A.4.c.	Operate and maintain.	BR/FWS	Complete							
	II.A.4.d.	Evaluation	FWS	Complete							
	II.A.5.	Acquire interest in high-priority flooded bottomland habitats.									
	II.A.5.a.	Identify and evaluate sites.	FWS	Complete							
	II.A.5.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete							
	II.A.5.c.	Conduct appraisal/NEPA compliance.	PD	Complete							
>*	II.A.5.d.	Negotiate and acquire.	PD	Complete							
	II.A.5.e.	Evaluate effectiveness of land acquisition activities and provide recommendations	PD	Complete							
	II.A.6.	Develop Colorado River Subbasin Floodplain Management Plan	Program	Complete							
>*	II.A.6.a.	Implement, validate and refine Colorado River Subbasin Floodplain Management Plan	Program	Ongoing	X	X	X	X	X		

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	II.A.7.	Matheson								Ongoing O, M, & R	The Program approved the transfer of unexpended capital funds intended for Wahweap repairs to be used for Matheson Phase I. These funds contributed to the installation of water control gates and fish screens to prevent nonnative fish entry. UDWR operated the wetland using larval presence to initiate filling of the wetland, despite the gates and screens not being in place. Larvae were collected from within the wetland, but a fish kill later occurred. This is likely due to the inundation of terrestrial vegetation, which causes a decline dissolved oxygen as it decomposes. This phenomenon is common in Green River wetlands when inundation follows prolonged periods of floodplain disconnection from the river.
	II.A.7.a.	Develop and approve management plans.	UDWR	Complete							
	II.A.7.b.	Site design/complete environmental compliance.	UDWR/ TNC	In progress							Initial construction is complete with environmental compliance. Phases 2 and 3 may still occur, which may require additional environmental compliance.
	II.A.7.c.	Construct.	UDWR/ TNC	in progress	X	X					! Initial construction is complete. More work is planned to make additional improvements, pending availability of funds. The wetland is currently operational, but relatively small.
	II.A.7.d.	Operate and maintain.	UDWR	Ongoing	X	X	X	X	X		UDWR operated the wetland opportunistically in 2019. All features are now in place to operate the wetland as intended.
	II.A.7.e.	Monitor and evaluate success; modify as needed.	UDWR	Ongoing	X	X	X	X	X		
	II.B.	Restore native fish passage at instream barriers.									
	II.B.1.	Restore passage at Grand Valley Irrigation Co. Diversion Dam (Palisade)									
	II.B.1.a.	Evaluate and implement viable options to restore fish passage.	BR/FWS	Complete							
	II.B.1.a.(1)	Obtain landowner consent/agreement.	BR	Complete							
	II.B.1.a.(2)	Site design/environmental compliance.	BR	Complete							
>*	II.B.1.a.(3)	Construct.	BR	Complete							
>*	II.B.1.a.(4)	Operate and maintain.	FWS-FAC/BR	Ongoing	X	X	X	X	X	The GVIC passage will need to be maintained and operated in perpetuity.	
	II.B.1.a.(5)	Monitor and evaluate success.	FWS-FAC/BR	Complete							
	II.B.1.b.	Screen GVIC diversion to prevent endangered fish entrainment, if warranted.									In 2019, Applegate Group (with funding from Reclamation) completed hydraulic modeling of a proposed 12-inch raise to the crest of GVIC's diversion dam. The intent of the dam raise would be to improve the operation of GVIC's fish screens and fish passage by improving the effectiveness of diversions at low flows and increasing hydraulic head in the diversion canal. Applegate concluded this modification would qualify for 'no rise' floodplain certification, simplifying Corps permitting. GVIC and Reclamation continue exploring designs and developing cost estimates.
	II.B.1.b.(1)	Design.	BR	Complete							
>*	II.B.1.b.(2)	Construct.	BR	Complete							

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>*	II.B.1.b.(3)	Operate and maintain.	FWS-FAC/BR	Ongoing	X	X	X	X	X	The GVIC screen will need to be maintained and operated in perpetuity.	GVIC's fish screens operated about 68% of the time during the irrigation season in 2019 -- slightly better than average since 2009, but considerably poorer performance than operatios at Redlands and at the Grand Valley Project roller dam. The primary reason these screens did not operate for approximately 68 days in 2019 was having to deal with excessive river debris associated with high flows. GVIC and Reclamation continue investigating the feasibility of raising ~350 feet of the GVIC diversion dam by approximately 12 inches to increase hydraulic head and improve the performance of existing and/or future fish screens. The Program funded an initial floodplain impacts analysis of this concept and has now earmarked funds for potential construction expenditures.
	II.B.2.	Restore fish passage at Price Stubb.									
	II.B.2.a.	Evaluate and implement viable options.									
	II.B.2.a.(1)	Obtain landowner consent/agreement.	BR	Complete							
	II.B.2.a.(2)	Site design/environmental compliance.	BR	Complete							
>*	II.B.2.a.(3)	Construct.	BR	Complete							
>*	II.B.2.a.(4)	Operate and maintain.	BR	Ongoing	X	X	X	X	X	Maintenance (primarily debris removal at the upstream entry point) will need to be conducted in perpetuity. Colorado and USFWS will need to determine if continued operation of the PIT antenna is worthwhile.	
	II.B.2.a.(5)	Monitor and evaluate success.	FWS-FAC/BR	Ongoing	X	X	X	X	X		The Price-Stubb PIT tag antennas (at river mile 188.3) detected over 1,135 unique fish in 2019, and 74% of detections were fish moving upstream. Six native species were detected including endangered bonytail (n=176). razorback sucker (n=278), and Colorado pikeminnow (n=5). The remainder are either 3-species or unidentified tags.
	II.B.3.	Restore fish passage at Government Highline (aka Grand Valley Project, Roller Dam, *Grand V*alley Water Users).									
	II.B.3.a.	Evaluate and implement viable options.									
	II.B.3.a.(1)	Site design/environmental compliance.	BR	Complete							
>*	II.B.3.a.(2)	Construct.	BR	Complete							
>*	II.B.3.a.(3)	Operate and maintain.	BR	Ongoing	X	X	X	X	X	The GVP passage will need to be maintained and operated in perpetuity.	In 2019, 25 dump truck loads of sediment were removed from around the fish passage facilities, and as a result, the passage operated as intended for the first time since 2015. In addition, GVWU opened the roller nearest the passage to assist in sluicing sediment, which helped maintain the cleared area.
	II.B.3.a.(4)	Monitor and evaluate success.	FWS-FAC/BR	Ongoing	X	X	X	X	X		In 2019, the fish passage operated for 146 days, between 30 April and 25 September with a 3-day closure to facilitate sediment removal. 11,862 fish used the passage, including 29 endangered razorback sucker, two humpback chub, one Colorado pikeminnow, and 16 bonytail. The majority of the fish that used the passage were native species (78.7%). All nonnative fish (except rainbow trout, brown trout and channel catfish) were removed.
	II.B.3.b.	Screen Government Highline diversion to prevent endangered fish entrainment.									
	II.B.3.b.(1)	Design.	BR	Complete							
>*	II.B.3.b.(2)	Construct.	BR	Complete							

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>*	II.B.3.b.(3)	Operate and maintain.	FWS-FAC/BR	Ongoing	X	X	X	X	X	The GVP screen will need to be maintained and operated in perpetuity.	Operation of the GVWUA fish screens in 2019 began on Apr 11 and terminated Oct 13. These screens operated about 97% of days during the irrigation season (210 days total), with some delay starting the screens in April following initial power and irrigation deliveries.
	II.C.	Support actions to reduce or eliminate contaminant impacts. [NOTE: Contaminants remediation (in all reaches) will be conducted independently of and funded outside of the Recovery Program.]									FWS annually updates a 'Contaminants Report' for the upper Colorado River basin that summarizes activities to address contaminant concerns outlined in the RIPRAP (see Annual Reports webpage).
	II.C.1.	Support actions to reduce or eliminate contaminant impacts of selenium in the Grand Valley.	FWS-ES	Ongoing	X	X	X	X	X		The Grand Junction Environmental Contaminants (EC) office provides the FWS Salinity Coordinator for the Colorado River Basin Salinity Control Program (currently Creed Clayton). The position involves coordination with various Federal, state, and local programs to reduce salinity concentrations within the upper Colorado River Basin to meet salinity compact requirements at the US/Mexican Border. It also provides a link to the Gunnison River Programmatic Biological Opinion (Reclamation) activities to reduce selenium concentrations in the Gunnison Basin and throughout the Colorado River Basin.
	II.C.2.	Support remediation of groundwater contamination at the Atlas Mill tailings site.	FWS-ES	Ongoing	X						
	II.C.3.	Identify measures to minimize risk of hazardous materials spills in Black Rocks and Westwater Canyon from transport along the adjacent railway to protect humpback chub populations.	FWS-ES	Ongoing	X						EPA has developed a Sub-Area Spill Contingency Plan for the Green River and is now developing the same for the Colorado River drainage. EPA initiated planning efforts for this plan in 2015 and Colorado EC staff has participated in these planning meetings and activities since early February of 2015.
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Develop and implement control programs in reaches of the Colorado River occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continued as needed. See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.									
	III.A.1.	Determine relationship between Aspinall test flows and nonnative fish abundance.	UDWR/ FWS-FAC	Complete							
>*	III.A.2.	Reclaim ponds in critical habitat.	CDOW	Complete							
	III.A.2.a.	Evaluate and make recommendations.	CDOW	Complete							
	III.A.3.	Nonnative cyprinids and centrarchids in nursery habitats.									
	III.A.3.a.	Remove small nonnative cyprinids from backwaters and other low velocity habitats.	CDOW/UDWR	Complete							
	III.A.3.b.	Remove nonnative centrarchids from backwaters and other low velocity habitats.	FWS	Complete							

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	III.A.4.	Preclude escapement from ponds in critical habitat as needed and feasible.									! No northern pike were collected in Mamm Creek Pit#1 in response to continued removal using the Merwin Trap and other sampling techniques. Pits #2 and #3 continue to be free of northern pike. X Northern pike were discovered in East Rifle Municipal Pond, likely from an illegal introduction. CPW plans to continue monitoring and removal efforts in the spring of 2020 during the northern pike spawning season to further reduce the abundance of northern pike in the pond and to evaluate abundance and population size structure. USFWS removed over 1,000 nonnative fish from three off-channel ponds in the Grand Valley (Beswicks, CDOT, and Butch Craig). Beswick's pond had few (n=22) nonnative fish; CDOT was dominated by native razorback sucker (n=54), which were stocked into the Colorado River; Black bullhead, white sucker, and green sunfish dominated at Butch Craig. This work will not be performed in 2020 because of budget constraints.
	III.A.4.a.	Evaluate sources of nonnative fishes and make recommendations.	CPW/FWS	Ongoing						Continue to determine sources of problematic nonnative fishes and make recommendations as needed.	See General, III.C for discussion of isotopic analysis.
	III.A.4.b.	Screen Rifle Creek below Rifle Gap Dam (non-Program funds).								CPW will continue to operate and maintain screen.	
	III.A.4.b.(1)	Design with appropriate peer review	CPW/BR /FWS	Complete							
>*	III.A.4.b.(2)	Construct screen (2013)	CPW	Complete							
	III.A.4.b.(3)	Finalize lake management plan, per Nonnative Fish Stocking Procedures (2015)	CPW	Complete							! Per LMP, 2019 was the final (third year of three) for fertile walleye removal paired with sterile walleye stocking. CPW removed 101 females (87 in 2017; 57 in 2018).
	III.A.4.b.(4)	Conduct follow-up monitoring prior to and following stocking to determine effectiveness of screen.	CPW	Ongoing	X	X	X	X	X	CPW will continue to monitor the screen for effectiveness.	Based on sampling at the screen and in downstream locations, the screen is extremely efficient and successful at reducing escapement from the reservoir into the downstream rivers.
>*	III.A.5.	Develop and implement program to identify required level of channel catfish control.	FWS	On hold							Channel catfish control was discontinued and shifted to higher priority threat species (e.g., smallmouth bass, northern pike, and walleye) when their abundance increased.
>*	III.A.6.	Develop and implement program to identify required level of smallmouth bass control.	FWS/CPW	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Crews removed 1,822 smallmouth bass and 2,270 largemouth bass in 2019. Catches of age-0 smallmouth bass indicate a weak year class (< 100 mm) was produced in 2019 in the Grand Valley reaches of the Upper Colorado. The catch rate for juvenile smallmouth bass 100-199 mm increased 326% from 2017 suggesting that 2018 cohort is strong. The center of smallmouth bass density in the Colorado River continues to be the Grand Valley and just downstream.
>*	III.A.7.	Develop and implement program to identify required level of northern pike control.	FWS/CPW	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Northern pike continue to be uncommon in the Colorado River. There was only one individual captured in 2019. Addressing off channel habitats appears to be the most effective control strategy to prevent escapement and in-river establishment.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
>*	III.A.8.	Walleye in the Colorado River	FWS / UDWR / CPW	Ongoing	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	X 237 walleye were removed, mainly during targeted removal projects. One walleye was collected in the Grand Valley; the rest were collected via concentrated efforts immediately downstream of Westwater Canyon or during Colorado pikeminnow population estimate sampling throughout the lower river.
	III.A.9	Other emerging nonnative fishes.	FWS / UDWR / CPW	Ongoing	X	X	X	X	X	Monitor fish community of the Colorado River and respond appropriately to any new introductions or proliferation of nonnative species.	2019 produced a reduced catch of gizzard shad in the Colorado River compared to previous two years (n=758 in 2019; n=2,057 in 2018). 2,270 largemouth bass were removed in the river main channel in 2019. There was a large influx of largemouth bass to the system in 2018 that warrants further investigation. Largemouth bass in this reach tend to be smaller subadults that do not appear to be self-sustaining in the main channel. One 800mm grass carp was collected in 2019, near Moab. X 23 striped bass were were collected and removed from the Colorado River in 2019. This is a dramatic increase from previous years. These fish ranged in total length from 375 to 581 mm with a mean total length of 517 mm.
>*	III.A.10.	Upstream of Grand Valley Project dam: Determine and implement an adequate level of mechanical removal in the main channel. More importantly, use all techniques available to eradicate northern pike (and other nonnative species of concern) from floodplain habitats.	CPW/ Program	Ongoing	X	X	X	X	X	Monitor fish community of the Colorado River and respond appropriately to any new introductions or proliferation of nonnative species.	CPW conducted removal work between between Silt and Una Bridge. No northern pike were collected. Four smaller smallmouth bass were collected, none were adults. In previous years, a backwater downstream of Rulison at RM 228.8, was considered a concentration area for both smallmouth and largemouth bass. However, in 2019, only a small number of green sunfish and a single largemouth bass were captured.
	III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.									
>*	III.B.1.	Evaluate control options and implement measures to control nonnative fish escapement from Highline Reservoir.	CDOW/ CRWCD	Complete							

