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)

May 3, 2019

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:

RECOVERY IMPLEMENTATION PROGRAM
SECTION 7 CONSULTATION, SUFFICIENT PROGRESS,
AND HISTORIC PROJECTS AGREEMENT

Agreement

Section 7 Consultation, Sufficient Progress, and Historic Projects

Recovery Implementation Program for the Endangered Fish Species
in the Upper Colorado River Basin

October 15, 1993
Revised March 8, 2000

I. Background

The Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP) is intended to go considerably beyond offsetting water depletion impacts by providing for the full recovery of the four endangered fishes. The RIP participants recognize that timely progress toward recovery in accordance with a well-defined action plan is essential to the purposes of the RIP, including both the recovery of the endangered fishes and providing for water development to proceed in compliance with State law, Interstate Compacts, and the Endangered Species Act (ESA). Recovery activities which result in significant protection and improvement of the endangered fish populations and their habitat need to receive high priority in future planning, budgeting, and decision making. The RIP participants accept that certain positive population responses to RIP initiatives are not likely to be measurable for many years due to the time required for the endangered fishes to reach reproductive maturity, limited knowledge about their life history and habitat requirements, sampling difficulties and limitations, and other factors. The RIP participants also recognize that further degradation of endangered fish habitats and populations will make recovery increasingly difficult.

II. RIP Recovery Action Plan (RIPRAP)

The Recovery Action Plan (RIPRAP) identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner possible in the upper basin. It has been developed using the best information available and the recovery goals established for the four endangered fish species. By reference, the RIPRAP is incorporated and considered part of this agreement. The RIPRAP will be an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modifications to the RIPRAP. The RIPRAP will be reviewed annually and modified or updated, if necessary, by September 30 of each year or prior to adoption of the annual work plan, whichever comes first. The RIPRAP will serve as a guide for all future planning, research, and recovery efforts, including the annual work-planning and budget decision process.

The RIP is intended to provide the reasonable and prudent alternatives for projects undergoing Section 7 consultation in the upper basin. While some recovery actions in the RIPRAP are expected to have more direct or immediate benefits for the endangered fishes than others, all are considered necessary to accomplish the objectives of the RIP. Recovery actions which protect or improve habitat conditions and result in more immediate, positive population responses will be most important in determining the extent to which the RIP provides the reasonable and prudent alternatives for projects undergoing Section 7 consultation. In general, these actions will be given highest priority in the RIPRAP.

The Fish and Wildlife Service (FWS) will determine whether progress by the RIP provides a reasonable and prudent alternative based on the following factors:

a. Actions which 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.
b. Status of fish population.
c. Adequacy of flows.
d. Magnitude of the impact of projects.

Therefore, these factors were considered in the development and prioritization of the recovery actions in the RIPRAP.

III. Framework for Agreement

The following describes the agreement among RIP participants on a framework for conducting Section 7 consultations on depletion impacts related to new projects (as defined in Section 4.1.5 a. of the RIP) and impacts[1] associated with historic projects in the Upper Colorado River Basin. This agreement is meant to supplement and clarify the process outlined in Sections 4.1.5, 4.1.6 and 5.3.4 of the RIP. This agreement applies only to the four Colorado River endangered fishes in the Upper Colorado River Basin, excluding the San Juan River, and is not a precedent for other endangered species or locations.

1. Activities and accomplishments under the RIP are intended to provide the reasonable and prudent alternatives which avoid the likelihood of jeopardy to the continued existence of the endangered Colorado River fishes (hereinafter the "reasonable and prudent alternative") resulting from depletion impacts of new projects and all existing or past impacts related to historic projects with the exception of the discharge by historic projects of pollutants such as trace elements, heavy metals, and pesticides. However, where a programmatic biological opinion applies, the appropriate provisions of such an opinion will apply to future individual consultations.

   The RIP participants intend the RIP also to provide the reasonable and prudent alternatives which avoid the likely destruction or adverse modification of critical habitat, to the same extent as it does to avoid the likelihood of jeopardy. Once critical habitat for the endangered fishes is formally designated, the RIP participants will make any necessary amendments to the RIPRAP to fulfill such intent.

2. The RIP is intended to offset both the direct and depletion impacts of historic projects occurring prior to January 22, 1988 (the date when the Cooperative Agreement for the RIP was executed) if such offsets are needed to recover the fishes. Under certain circumstances, historic projects may be subject to consultation under Section 7 of the ESA. An increase in depletions from a historic project occurring after January 22, 1988, will be subject to the depletion charge. Except for the circumstances described in item 11 below, depletion charges or other measures will

[1] All impacts except the discharge of pollutants such as trace elements, heavy metals, and pesticides.

not be required from historic projects which undergo Section 7 consultation in the future.

3. The Bureau of Reclamation (BR) and the Western Area Power Administration will operate projects authorized and funded pursuant to Federal reclamation law consistent with its responsibilities under Section 7 of the ESA and with any existing contracts. No depletion charge will be required on depletions from BR projects as long as BR continues its contributions to the RIP's annual budget.