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	III.B.1.a.	Operate and maintain Highline Reservoir net.	CPW	Ongoing	X	X	X	X	X	CPW will maintain Highline Reservoir net (and it will need to be replaced periodically).	CPW continues to operate and maintain the Highline Reservoir net. Park staff inspect the buoy line, top line, and floats weekly, repairing a anchor and cable in 2019. CPW oversaw 5 net cleanings in 2019; the hot summer with little precipitation necessitated the fifth cleaning because of increased algal growth in 2019. Issues with net performance (gaps between lake bottom and net) were noted and repaired in 2017. The net was potentially compromised during portions of the fall in 2018 and in 2019 during canal surges in which the amount of water going over the spillway resulted in a portion of the top of the spillway net and protective skirt going under the surface of the water. These surges from the canal were a result of heavy rains and irrigation operations. CPW monitored the area between the spillway and the net twice pre-irrigation in 2019. Overall catch per unit effort in 2019 between the spillway net and spillway was reduced compared to previous years, especially for gizzard shad and fish over 100 mm in length. Data gathered from Mack Wash immediately downstream of the reservoir were encouraging in the sense that 2019 catch rates for largemouth bass and green sunfish were relatively low when compared to previous years of sampling. CPW has taken several actions to reduce the chance of fish escaping from Highline Lake, including: coordinating with local irrigators, cleaning the net more often, adjusting the net hardware, and only using the bottom release when fish are not likely to be present.
	III.B.1.b.	Evaluate Highline Reservoir net.	CDOW	Complete							
	III.B.2.	Remove bag and possession limits on warm water nonnative sportfishes within critical habitat in Colorado.	CDOW	Complete							
	III.B.3.	Develop basinwide aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.	CDOW	Complete							
>*	III.B.3.a.	Implement CPW's Colorado River Aquatic Management Plan.	CPW	Ongoing	X	X	X	X	X		
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									No Colorado pikeminnow were collected from the Colorado River for broodstock augmentation.
	IV.A.	Augment or restore populations as needed, and as guided by the Genetics Management Plan.									
	IV.A.1.	Razorback sucker.									
	IV.A.1.a.	Develop experimental augmentation plan and seek Program acceptance.	FWS-FAC	Complete							
	IV.A.1.b.	Implement experimental augmentation plan.									
>	IV.A.1.b.(1)	Stock fish.	FWS-FAC	Complete							
	IV.A.1.b.(2)	Monitor and evaluate results; make recommendations regarding further augmentation.	FWS-FAC	Complete							
	IV.A.2.	Monitor the fish community in the upper Colorado River (above Palisade) and develop management action plan, including recommendations for Colorado pikeminnow and razorback sucker augmentation.	CDOW	Complete							
	IV.A.3.	Develop integrated stocking plan for razorbacks in the Colorado River in Colorado.	CDOW/PD	Complete							
	IV.A.3.a.	Program acceptance.	CDOW/PD	Complete							

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>	IV.A.3.b.	Implement razorback sucker integrated stocking plan. Superseded by Basinwide Integrated Stocking Plan (2015), see General IV.B.2.	CPW/FWS	Ongoing	X	X	X	X	X		In 2019, 4,444 razorback sucker were stocked into the Colorado River from the Ouray NFH- Grand Valley Unit. Nonnative fish removal in Grand Valley gravel pit ponds resulted in stocking 62 razorback sucker from the gravel pit ponds into the Colorado River. Additional razorback sucker were stocked into the Gunnison (see Gunnison IV.A.3.b.)
	IV.A.3.c.	Evaluate stocking success as identified in monitoring plan for stocked fish. Zelasko et al. 2009, 2011.	Program	Ongoing	X	X	X	X			Stocking success has not been specifically evaluated, but populations of stocked razorback sucker are increasing in the Colorado River. Data collected during Colorado pikeminnow sampling (Project 127) shows razorback sucker populations between 5,000-8,000 stocked adults.
	IV.A.4.	Develop integrated stocking plan for Colorado pikeminnow in the Colorado River in Colorado.	CDOW/PD	Complete							
	IV.A.4.a.	Program acceptance.	CDOW/PD	Complete							
	IV.A.5.	Develop integrated stocking plan for bonytail in the Colorado River.	Program	Complete							
	IV.A.5.a.	Program acceptance.	CDOW/PD	Complete							
>	IV.A.5.b.	Implement bonytail integrated stocking plan. Superseded by ~~Basinwide~~ *Revised* Integrated Stocking Plan (2015), see General IV.B.2.	FWS/CPW/UDWR	Ongoing	X	X	X	X	X		In 2019, 13,924 bonytail were stocked into the Colorado by Mumma (NASRF) and the Ouray NFH - Grand Valley Unit across multiple stocking events and locations. An additional 588 bonytail were stocked in Salt Creek (a small tributary to the Colorado) by Mumma. 3,651 fish were stocked in Upper Lake Powell by Wahweap.
	IV.A.5.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	Program	Ongoing	X	X	X	X			
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									
	V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.									
	V.A.1.	Determine Colorado pikeminnow larval drift into Lake Powell.	NPS	Complete							
	V.B.	Monitor populations per requirements in the 15-Mile Reach PBO.									
	V.B.1.	Determine initial baselines and indices for Colorado pikeminnow and humpback chub.	PD	Complete							
	V.B.1.a.	Evaluate population response, per 15-Mile Reach PBO (every 5 years beginning in FY 05).	FWS	Ongoing	X	X	X	X			2019 was the first year of a three year sampling schedule for Colorado pikeminnow estimates on the Colorado River (see also V.D.)
	V.B.2.	Determine initial baselines and indices for razorback sucker and bonytail.	PD	Complete							
	V.B.2.a.	Evaluate population response, per 15-Mile Reach PBO (every 5 years beginning in FY 05).	FWS	Ongoing	X	X	X	X			Razorback sucker are collected and estimated under the Colorado pikeminnow monitoring (V.D.)
	V.B.3.	Revise population indices to conform to recovery goals.	FWS	Complete							
	V.B.4.	Monitor incidental take.									

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	V.B.4.a.	Develop plan to monitor incidental take of e	FWS	Complete							
	V.B.4.b.	Implement plan to monitor incidental take of endangered fish in diversion structures.	FWS	Ongoing	X	X	X	X	X	Canal salvage will likely be needed into the future, unless screen structures are modified.	Funding for fish salvage under FWS project C-29a was cut in 2018, but ! CPW and local partners from NPS and BR were able to coordinate a limited canal salvage. Salvage in GVIC yielded 1,859 fish, including 4 razorback sucker and 7 bonytail. GVWU salvage resulted in 4,185 fish being collected, including 2 razorback sucker. Several calls from the public reporting stranded fish resulted in more salvage effort than expected.
	V.C.	Estimate humpback chub populations. (Sampling occurs in September and October, overlapping fiscal years.)									
	V.C.1.	Black Rocks. See McAda 2002; Francis and McAda 2011; and Francis et al. 2016.	FWS	Ongoing	X	X	X	X	X	Continue to estimate abundance of humpback chub in Black Rocks.	Draft report including 2016-2017 data is expected in spring 2020. Robust design parameter estimation will include Westwater Canyon data. No sampling took place in 2019, per sampling schedule.
	V.C.2.	Westwater. See Hudson and Jackson 2003, Elverud 2012; Hines et al. 2016.	UDWR	Ongoing	X	X	X	X	X	Continue to estimate abundance of humpback chub in Westwater Canyon.	Draft report including 2016-2017 data is expected spring 2020. No sampling took place in 2019, per sampling schedule.
	V.C.3.	Cataract Canyon	UDWR	Ongoing	X	X	X	X	X	Continue to estimate CPUE of humpback chub in Cataract Canyon.	2019 sampling yielded above average catch per unit effort (CPUE) for adult humpback chub. The year's effort also documented continuing reproduction & recruitment via captures of sub-juvenile chub and juvenile humpback chub. PI recommends investigating new statistical techniques to analyze the full dataset and create a summary report which may highlight opportunities for efficiency (e.g., eliminating sampling times which are ineffective) and investigating the relationships of covariates (e.g., environmental conditions and nonnative fish catch rates) with chub catch rates.
	V.D.	Estimate Colorado pikeminnow populations in the upper Colorado River (including Gunnison River). Three years sampling (e.g., FY 13, 14, 15) followed by two years no sampling; data analysis and report write-up in first year of no sampling (e.g., FY 16). See Osmundson and White 2009 and 2014.	FWS	Ongoing	X	X		X	X	Continue to estimate abundance of Colorado pikeminnow in upper Colorado River..	2019 was the first year of sampling in the current three year schedule (2019-2021). The sampling yielded 313 individual Colorado pikeminnow. 37% were juvenile fish (<400mm), and two large year classes could be seen in the length-frequency histogram: age-1 (2018) and age-4 (2015). A draft of the final report for 2013-2015 data was sent to the PDO in December 2019, and initial review was returned to PI In January 2020.
	V.D.1	Monitor age-0 Colorado pikeminnow in backwaters	UDWR	Ongoing	X	X	X	X	X	Continue monitoring age-0 Colorado pikeminnow.	Five age-0 Colorado pikeminnow were collected in Colorado River nursery habitats during ISMP sampling, resulting in a catch rate (0.2 fish/100m^2) much lower than the long term median (2.5 fish/100m^2).
	V.E.	Implement razorback sucker monitoring plan. See Osmundson and Seal 2009.	FWS, UDWR	Ongoing	X	X	X	X	X	Continue to estimate abundance of razorback sucker.	Six suspected wild, age-1 razorback sucker (TL=111-176 mm) were collected during project 127 pikeminnow sampling. Project 160 also documented a juvenile razorback sucker (TL=167 mm) near RMI 32. All life stages being monitored through projects 127, 138, and 163. See General, V.A.1.a.

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	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Identify fish habitat and flow needs.									
	I.A.1.	Initially identify year-round flows needed for recovery (Flow recommendations will be provided upon completion of Aspinall Unit studies.)									
	I.A.1.a.	Complete draft technical synthesis report.	FWS	Complete							
	I.A.1.b.	Complete draft biological assessment.	BR	Complete							
	I.A.1.c.	Complete final technical synthesis report.	FWS	Complete							
	I.A.1.d.	Complete final biological assessment.	BR	Complete							
	I.A.1.e.	Complete draft NEPA document .	BR	Complete							
	I.A.1.f	Complete final NEPA document and record of decision.	BR	Complete							
	I.A.1.g	Complete ESA Section 7 consultation resulting in a programmatic biological opinion (PBO) for the Gunnison Basin.	FWS/BR/WAPA	Complete							
	I.B.	State acceptance of initial flow recommendations (Flow recommendations will be provided upon completion of Aspinall Unit studies.)									
	I.B.1.	Review scientific basis, dependent on development of flow recommendations by FWS.	CWCB/CDOW	Complete							
	I.B.2.	Assess legal and physical availability of water.	CWCB	Complete							
	I.B.3.	Assess impacts of depletions on Colorado's Compact allocations.	CWCB	Complete							
	I.B.4.	CWCB notice of intent to appropriate (in Colorado).	CWCB	Pending							
	I.C.	Legally protect identified flows.									
	I.C.1.	Acquire (flow recommendations will be provided upon completion of Aspinall Unit studies.)									
	I.C.1.a.	Assess, acquire and convert water rights to instream flows.	CWCB	Ongoing							
	I.C.2.	Appropriate (flow recommendations will be provided upon completion of Aspinall Unit studies.)									
	I.C.2.a.	CWCB approval to appropriate.	CWCB	Pending							
>*	I.C.2.b.	Colorado Attorney General's Office file date.	CWCB	On hold							
>*	I.C.2.c.	Water court adjudication (litigation dependent).	CWCB	On hold							
	I.C.3.	Deliver.									
>*	I.C.3.a.	Aspinall Unit supplemental releases to maintain 2,000 cfs minimum flow at Colorado-Utah state line 9 out of 10 years. Provide annual report. (Through 2001 only.)	BR	Complete							
	I.C.3.b.	Flows from Aspinall Unit for research studies.									
>*	I.C.3.b.(1)	Deliver flows.	BR	Complete							
>*	I.C.3.b.(2)	Protect research flows.	FWS/BR/CWCB	Complete							
>*	I.C.3.c.	Continue annual coordination meetings.	BR	Ongoing	X	X	X	X	X	BR will continue coordination & releases.	The USBR held public meetings on annual operations of the Aspinall Unit in 2019 on Jan 17 (Montrose), Apr 23 (Grand Junction), and Aug 15 (Blue Mesa Reservoir).
	I.C.3.d.	Flows from Paonia Reservoir in accordance with FWS Horsethief Biological Opinion.									
>*	I.C.3.d.(1)	Deliver flows.	BR	Ongoing	X	X	X	X	X	BR will continue coordination & releases.	
	I.C.3.e.	Flows from Aspinall Unit pursuant to Aspinall Biological Opinion and record of decision..									
	I.C.3.e.(1)	Determine if change in water right and/or contract is needed.	BR	Complete							
	I.C.3.e.(2)	Enter into contract if needed.	BR	Complete							

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>*	I.C.3.e.(3)	Deliver flows.	BR	Ongoing	X	X	X	X	X	BR will continue coordination & releases.	The May 1, 2019, forecast Apr-Jul inflow to Blue Mesa Reservoir was a "Mod Wet" 970 KAF, resulting in a 2019 peak flow target of 14,350 cfs at the Gunnison River near Grand Junction (Whitewater) gage. Actual inflow to Blue Mesa substantially exceeded projections. ! Reclamation releases from the Aspinall Unit combined with natural inflows resulted in flow exceeding 'bankfull' of 14,350 cfs for six days, 'half-bankfull' of 8,070 cfs for 23 days, and a peak of ~17,200 cfs on June 9. Base flow was maintained above the minimum 1500 cfs target for the entire June-Aug period, and well above the 1050 cfs target for Sept and Oct. For additional details, see the 2019 Hydrologic Conditions Summary RIPRAP supplement.
	I.C.3.e.(3)(a)	Study Gunnison River return flows to determine consumptive use to be charged against flow deliveries.	USGS	Complete							
	I.D.	Evaluate and revise as needed flow regimes to benefit endangered fish populations. (Data series summarizing 2005-2008 daily sediment sampling on Gunnison, Green and Duchesne rivers completed [Williams et al. 2009] and scientific investigations report [Williams et al. 2013] completed)	FWS/ Program	On hold							Effort was shifted to the Green and the White River beginning in 2017, as recommended by the Peak Flow Technical Supplement, LaGory et al. 2015.
	I.D.1.	Develop study plan to evaluate flow recommendations / evaluate Selenium Management Program.	FWS/BOR/WAPA	Complete							
	I.D.1.a.	Monitor Physical Response in the Gunnison River to the Proposed Action.									
	I.D.1.a.(1)	Reinstate sediment monitoring in the Gunnison River as directed by project 85f.	Program	Pending							No activity on the Gunnison River in 2019. Project 85f 2019 sediment monitoring efforts were focused on Green River in Utah. Program needs to determine when/if geomorphic studies of the Aspinall Study Plan will be conducted, and a timeframe for evaluating effects of the endangered fish flows should be identified.
	I.D.1.a.(2)	Evaluate bed-load transport in gravel and cobble-bed portions of the Gunnison River below Hartland Dam (Peak Flow Tech Supplement priority).	Program	Pending							No activity on the Gunnison River in 2019. Project 85f 2019 sediment monitoring efforts were focused on Green River in Utah.
	I.D.1.a.(3)	Collect aerial photography during the peak flows to determine area of floodplain inundation at Escalante SWA and other sites.	Program	Pending							Lower priority site; no activity in 2019.
	I.D.1.a.(4)	Collect aerial photography during base flows to monitor channel width and complexity and to serve as base maps for habitat mapping.	BR	Pending							Lower priority site; no activity in 2019.
	I.D.1.a.(5)	Repeat depth-to-embeddedness (DTE) surveys in the Escalante area.	BR	Pending							Lower priority site; no activity in 2019.

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	I.D.1.a.(6)	Evaluate the effect of operations to meet the Proposed Action on the Gunnison River thermal regime.	PDO	In Progress	X						In 2019, Jana Mohrman and Don Anderson completed a report on the data collected at two Gunnison River temperature sites monitored by the PDO that were discontinued in 2018 (below Crystal Reservoir and above the North Fork Gunnison confluence). One interesting finding is a suggestion that water temperatures in the Gunnison River at Delta are frequently higher than anticipated in Osmundson's 1999 report, and perhaps not as much of a limiting factor to Colorado pikeminnow's use of river habitat upstream of Delta as was believed at that time. This report will be posted to the Program webpage in 2020.
	I.D.1.b.	Monitor Biological Responses in the Gunnison River to the Proposed Action.									
	I.D.1.b.(1)	Initiate a fish community monitoring study in Gunnison River main channel and floodplain habitats.	CPW/FWS	Ongoing	X	X	X	X	X		Monitoring of the fish community response in the lower Gunnison and upper Colorado Rivers (18-mile reach) occurs annually under Project 163. Also see Gunnison V.A.3.
	I.D.1.b.(2)	Assess primary and secondary productivity in cobble bars (runs and riffles).	TBD	Pending							
	I.D.1.c.	Support Reclamation's Selenium Management Program.									The USGS five-year selenium report assessing dissolved selenium concentrations and loads in the lower Gunnison River basin, published in 2018, concluded Se concentrations in the Gunnison River at Whitewater finally decreased to the state standard in 2016. While this is encouraging, additional monitoring, data and analysis are needed. Also, more work is needed to continue reducing Se within critical habitat; hotspots remain in habitats preferred by endangered fish (backwaters, side channels, tributary confluences, etc.).
	I.D.1.c.(1)	Collect tissues from endangered fish (or surrogate species) as directed by FWS (coordinated with fish community monitoring, I.D.1.b.(1)).	CPW/FWS	Pending							No tissue collection in 2019.
	I.D.1.c.(2)	Investigate selenium toxicity in razorback sucker.	FWS	In Progress							A courtesy copy of Barb Osmundson's draft contaminants report (not a Program-funded report) mentioned in the Aspinall PBO was shared with the BC in Oct 2018, and comments invited at that time. However, as Barb has since retired and related funding has ceased, it is unclear if or when a final report will be generated. Natalie Day (lead author, USGS), along with several USGS and USFWS peers, published a research article in PLoS ONE, January 2020, titled 'Mercury and selenium concentrations in fishes of the Upper Colorado River Basin, southwestern United States: A retrospective assessment". This report summarizes findings regarding Hg and Se in the tissues of 2,324 individual fish collected from seven major Colorado River tributaries from 1962 to 2011 including the Gunnison. Se concentrations in fish tissues generally were highest in the Gunnison river basin.
	I.D.2.	Integrate and synthesize information to evaluate and recommend necessary revision of the proposed action (implement flow recommendation)	Program	In Progress							These investigations are comprised of fish community monitoring (Project 163) at this time. The Program should determine if future channel monitoring efforts will contribute to this evaluation.
	I.E.	Initiate investigations of the feasibility of modifying releases from Aspinall Unit dams to increase water temperatures that would allow for upstream expansion of Colorado pikeminnow in the Gunnison River.	BR/Contract	Complete							

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	II.	**RESTORE HABITAT (HABITAT DEVELOPMENT AND MAINTENANCE)**									
	II.A.	Restore and manage flooded bottomland habitat.									
	II.A.1.	Develop management plan for Escalante State Wildlife Area.		Complete 5/94							
	II.A.2.	Develop and implement levee removal strategy at high-priority sites.									
	II.A.2.a.	Preconstruction (contaminants screening, floodability assessments, environmental compliance, design & engineering).	BR	Complete							
>*	II.A.2.b.	Construction (levee removal)	BR	Complete							
	II.A.2.c.	Operate and maintain.	BR/FWS	Complete							
	II.A.2.d.	Evaluation.	FWS	Complete							
	II.A.3.	Acquire interest in high-priority flooded bottomland habitats.									
	II.A.3.a.	Identify and evaluate sites.	FWS	Complete							
	II.A.3.b.	Pre-acquisition planning and identification of acquisition options.	PD	Complete							
	II.A.3.c.	Conduct appraisal/NEPA compliance.	PD	Complete							
>*	II.A.3.d.	Negotiate & acquire.	PD	Complete							
	II.A.3.e.	Evaluate effectiveness of land acquisition activities and provide recommendations.	PD	Complete							
>*	II.A.4.	Develop and implement Colorado River Subbasin Floodplain Management Plan (Valdez and Nelson 2004b).	Program	Ongoing	X	X	X	X	X		
	II.B.	Restore native fish passage at instream barriers.									
	II.B.1.	Restore passage at Redlands.									
	II.B.1.a.	Assess and make recommendations for fish passage.	FWS	Complete							
	II.B.1.b.	Implement viable options to restore fish passage.									
	II.B.1.b.(1)	Design passage, conduct NEPA compliance.	BR	Complete							
>*	II.B.1.b.(2)	Construct fish ladder.	BR	Complete							
>*	II.B.1.c.	Operate and maintain fish ladder.	FWS-FAC/BR	Ongoing	X	X	X	X	X	The Redlands fish ladder will need to be maintained and operated in perpetuity.	In 2019, the Redlands fish passageway remained operational from May 6 through September 24 for its 24th consecutive year of operation. Six razorback sucker and eight bonytail were captured, but no Colorado pikeminnow. A total of 3,438 fish were handled at the ladder, about 59% of which were native fish. All native fish were released upstream of the Redlands Diversion Dam.
	II.B.1.d.	Monitor and evaluate success.	FWS-FAC/BR	Complete							
	II.B.1.e	Identify minimum flows below Redlands Diversion Dam.	FWS-FAC	Complete							
>*	II.B.1.f.	Deliver flows below Redlands.	BR	Ongoing	X	X	X	X	X	BR will continue to provide flows for passage operation.	
	II.B.1.g.	Screen Redlands diversion structure to prevent endangered fish entrainment.									
	II.B.1.g.(1)	Design.	BR	Complete							
>*	II.B.1.g.(2)	Construct.	BR	Complete							

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>*	II.B.1.h.	Operate and maintain fish screen.	Redlands Water & Power	Ongoing	X	X	X	X	X	The Redlands fish screen will need to be maintained and operated in perpetuity.	The Redlands fish screen was put online 21 March and taken off-line on 1 November, with only a few hours of downtime on April 21 for repairs.
	II.B.2.	Restore passage at Hartland.									
	II.B.2.a.	Assess and make recommendations for fish passage. (Passage at Hartland not identified as necessary for recovery in species' recovery goals).	FWS-FAC	Complete							
	II.B.2.b.	Evaluate viable options to restore fish passage.	BR	Complete							
	II.B.2.c.	Support local interests in efforts to pursue removal of the Hartland Diversion dam. [NOTE: These efforts will be conducted independently of and funded outside of the Recovery Program]	BR/FWS/PD	Complete							
	II.B.2.d.	Screen Hartland diversion to prevent endangered fish entrainment, if warranted.		Complete							
	II.B.2.d.(1)	Assess need.	BR/FWS/PD	Complete							
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative interactions between nonnative and endangered fishes.									
>*	III.A.1.	Reclaim ponds in critical habitat	CDOW	Complete							
	III.A.1.a.	Evaluate and make recommendations.	CDOW	Complete							
	III.A.2.	Develop basinwide aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.	CDOW	Complete							
>*	III.A.2.a.	Implement CPW's Gunnison River Aquatic Management Plan.	CPW	Ongoing	X	X	X	X	X	CPW will continue to implement plan.	
	III.A.3.	Preclude new nonnative species introductions, translocations or invasions to preserve native species dominance within critical habitat.	Program	Ongoing	*X*	X	X	X	X	Monitor and implement appropriate actions.	! Gunnison River remains free of smallmouth bass.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
>*	III.A.3.a	Install and maintain net to prevent escapement of smallmouth bass at Ridgway Reservoir.	CPW / BR	Ongoing	X	X	X	X	X	Stakeholders will continue to operate and maintain net per agreements (in development). CPW will continue to implement revised LMP (in draft).	An illicitly introduced smallmouth bass population in Ridgway Reservoir continues to threaten the downstream Gunnison River native fish community. The population was confirmed in 2013. Densities of smallmouth bass near the spillway were high, indicating a high risk of escapement from reservoir spilling. A working group focused on installing a nonnative fish escapement solution selected a rigid screen located on the elevated spillway apron as the preferred design. This design was approved by the MC for capital funding. The design has passed dam safety modeling and is progressing for installation, with construction expected fall of 2020. CPW implemented an unlimited harvest of smallmouth bass in Ridgway Reservoir beginning on April 1, 2015. CPW conducted a harvest tournament for smallmouth bass each summer since 2015. Anglers removed approximately 1,500 smallmouth bass in three weeks in 2019. Monitoring estimates that five years of tournaments have reduced the population of smallmouth at Ridgway Reservoir by 79% from initial estimates. TriCounty Water Conservancy District successfully avoided spills from 2011 through 2019.
	III.A.3.b	Implement control measures to prevent escapement of northern pike at Crawford Reservoir.	CPW	Ongoing	X	X	X	X	X		CPW removed 601 northern pike in spring 2019; the post-removal population estimate is 111 pike >18 inches. A large cohort was produced in 2017, when conditions were favorable for northern pike spawning and poor for sampling. Some or all of these fish recruited to the 18"+ size class in 2019, leading to a higher post-removal estimate than the 2018 estimate of 68 adults.
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A.	Augment or restore populations as needed and as guided by the Genetics Management Plan.									
	IV.A.1.	Razorback sucker.									
	IV.A.1.a.	Develop experimental augmentation plan and seek Program acceptance.	FWS-FAC	Complete							
	IV.A.1.b.	Implement experimental augmentation plan. (Goal: 10 adults/river mile.)									
>	IV.A.1.b.(1)	Stock fish.	FWS-FAC	Complete							
	IV.A.1.b.(2)	Monitor and evaluate results; make recommendations regarding further augmentation.	FWS-FAC	Complete							
	IV.A.2.	Develop integrated stocking plan for Colorado pikeminnow in the Gunnison River.									
	IV.A.2.a.	Program acceptance.		Complete							
>	IV.A.2.b.	Implement Colorado pikeminnow integrated stocking plan.	CPW/FWS	On hold							
	IV.A.2.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	FWS/CPW	On hold							
	IV.A.3.	Develop integrated stocking plan for razorback sucker in the Gunnison River.									
	IV.A.3.a.	Program acceptance.		Complete							
>	IV.A.3.b.	Implement razorback sucker integrated stocking plan. Superseded by *Revised* Integrated Stocking Plan (2015), see General IV.B.2.	CPW/FWS	Ongoing	X	X	X	X	X		In 2019, the Ouray NFH - Grand Valley Unit (USFWS) stocked 3,087 razorback sucker into the Gunnison River.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	IV.A.3.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	LFL/FWS/STATES/PD	Ongoing	X	X	X	X	X		Stocking success is being evaluated indirectly by projects 163 and 127, coupled with antenna data, fish passage data, and other monitoring efforts.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									
	V.A.	Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.									
	V.A.1.	Conduct Colorado pikeminnow and razorback sucker inventory in Gunnison River above Redlands (Burdick 1995).	FWS-FAC	Complete							
	V.A.2.	Identify additional spawning sites of endangered fishes on the Gunnison River.	FWS-FAC	Ongoing	X	X	X	X	X		
	V.A.3.	Conduct a fish community monitoring study in Gunnison River main channel and floodplain habitats to evaluate the effects of changing flows from the Aspinall Unit.	FWS-FAC	Ongoing	X	X	X	X	X		Fish community monitoring is ongoing (Project #163). Two sampling trips captured 46 razorback sucker and numerous other native species in the Gunnison River (also see Colorado I.B.5.b.(1)) and Gunnison I.D.1.b.(1)) . PDO has received a draft report for 2011-2016 sampling which is currently under review.

		ACTIVITY	WHO	STATUS	FY20 10/19-9/20	FY21 10/20-9/21	FY22 10/21-9/22	FY23 10/22-9/23	Post-Program	Description of Anticipated Post-Program Activity	Assessment of significant accomplishments (!) and shortcomings (X) (Focused on February 1, 2019 - January 31, 2020)
	I.	**PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)**									
	I.A.	Secure instream flow right for the Dolores to support native species for 34 miles below the San Miguel River confluence. The decreed ISF right varies by time of year [900 cfs (4/15-6/14), 400 cfs (6/15-7/15), 200 cfs (7/16-8	CWCB	Complete 2018							
	III.	**REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)**									
	III.A.	Reduce negative interactions between nonnative and endangered fishes.									
	III.A.1.	Assess need and options to control nonnative fish escapement from McPhee Reservoir.	BR	Complete							
	III.B.	Reduce negative impacts to endangered fishes from sportfish management activities.									
	III.B.1.	Identify potential conflicts between present fish management practices in McPhee Reservoir and endangered fishes and formulate an alternative management plan.	CDOW	Complete							
	III.B.2.	Recovery Program needs to determine if nonnative fishes in the Dolores River basin pose a threat to endangered fishes and determine appropriate response.	CPW	Ongoing	X	X	X	X	X		In 2019, CPW took advantage of an extended release from McPhee Reservoir to conduct smallmouth bass removal, during which 553 smallmouth bass were removed. Smallmouth bass abundance appears to be comparable to 2017, the previous year in which smallmouth bass were removed. Researchers suspect that low flows in 2018 created excellent spawning and rearing conditions and precluded any removal passes from occurring.
>*	III.B.2.a.	Reclaim Miramonte Reservoir.	CPW	Complete 2013							
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**									
	IV.A	Implement stocking plan.	FWS / CPW / UDWR	Ongoing	X	X	X	X			Wahweap stocked 3,664 bonytail into the Dolores River at Rio Mesa in 2019.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**									

	V.A.	Survey native and nonnative fish in Dolores River (UDWR funding outside of Program).	UDWR/ USBR/ CPW	Complete			The Dolores antennas continued to struggle with power outages and connection issues, but some data is available. Backup datasets are forthcoming to fill in data gaps. Between January and April, the antenna detected six bluehead sucker, 74 bonytail (from three stocking events in the Dolores - 2016, 2018 and 2019), 25 flannelmouth sucker, 16 razorback sucker stocked in the Colorado or Gunnison rivers over 6 years, one roundtail chub and 298 unidentified fish. A scope of work has been approved to address antenna issues, under which work has been performed on the Dolores antennas.