4. The FWS will assess the impacts of projects that require Section 7 consultation and determine if progress toward recovery has been sufficient for the RIP to serve as a reasonable and prudent alternative. The FWS will use accomplishments under the RIP as its measure of sufficient progress. The FWS will also consider whether the probable success of the RIP is compromised as a result of a specific depletion or the cumulative effect of depletions. Support activities (funding, research, information and education, etc.) in the RIP contribute to sufficient progress to the extent that they help achieve 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. Generally, sufficient progress will be evaluated separately for the Colorado and Green River subbasins (but not individual tributaries within each subbasin). However, the FWS will give due consideration to progress throughout the upper basin in evaluating sufficient progress.

5. If sufficient progress is being achieved, biological opinions will identify the activities and accomplishments of the RIP that support it serving as a reasonable and prudent alternative.

6. If sufficient progress is not being achieved, biological opinions for new and historic projects will be written to identify which action(s) in the RIPRAP must be completed to avoid jeopardy. Specific recovery actions will be implemented according to the schedule identified in the RIPRAP. The FWS will confer with the Management Committee on the identification of these actions within established timeframes for the Section 7 consultation. For historic projects, these actions will serve as the reasonable and prudent alternative as long as they are completed according to the schedule identified in the RIPRAP. For new projects, these actions will serve as a reasonable and prudent alternative so long as they are completed before the impact of the project occurs. The FWS has ultimate authority and responsibility for determining whether progress is sufficient to enable it to rely upon the RIP as a reasonable and prudent alternative and identifying actions necessary to avoid jeopardy.

7. Certain situations may result in the FWS determining that the recovery action in previously rendered biological opinions are no longer serving as a reasonable and prudent alternative. These situations may include, but are not limited, to:

    a. Critical deadlines for specified recovery actions are missed;
    b. Specified recovery actions are determined to be infeasible; and
    c. Significant new information about the needs or population status of the fishes becomes available;

8. The FWS will notify the Implementation and Management Committees when a situation may result in the RIP not serving as a reasonable and prudent alternative.

The Management Committee will work with the FWS to evaluate the situation and develop the most appropriate response to restore the RIP as a reasonable and prudent alternative (such as adjusting a recovery action so it can be achieved, developing a supplemental recovery action, shortening the timeframe on other recovery actions, etc.).

9. The RIP is responsible for providing flows which the FWS determines are essential to recovery of the endangered fishes. Whether or not a Section 7 review is required, the RIP will work cooperatively with the owners/operators of historic projects on a voluntary basis to implement recovery actions needed to recover the endangered fishes.

10. The responsibility for the efficiency and effectiveness of the RIP, and for its viability as a reasonable and prudent alternative, rests upon RIP participants, not with individual project proponents. RIP participants fully share that responsibility.

11. If the RIP cannot be restored to provide the reasonable and prudent alternative per item 8, above, as a last resort the FWS will develop a reasonable and prudent alternative, if available, with the lead Federal Agency and the project proponent. (RIP participants recognize that such actions would be inconsistent with the intended operation of the RIP). The option of requesting a depletion charge on historic projects or other measures on new or historic projects will only be used in the event that the RIPRAP does not or can not be amended to serve as a reasonable and prudent alternative. In this situation, the reasonable and prudent alternative will be consistent with the intended purpose of the action, within the Federal Agency's legal authority and jurisdiction to implement, and will be economically and technologically feasible.

12. This agreement becomes effective upon adoption of the RIPRAP by the Implementation Committee. Until the RIPRAP is adopted, the FWS will use the procedures in this agreement and the January 1993, draft RIPRAP as the basis for identifying reasonable and prudent alternatives.

13. Experience may dictate a need to modify this agreement in the future. This agreement may be modified or amended by consensus of all the RIP participants. A review of the agreement may be initiated by any voting member of the Implementation Committee.

PART TWO:

RECOVERY IMPLEMENTATION PROGRAM
RECOVERY ACTION PLAN
(RIPRAP)

RECOVERY IMPLEMENTATION PROGRAM
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.