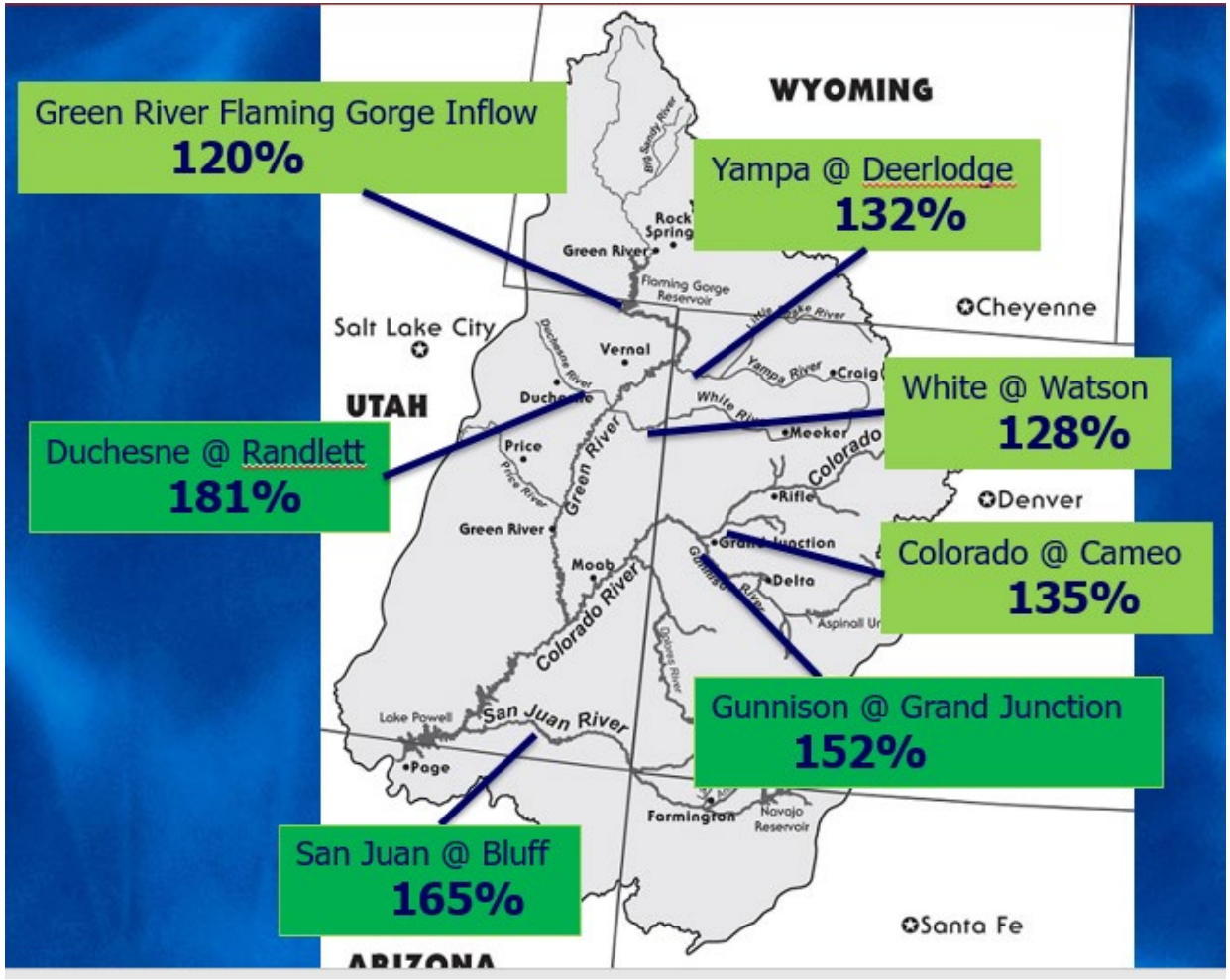
Summary of 2019 Hydrologic Conditions

Upper Colorado River
Endangered Fish Recovery Program

Don Anderson

1/21/20

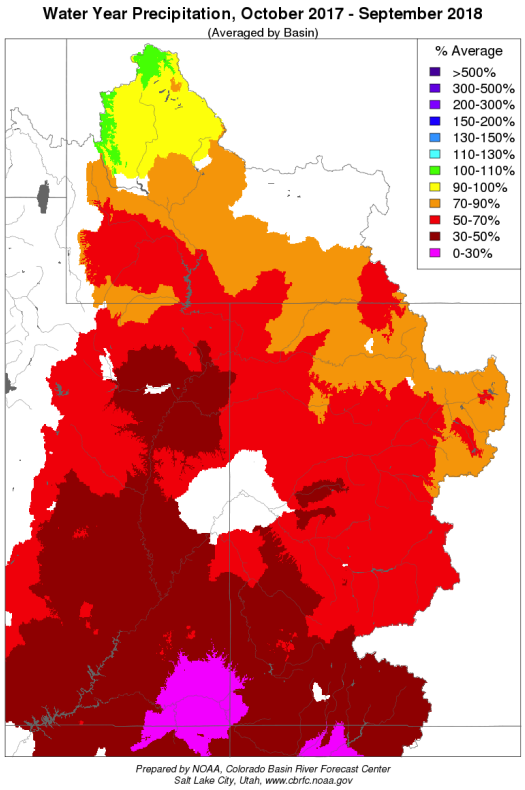
Total April-July 2019 runoff, as percent of the 1981-2010 average

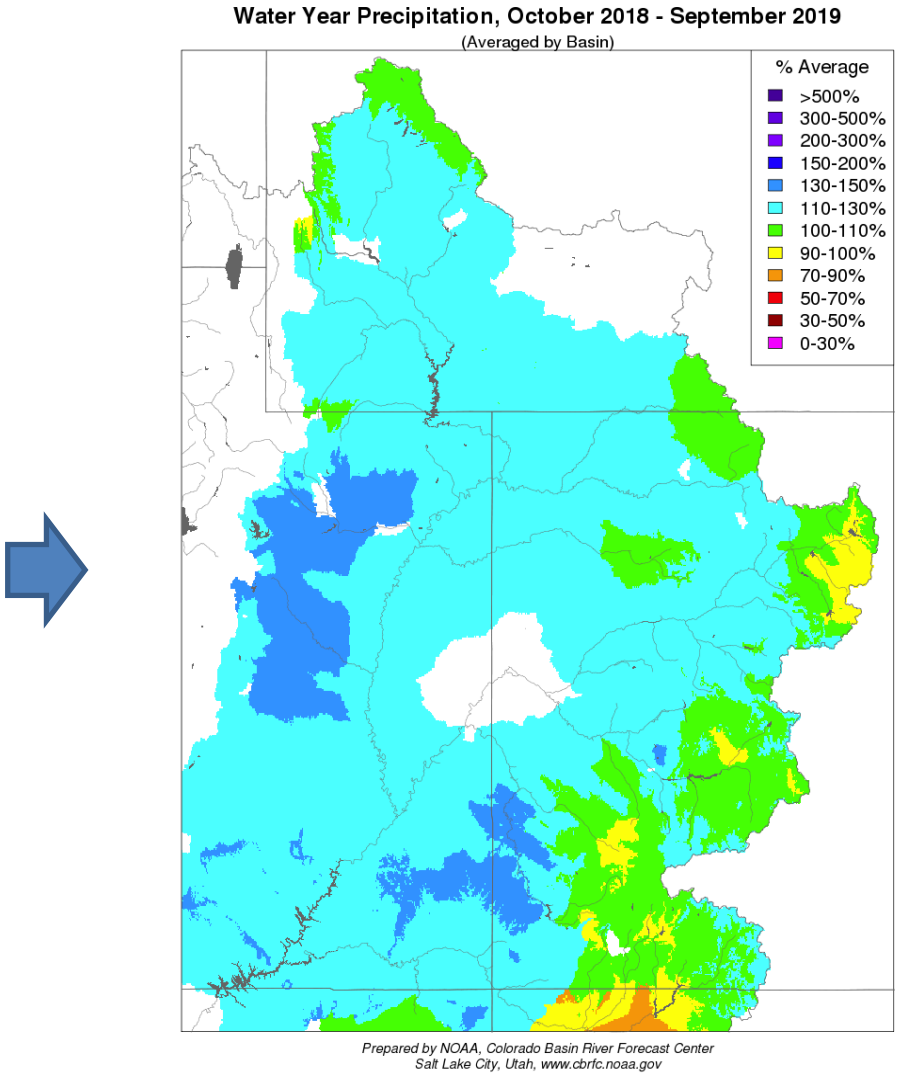


In 2019, April-July runoff was well above average throughout the entire upper Colorado River basin, especially in the Gunnison, San Juan, and Duchesne river basins.

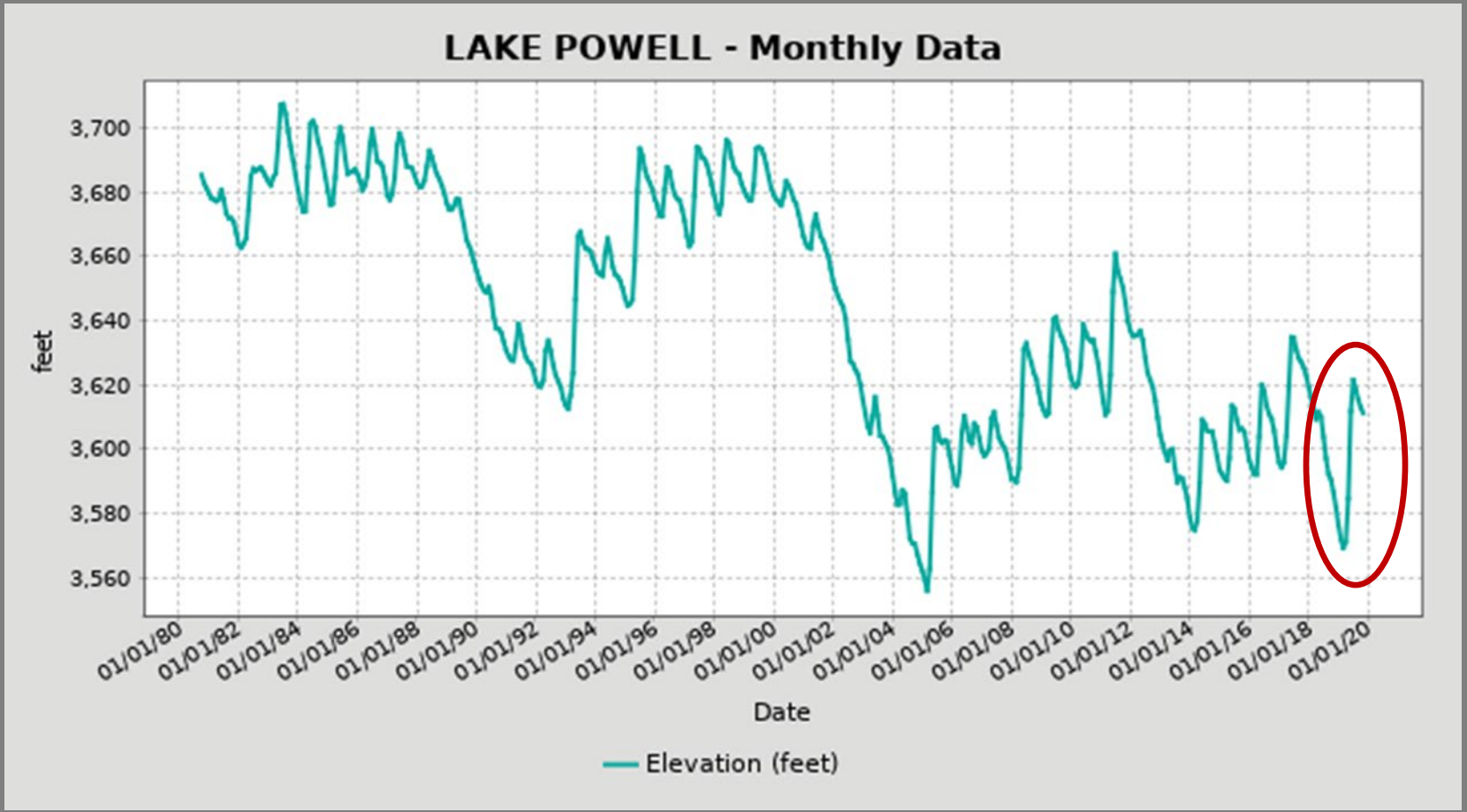
Water Year 2019: Precipitation was substantially greater everywhere in the Upper Colorado River Basin than in 2018, with average or above-average water year totals in all but a few higher-elevation areas.

Water Year 2018





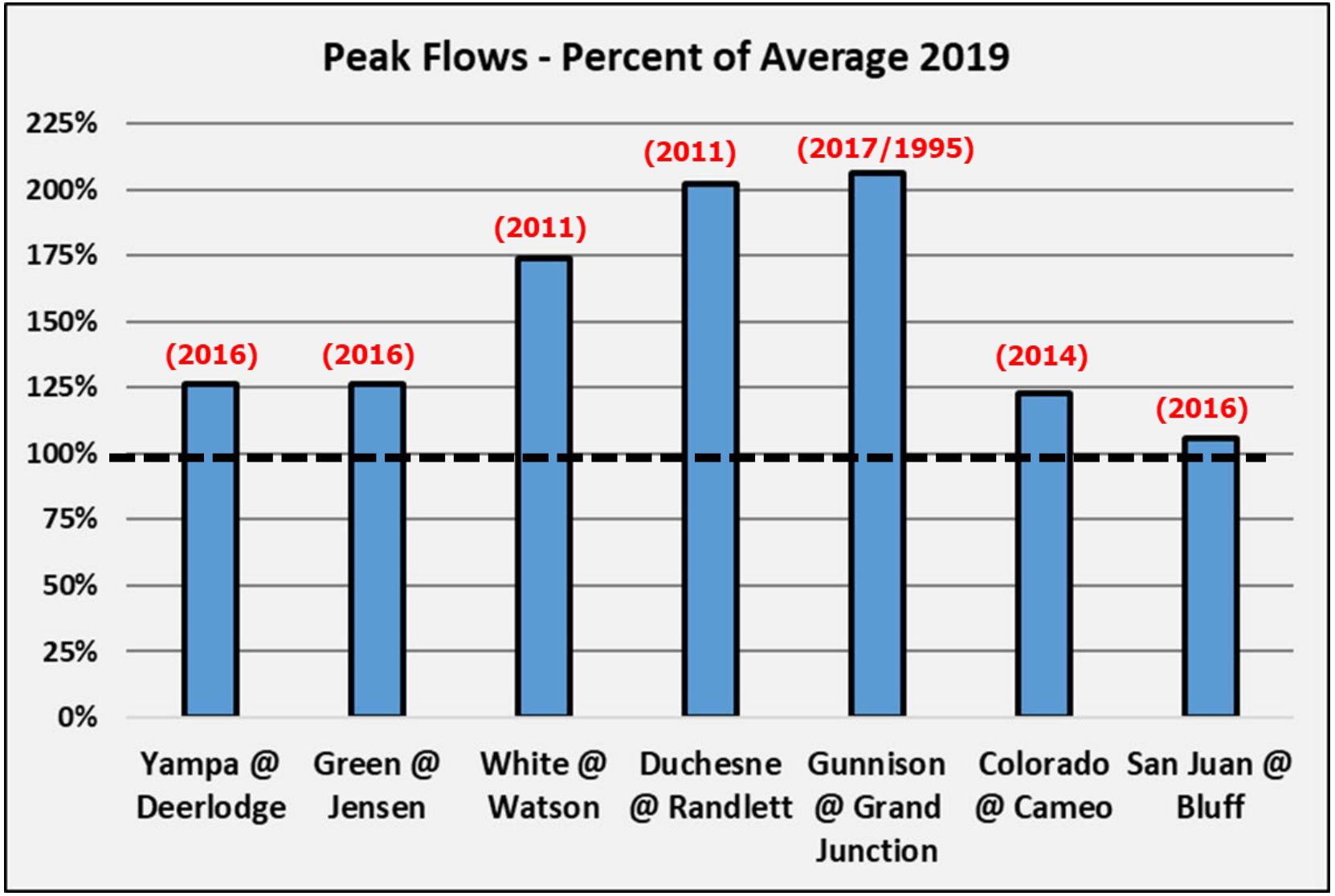
Lake Powell WY 2019 inflow: 122% of average (13.2 MAF)
Oct 1 elevation 22.5 ft higher than in 2018 (53% capacity)



Levels of concern are 3525 ft (other reservoirs must deliver to Powell) and 3490 ft (below the hydro intakes)

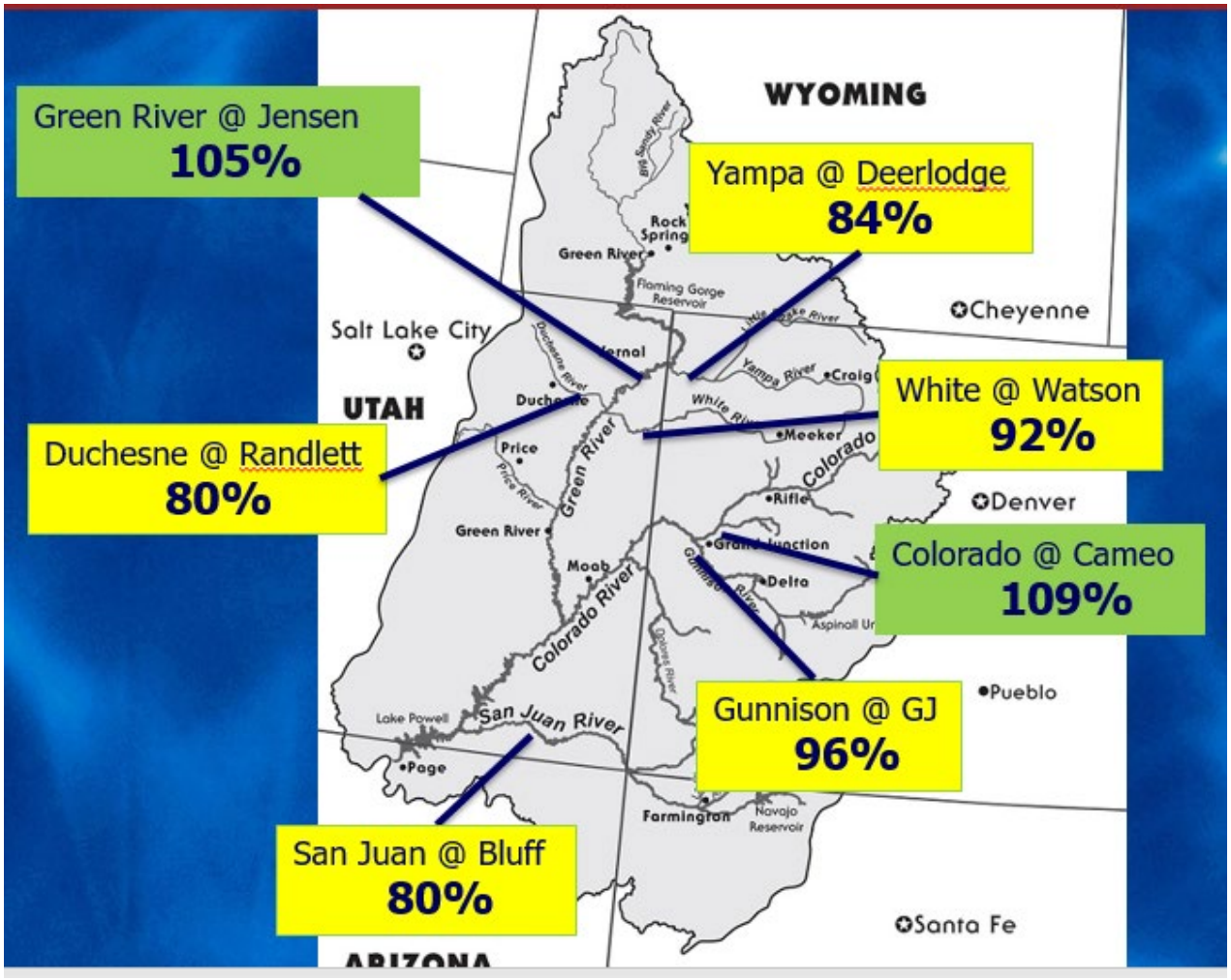
2019 Spring Peak Flows

Bars show peak flow magnitude as percent of the long-term average;
years in red parentheses are the most recent with comparable or higher spring peaks



2019 Base Flows

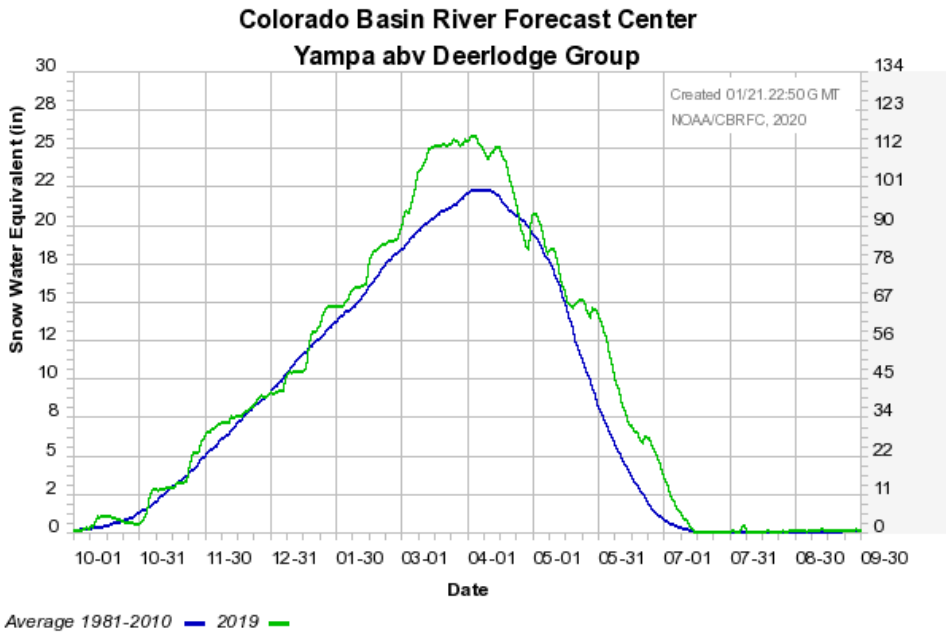
Aug-Oct 2019 flows as percent of long-term average



Averages are based on 1981-2010 period of record; in some cases some years from this period are missing.

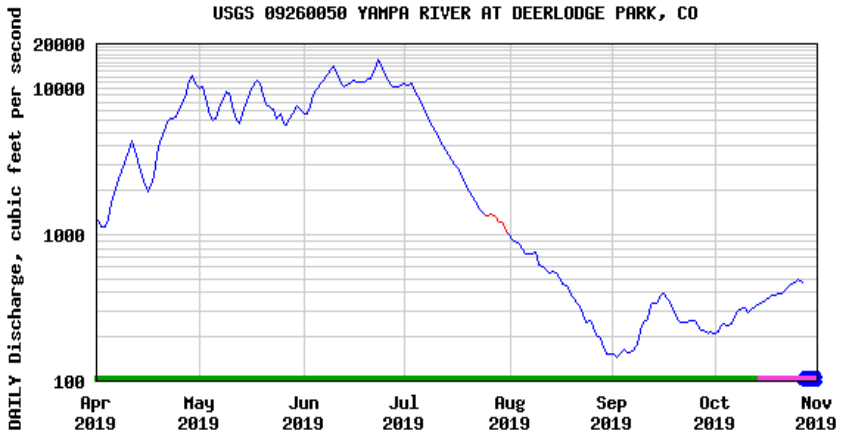
USGS gage data are provisional as of January 2020.

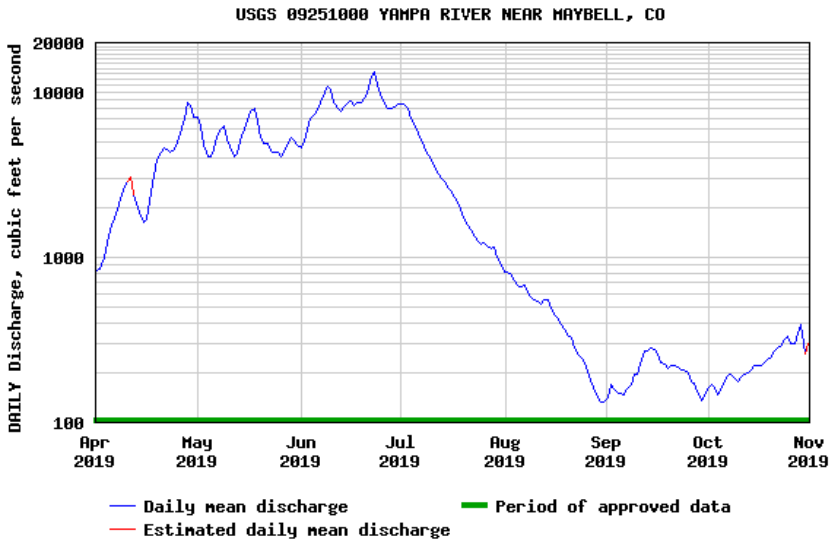
Yampa River Basin snow accumulation was above-average going into the peak snow accumulation season, with considerable delay of melt into May and June:



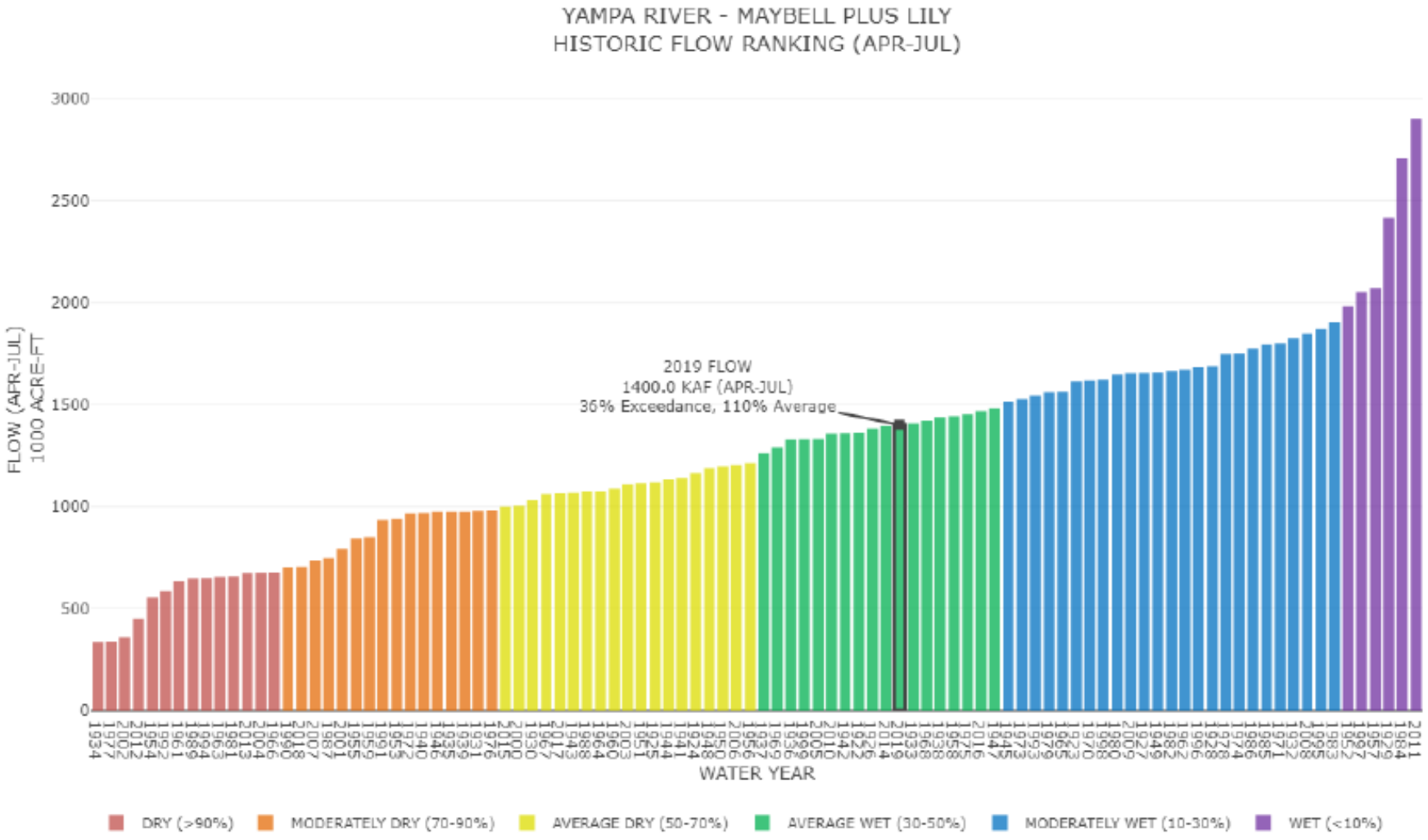
In contrast, July-through-October was unusually warm and dry, with very little monsoon precipitation. As a result, natural flows in the Yampa River dropped precipitously in August.

April through October 2019 Hydrographs:

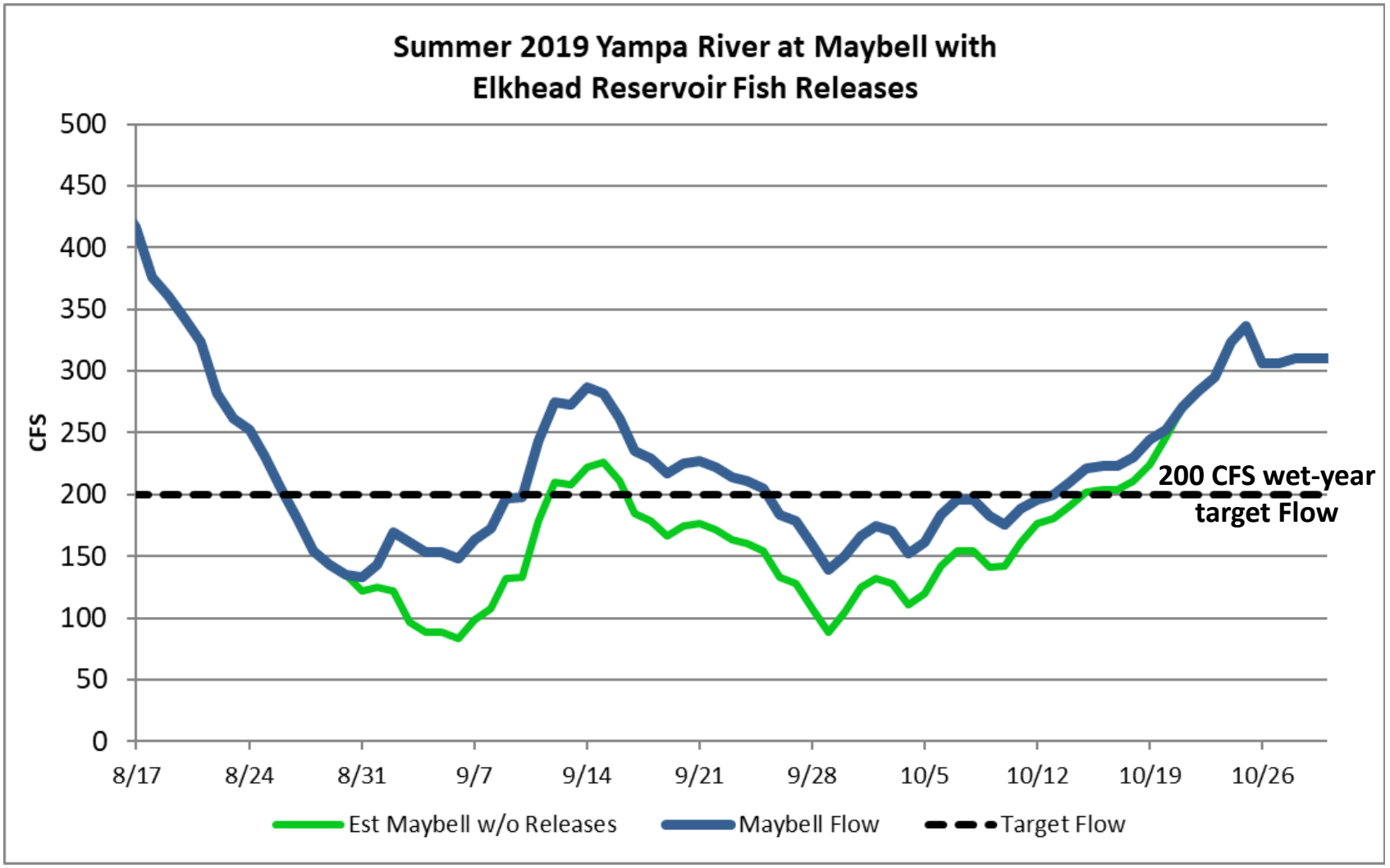




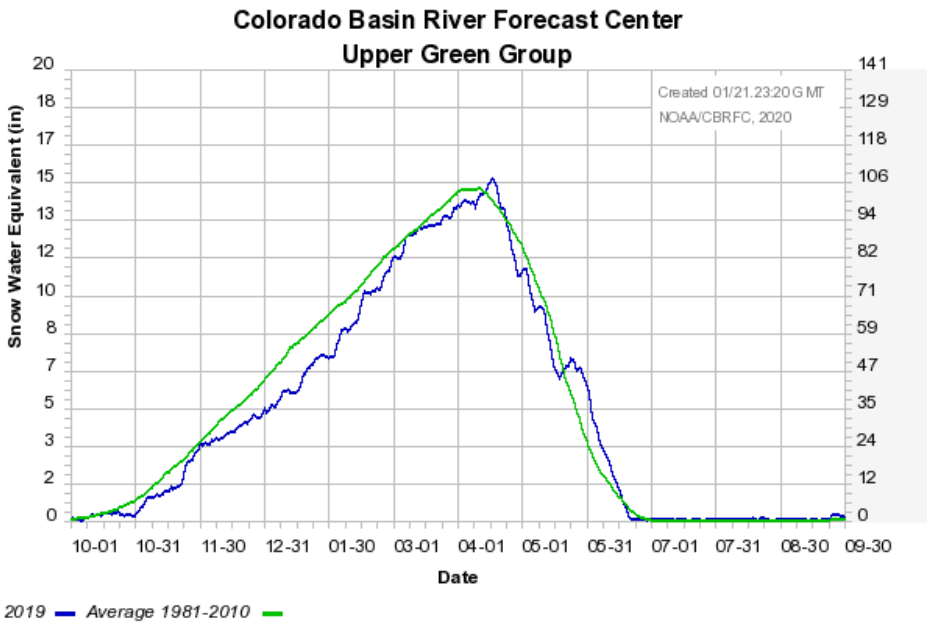
USBR's April-July projected runoff in the lower Yampa River Basin in 2019 (including Little Snake River inflow) fell into the "Average Above Median" category, at 36% exceedance. (Actual April-July runoff ended up around 132% of average, wetter than projected in this May 2019 graph.) This USBR graph displays the May 2019 projected rank of 2019 among all years 1922-2018:



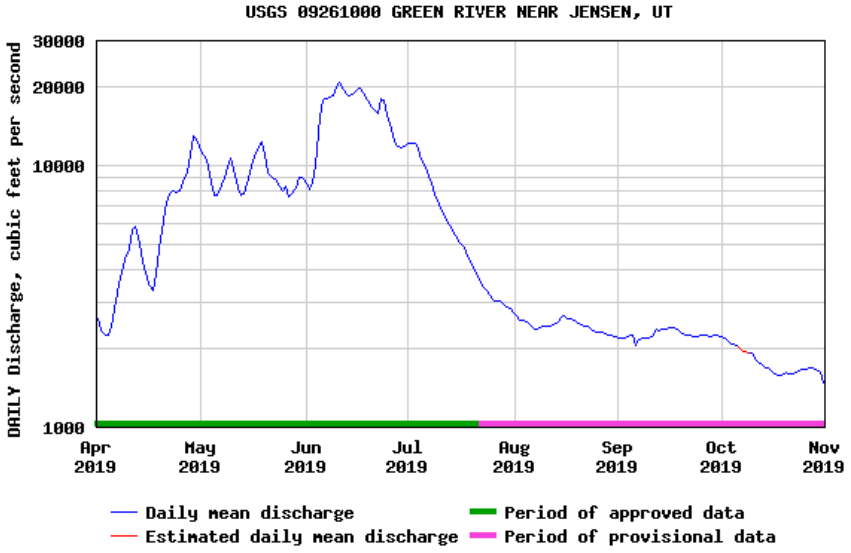
A total 5,000 acre-feet of Elkhead Reservoir fish pool water was released during the 2019 irrigation season to augment base flows for endangered fish in the Yampa River, beginning August 28. This graph shows the estimated improvement in Maybell gage flows due to these releases:

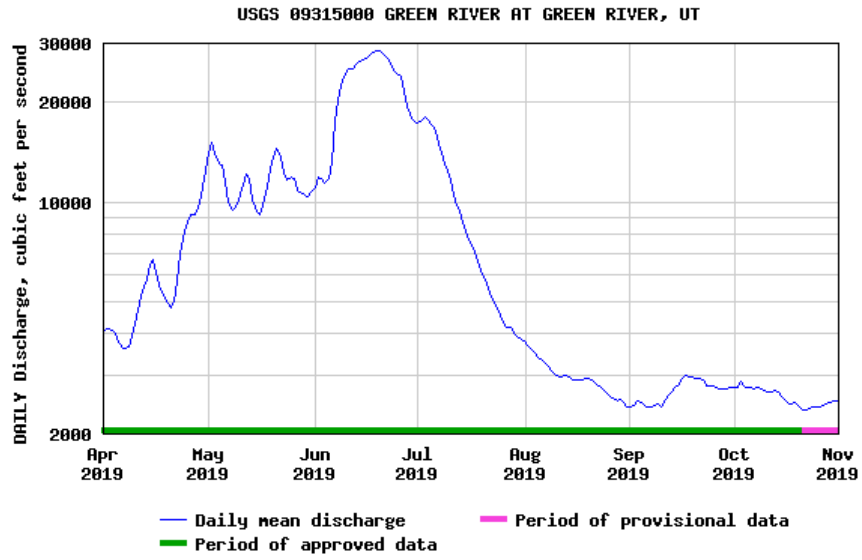


Snow accumulation in the Green River basin upstream of Flaming Gorge Reservoir tracked close to normal through most of the season:

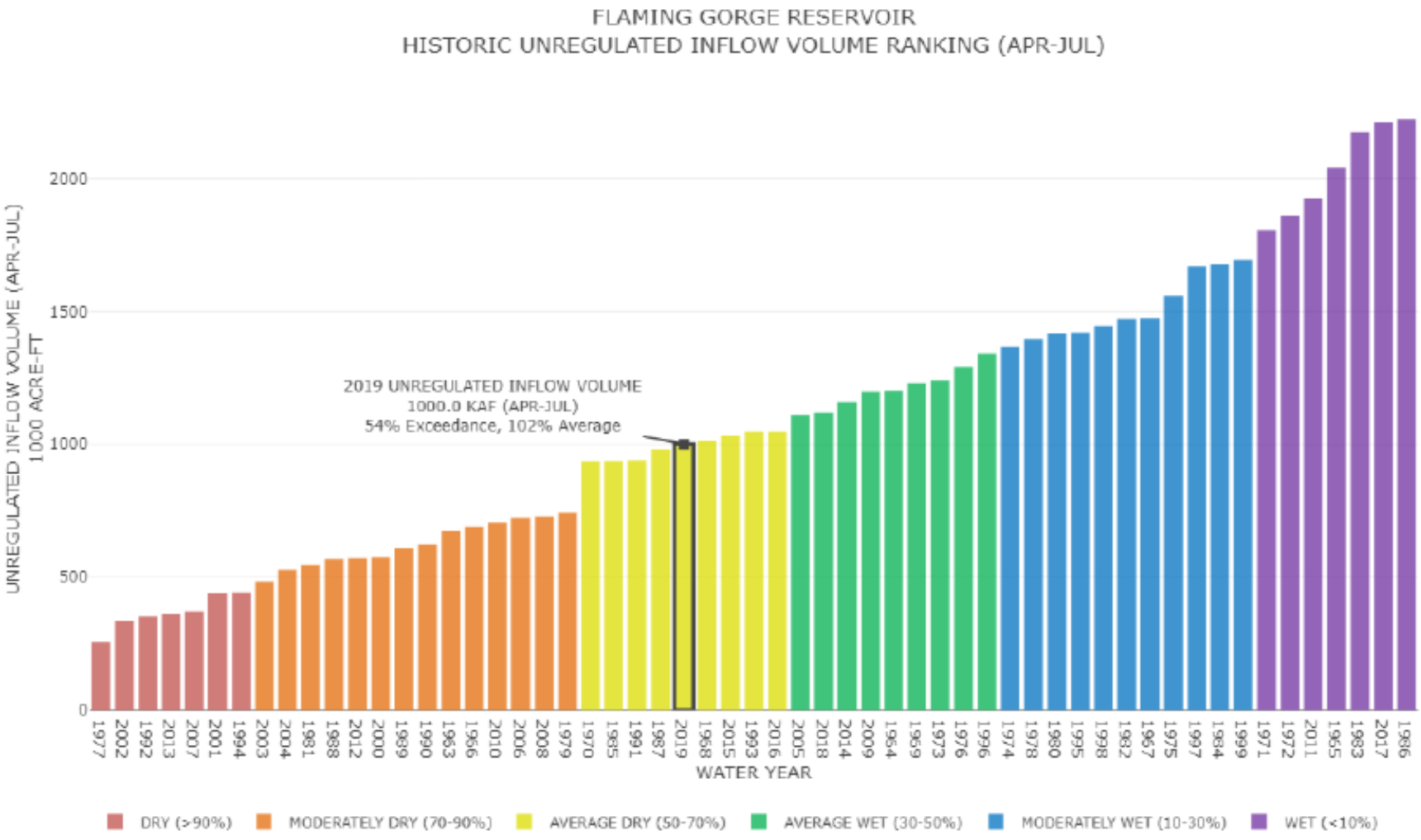


April through October 2019 Hydrographs, Green River in Utah:



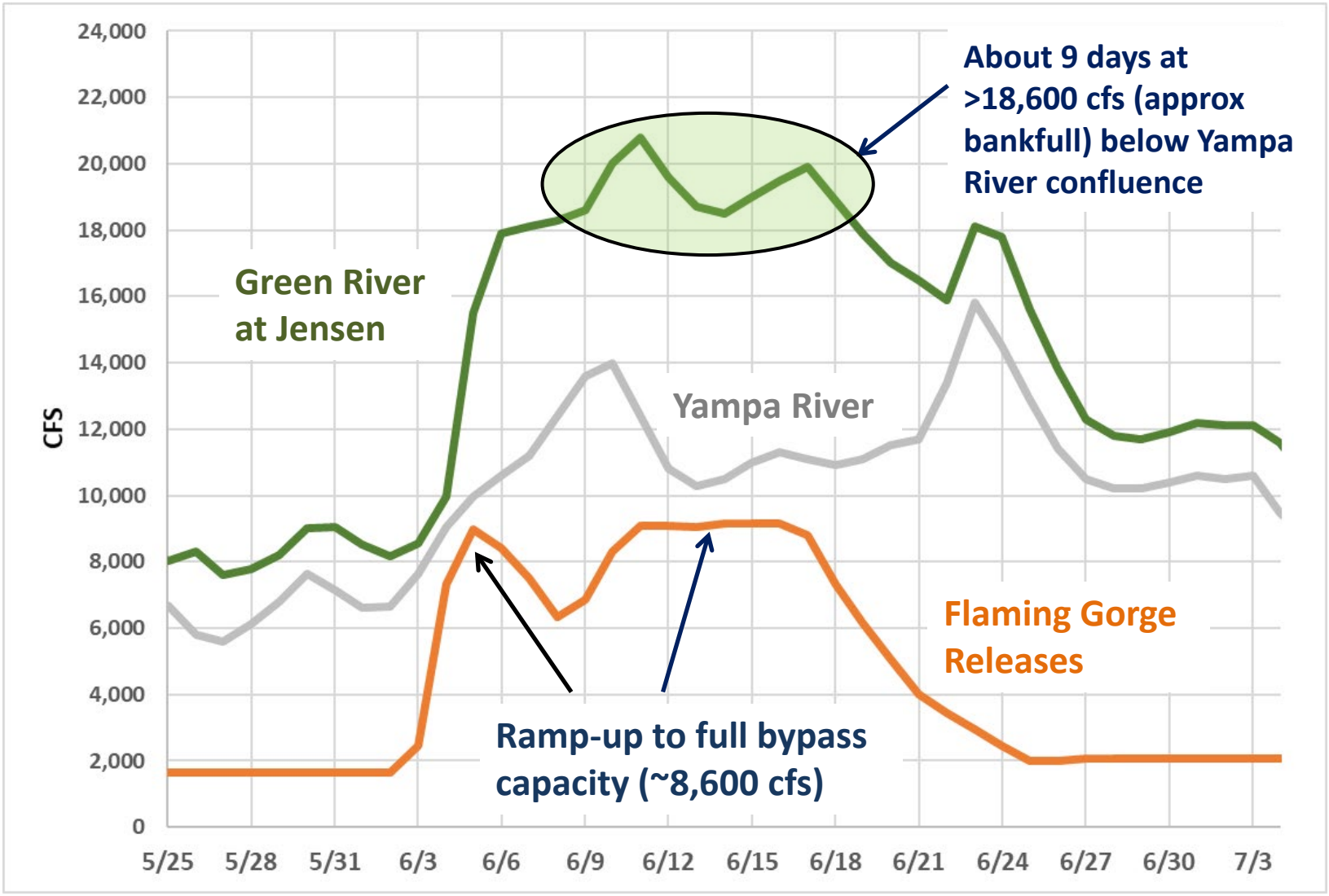


April-July runoff into Flaming Gorge in 2019 was projected in May to be close to average, falling into the "Average-Below Median" category, at 54% exceedance. (Actual April-July runoff ended up about 120% of average, wetter than projected in this May graph.) This USBR graph displays the May 2019 projected rank of 2019 among all years 1963-2018:

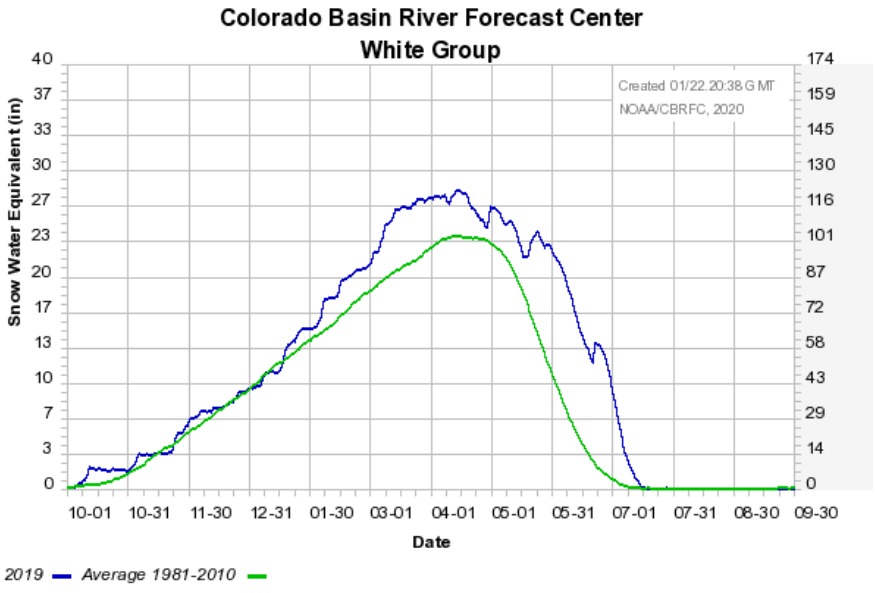


LARVAL-TRIGGERED PEAK FLOW OPERATIONS on the Green River, 2019:

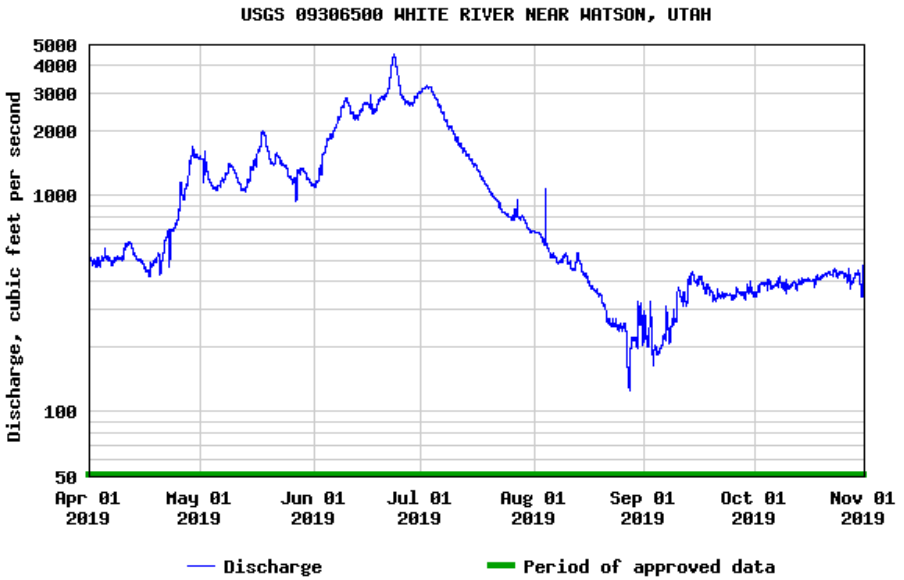
Detection of first larval razorback sucker occurred May 21, but slow larval emergence delayed ramped-up Flaming Gorge releases to begin June 3, with releases maintained at ~8,600 cfs for ~10 days in June



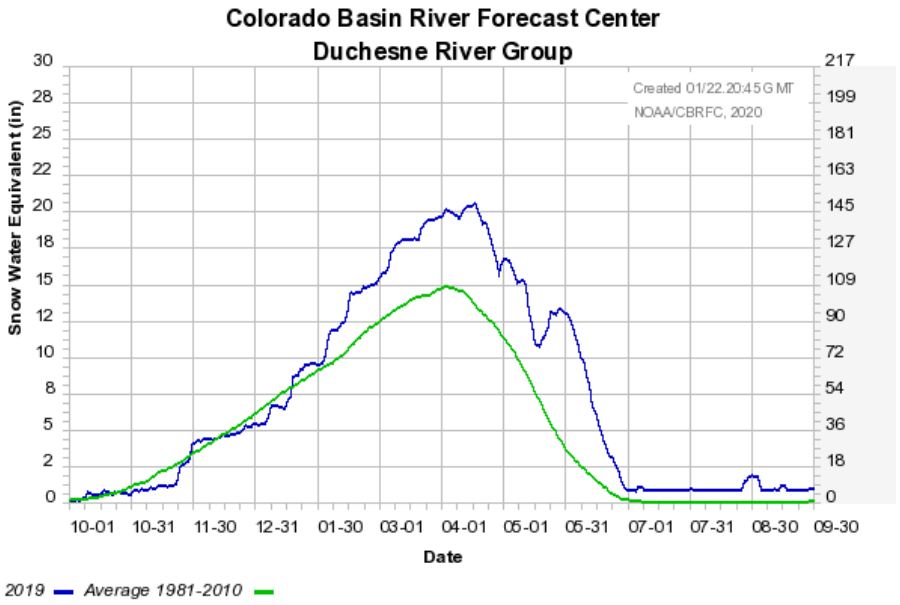
Snow accumulation in the White River basin climbed to above-normal by March; late snowstorms and cool temperatures delayed the period of elevated snowmelt runoff.



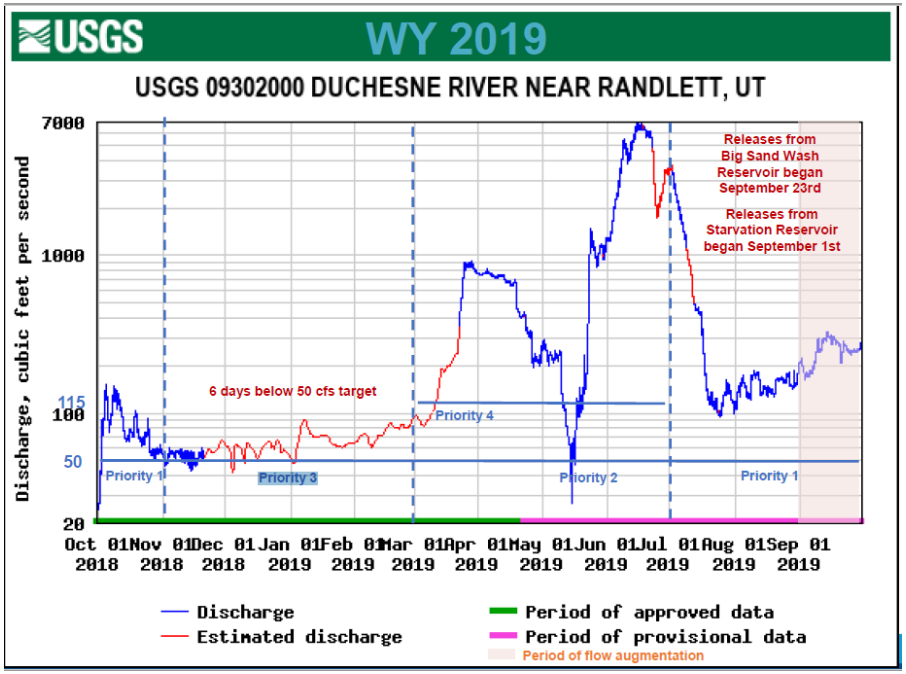
April through October 2019 Hydrograph:

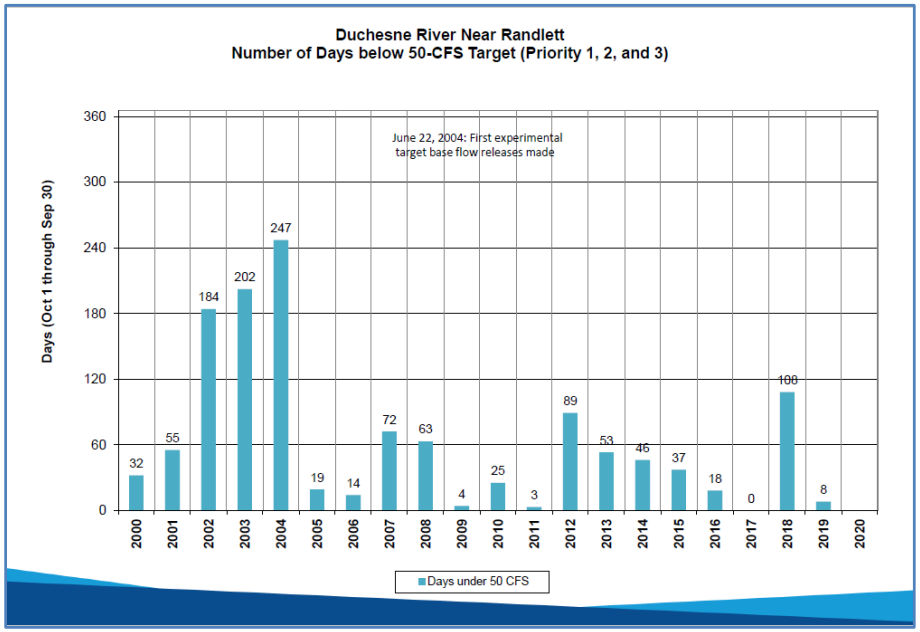


Snow accumulation in the Duchesne River basin climbed to well above-normal early in the 2019 calendar year, with late snowstorms and cool temperatures sustaining elevated snowpack late into the Spring season:



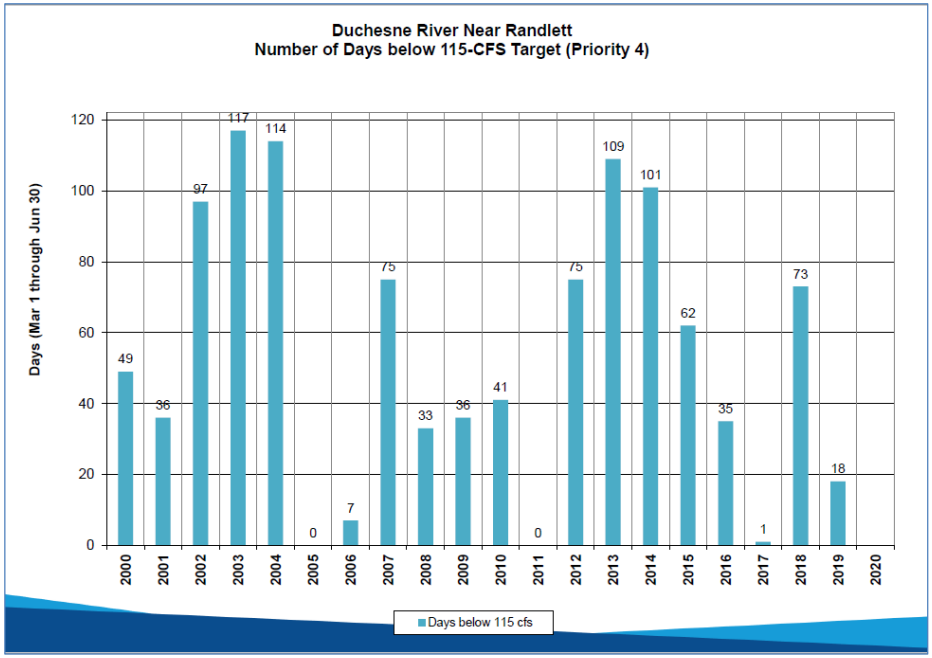
Full 2019 Water Year (Oct-Sep) Hydrograph relative to Priority 1, 2, 3 and 4 flow targets:





The 'Priority 1, 2 and 3' flow targets at the Randlett gage are 50 cfs from Jul-Oct, Nov-Mar, and Mar-June, respectively. In 2019, just 8 days dipped below this target, the second-fewest since 2011.

The 'Priority 4' flow target at the Randlett gage is 115 cfs from March 1 through June 30. In 2019, flows fell short of this target on 18 days, the second-fewest since 2011:



A total of 9,612 acre-feet of water was delivered to support instream flows in the Duchesne River in 2019, from the following sources:

WY 2019 Water Supply:

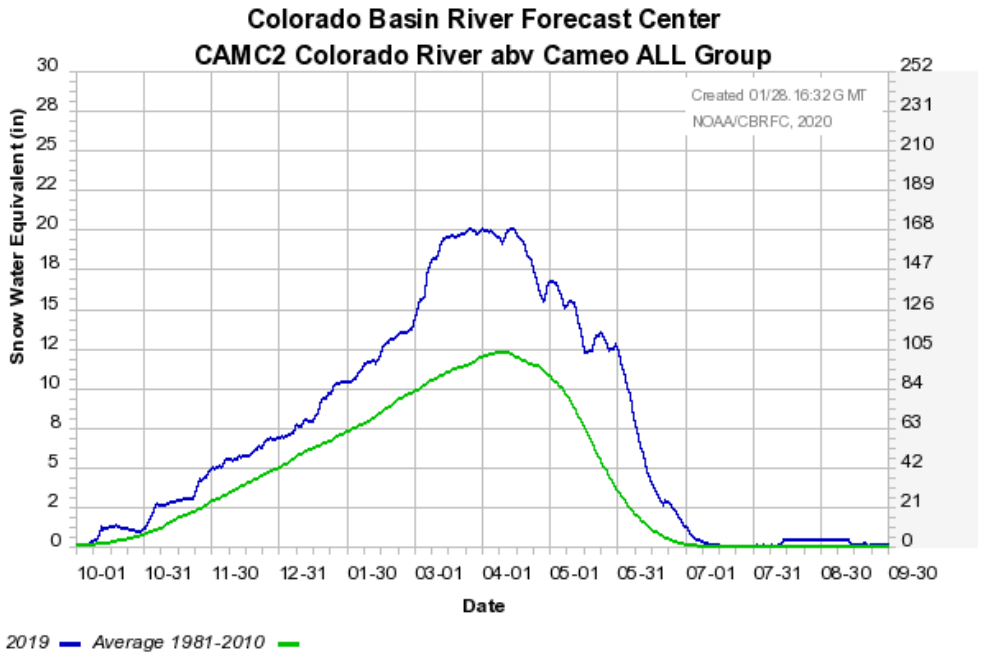
Daniels Replacement Project (Starvation)	*2,900 A-F*
*DOI Section 207 (Starvation) (0 Banked + 430)^*	*430 A-F*
*Rediverted "44,400" Water (Starvation)**	*4,782 A-F*
*DOI Section 207 (Big Sand Wash)^*	*1,500 A-F*
	9,612 A-F

**Value as of October 1, 2019*
**Subject to Spill*

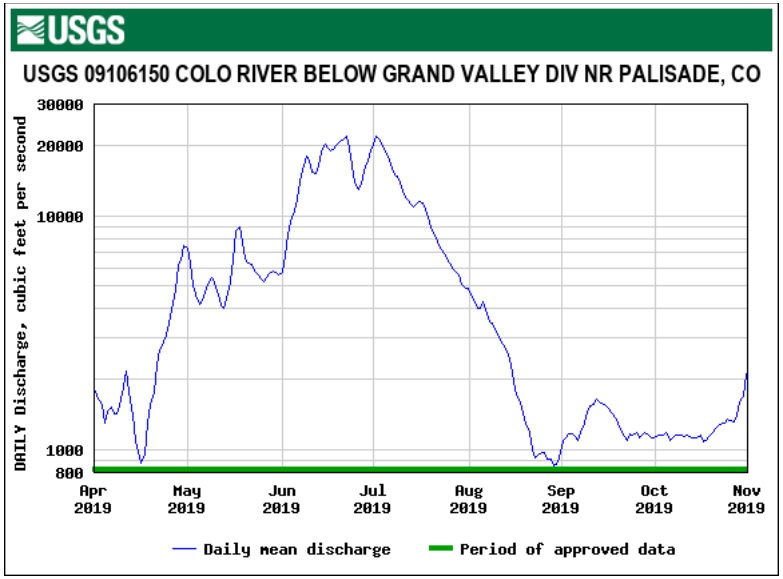
^Temporary 207 Contracts for 2016-2020 Delivery Seasons

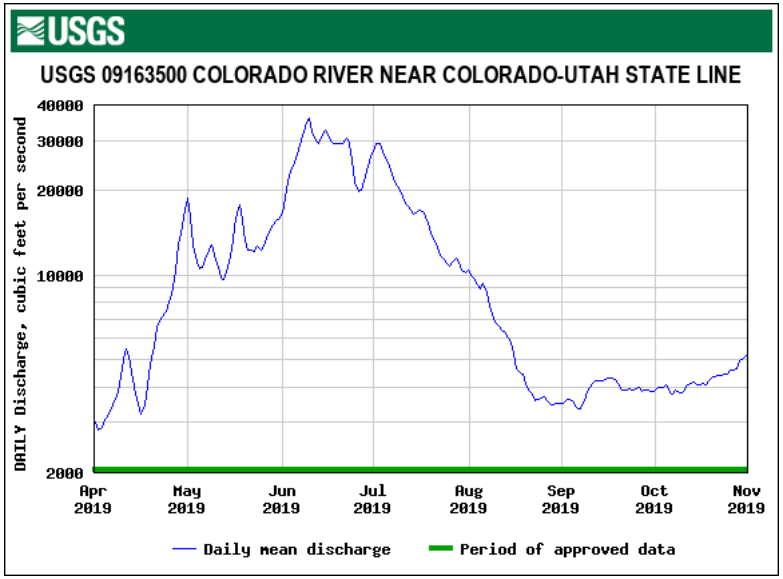
Upper Mainstem Colorado River

Snow accumulation in the upper mainstem Colorado River basin in 2019 was above-normal throughout the snow accumulation season, with a major bump in April and May with delayed runoff, followed by rapid melt-off in May and June:



April through October 2019 Hydrographs:

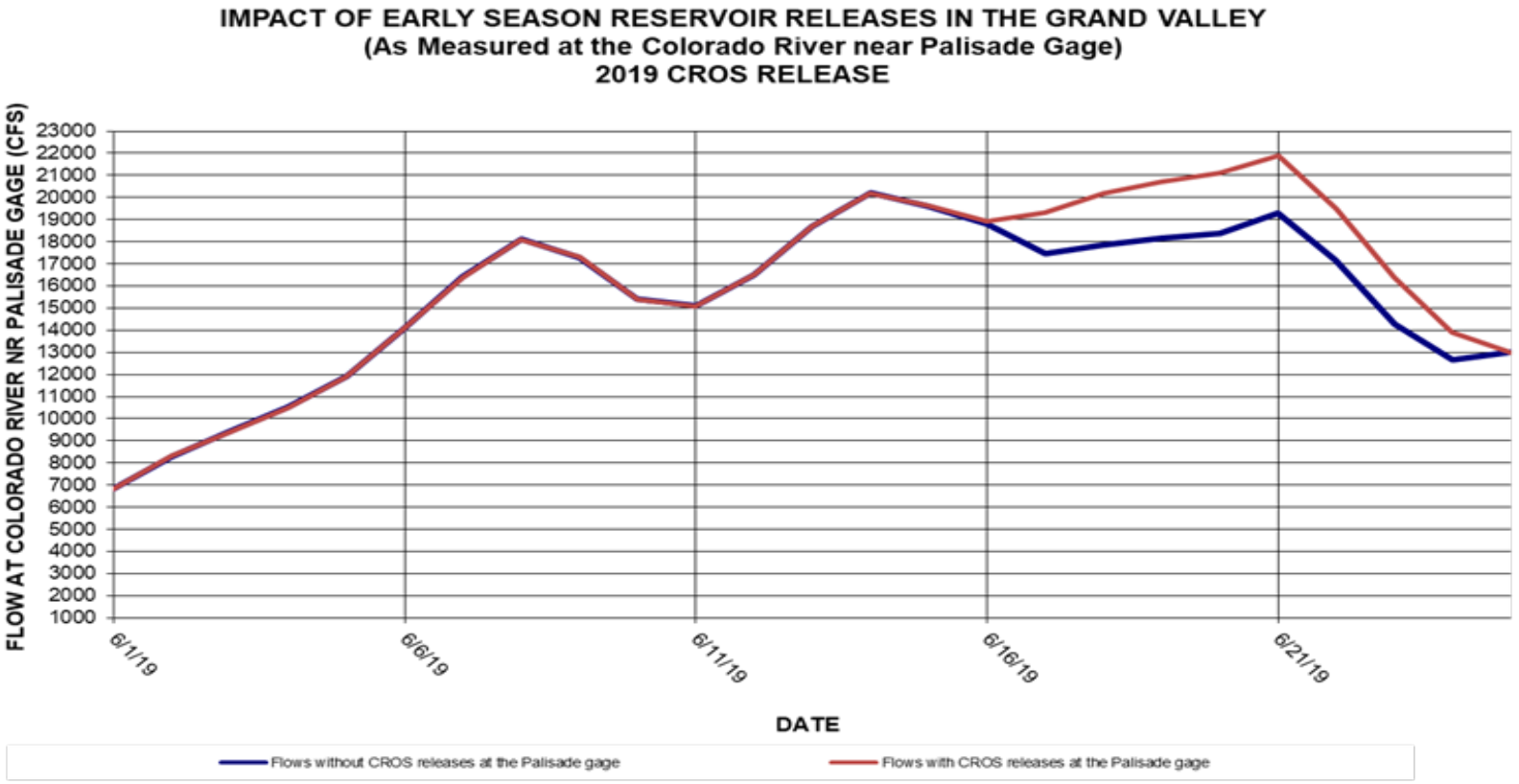




1/30/19

In 2019, Coordinated Reservoir Operations (CROS) were implemented to boost high spring flows in the 15-Mile Reach for the 4th time in the last 5 years, and for the 11th time since CROS was first implemented in 1997.

In 2019 a decision was made to prioritize extending the duration of the spring peak flow in the 15-Mile Reach instead of augmenting the peak flow magnitude, due to potential flooding concerns. CROS releases/bypasses began on June 13, peaked on June 18, and terminated on June 22. This augmented 15-Mile Reach flows from about June 16 to June 24. After accounting for transit losses, a total 35,391 AF of augmented flow is estimated to have passed through the 15-Mile Reach, with a maximum mean daily flow augmentation of 2,711 cfs on June 20. From June 18 through June 23 flow at the Palisade gage was augmented by 2,000 cfs or more (see figure below from CWCB). The following slide shows the sources of water for CROS operations since 1997.



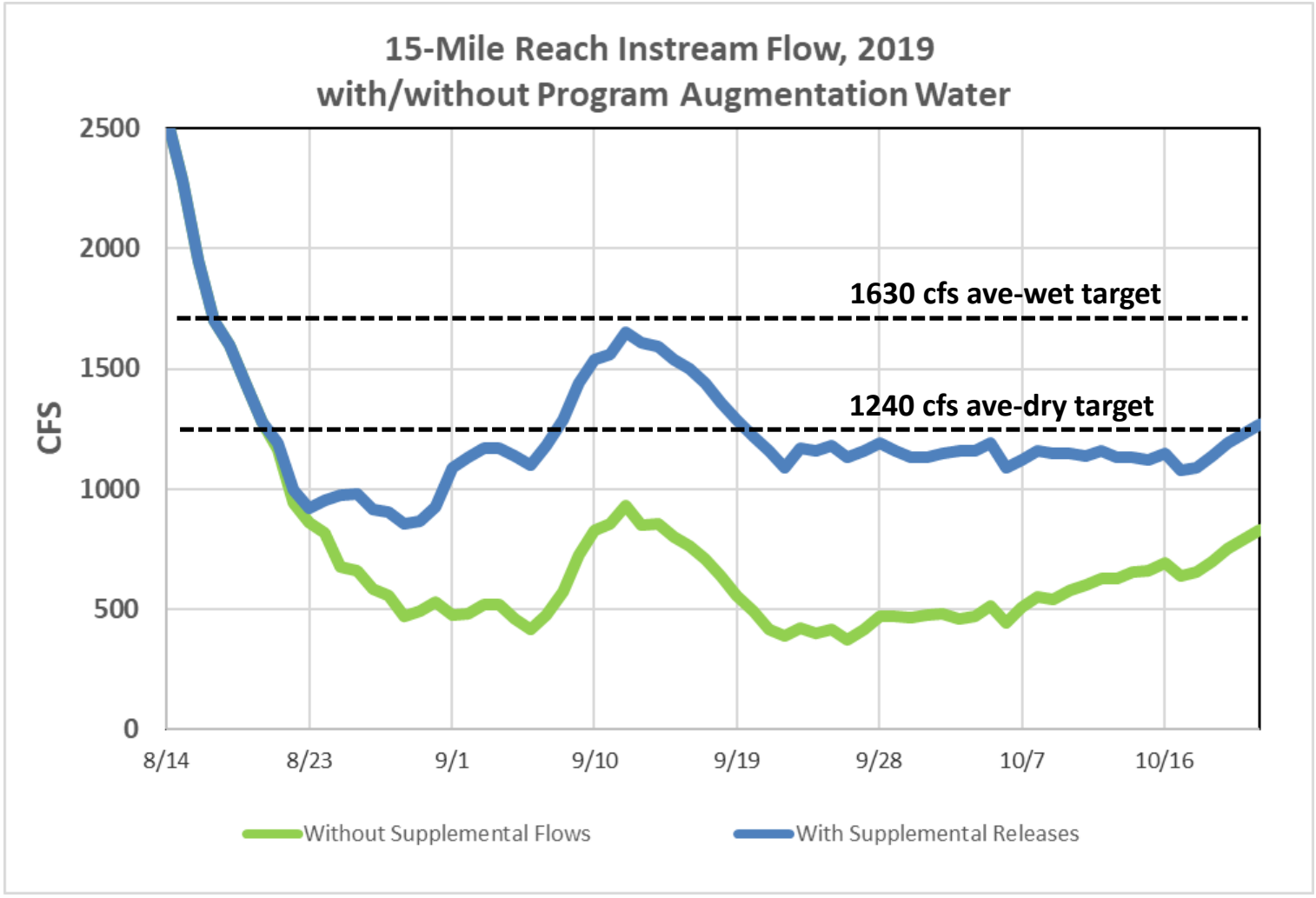
The table below summarizes the coordinated reservoir releases/bypasses (CROS operations) intentionally timed to boost 15-Mile-Reach peak flows since 1997, with 2019 highlighted in red (years with no CROS operations are not listed).

As indicated, a total of 39,156 ac-ft were provided from participating reservoirs in 2019.

Releases/Bypasses (AF) to support CROS Operations

Reservoir	Homestake	Lake Granby	Green Mountain	Ruedi	Williams Fork	Willow Creek	Windy Gap	Wolford Mtn	Moffat Tunnel	Total AF
1997			3,568	693	946			10,635		**15,842**
1998			12,482	5,106	1,672			4,431		**23,691**
1999		8,515	11,010	3,602	1,543	6,631		8,555		**39,856**
2006			6,788	6,297	6,625			9,007		**28,717**
2008			2,101	4,848						**6,949**
2009			14,113	5,858	5,044	2,638	2,061	13,069		**42,783**
2010			34,666	10,050	19,982			9,273		**73,971**
2015		18,002	11,292	4,599	2,733		906	4,587		**42,119**
2016	1,430		8,632	4,007	4,893			8,452	1,960	**29,374**
2017			14,410	4,502	3,293	7,206		4,245	2,079	**35,735**
2019	**655**		**21,223**	**5,998**	**9,273**		**2,007**			**39,156**
Sum	**2,085**	**26,517**	**140,285**	**55,560**	**56,004**	**16,475**	**4,974**	**72,254**	**4,039**	**378,193**

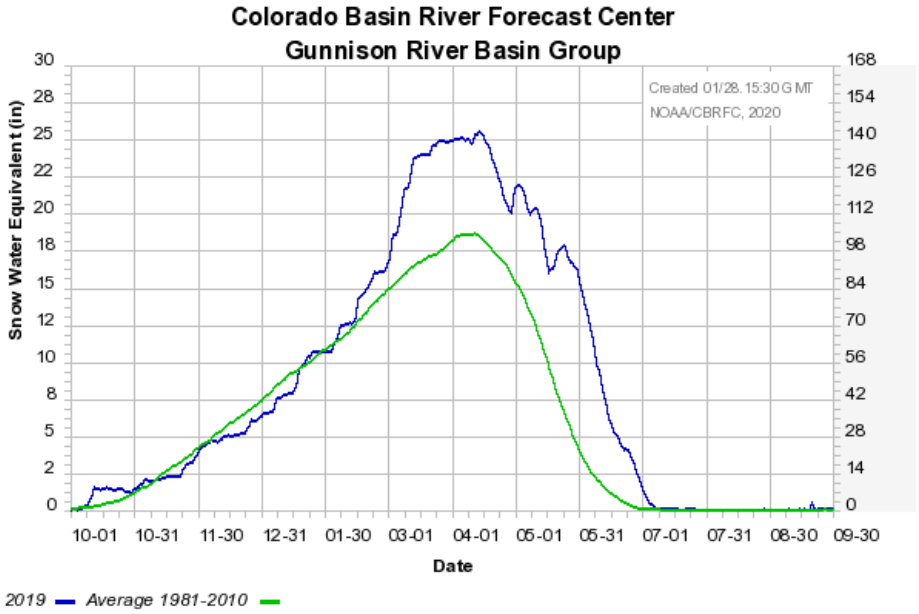
Base flows in the 15-Mile Reach of the Colorado River in 2019 were augmented with 31,812 ac-ft of reservoir releases from the Program's dedicated fish pools at Granby, Wolford Mountain, and Ruedi reservoirs (including 4,687 AF leased by CWCB from Ute Water); plus 53,833 ac-ft of water from the Green Mountain Reservoir HUP Surplus pool; plus 2,975 ac-ft for the 15-Mile Reach from maintenance releases from Wolford Mountain Reservoir by the Colorado River District; plus water leased from Ruedi Reservoir by The Nature Conservancy. The aggregate benefit of these releases to supplement base flows in the 15-Mile Reach through Oct 31 is illustrated below – the estimated flows had these supplemental releases not been provided are shown in green.



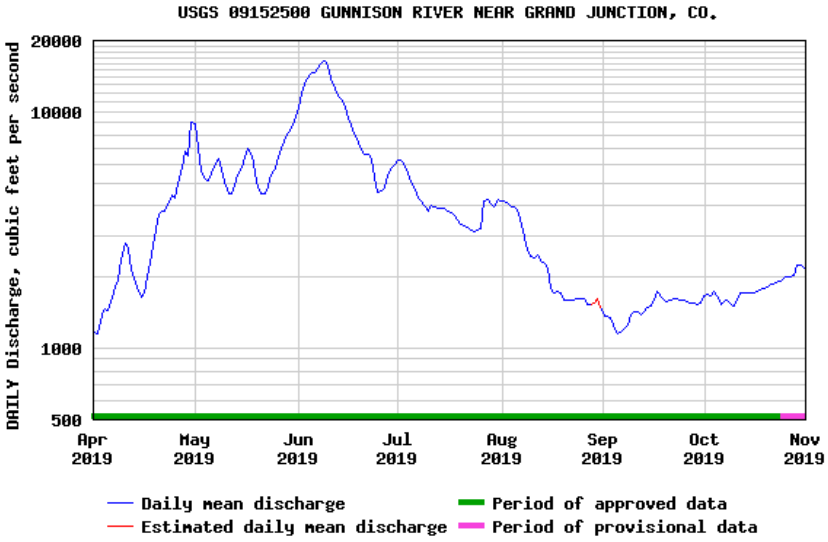
Summary of reservoir releases to augment 15-Mile Reach base flows since 1998 (AF)

Reservoir	Lake Granby	Green Mtn	Ruedi	Williams Fork	Willow Ck	Windy Gap	Wolford Mtn	Palisade Bybass	Total AF	Total AF Reservoirs Only (not incl. Palisade Bypass)
1998		31,736	20,803				11,516		64,055	64,055
1999	26,914	29,277	20,418	1,825	649		4,939		84,022	84,022
2000		47,187	19,064	3,858			11,072		81,181	81,181
2001		34,656	21,345	5,369			8,577		69,947	69,947
2002		-	10,975	3,757			308	2,053	17,093	15,040
2003		47,526	20,434	3,757			286	10,161	82,164	72,003
2004		119	15,981	2,678			-	13,654	32,432	18,778
2005		31,200	17,163	3,814			1,000	19,143	72,320	53,177
2006		25,358	20,045	5,712			10,842	10,812	72,769	61,957
2007		32,745	14,650	2,624			7,037	10,625	67,681	57,056
2008	849	61,433	20,423	9,389		764		15,997	108,855	92,858
2009	3,144	56,290	20,822	5,411			8,747	18,302	112,716	94,414
2010	992	57,813	20,825	5,113		893	8,413	20,617	114,666	94,049
2011		37,132	15,251	5,412			8,413	20,466	86,674	66,208
2012		-	20,596	5,412			5,320	14,616	45,944	31,328
2013	5,412	2,514	10,412				1,501	15,937	35,776	19,839
2014	5,413	59,342	15,413				3,000	19,317	102,485	83,168
2015	5,415	54,610	24,412	1,289			4,712	8,162	98,600	90,438
2016	5,413	55,390	27,413				5,766	12,210	106,192	93,982
2017	5,409	46,216	21,413				6,000	20,272	99,310	79,038
2018	4,805	2,356	19,496		607		24,812	10,198	62,274	52,076
2019	5,413	53,833	20,726				8,676	13,359	102,007	88,648
Sum	69,179	766,733	418,080	65,420	1,256	1,657	140,937	255,901	1,719,163	1,463,262

Snow accumulation in the Gunnison River basin was well above-normal by March and April, with delayed melt-off extending into May and June:



April through October 2019 Hydrograph of the Gunnison River near Grand Junction:



The May 1, 2019, forecast Apr-Jul inflow to Blue Mesa Reservoir was a "Mod Wet" 970 KAF, resulting in a formal 2019 peak flow target of 14,350 cfs for the Gunnison near Grand Junction (Whitewater) gage. Actual inflow to Blue Mesa substantially exceeded early projections. Reclamation releases from the Aspinall Unit peaked at more than 7,000 cfs in early June. Together with other inflows, flow at Whitewater exceeded 'bankfull' flow of 14,350 cfs for six days, 'half-bankfull' flow of 8,070 cfs for 23 days, and peaked at ~17,200 cfs on June 9. USBR graph below.