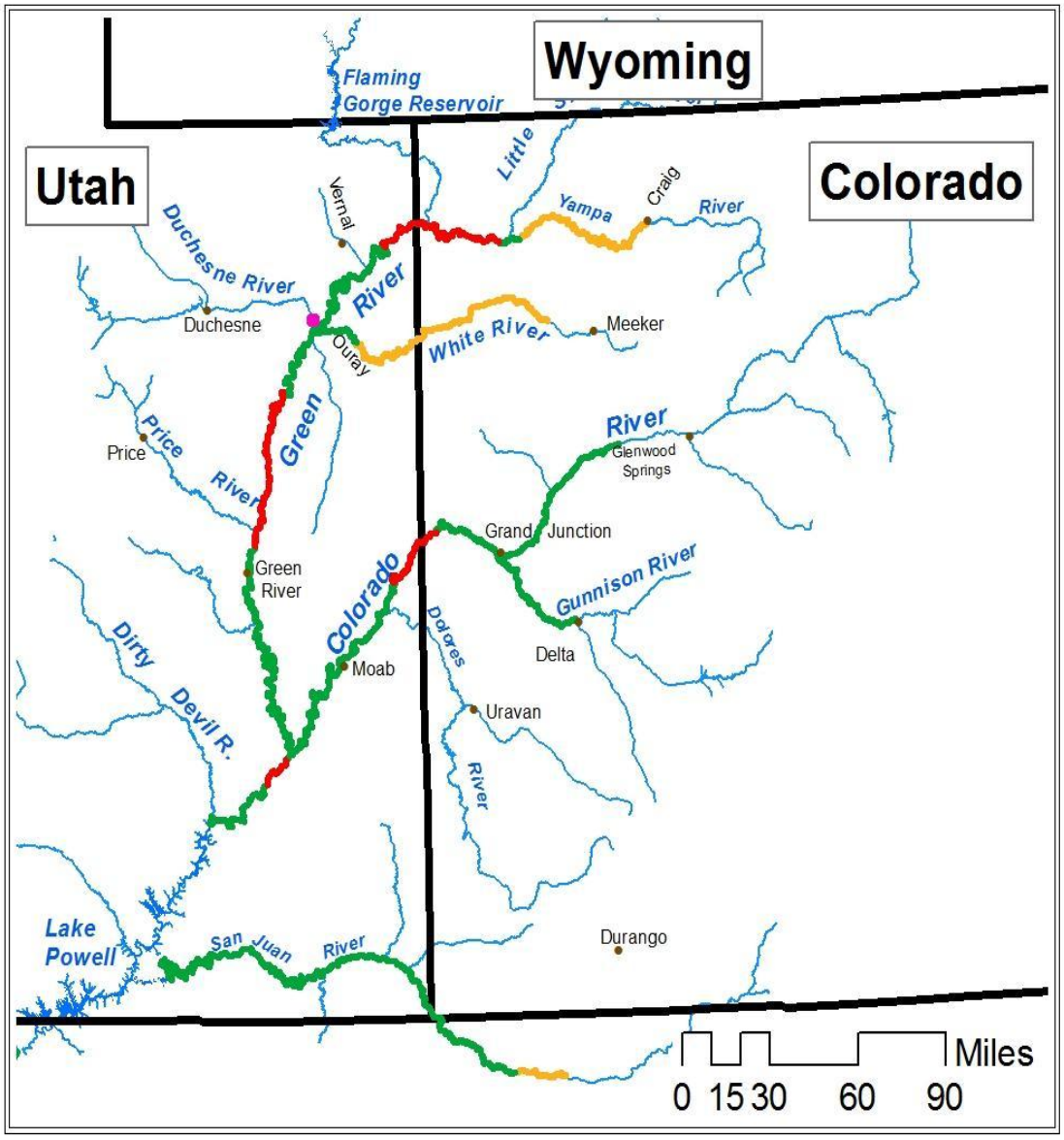
In the context of the recovery goals/plans, recovery of humpback chub, bonytail, and razorback sucker will occur in the Upper and Lower basins (each basin is treated as a "recovery unit"), with separate recovery criteria developed for each of the two recovery units. Based on the Colorado pikeminnow recovery 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).

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. The Service anticipates SSA completion in in 2019.

The Program Director's office has recommended deferring update of the bonytail recovery plan until new information warrants, but will complete a five-year status review in 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 million, adjusted annually for inflation. As per passage of PL 116-9, which reauthorized PL 112-270 and PL 106-392, annual funding will be applied to the full suite of the Recovery Program's actions through FY2023, with the exception of capital projects. In response to a 2018 Office of Management and Budget (OMB) directive, which cancelled the use of hydropower funds for the Colorado River environmental programs, stakeholders secured appropriations at full funding levels for FY19. PL 116-9 identifies appropriations as the source of annual funds in response to the 2018 OMB directive. Additional annual

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

funding will come from one-time water 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, 2018, the fee was $21.61 per acre-foot; the rate increases to $22.13 per acre-foot as of October 1, 2019. The actual rate of water development has not been projected therefore it is difficult to predict the amount of this funding source on an annual basis. Through FY2018, depletion fees and interest earned on these fees totaled approximately $3,300,000. 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 between FY 2019 and FY 2023 for remaining capital projects. 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 gage 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 completed in 2004 (Irving et al. 2004), and are currently under revision. A White River management plan is expected to be drafted 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 the river flows relative to these flow recommendations.

- 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 the 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) are being evaluated by a Recovery Program workgroup, with proposed updates to those recommendations anticipated in 2019.

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 (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); updates of this effort are planned every 5 years. 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).

In 2014, the Service participated in the workgroup for Environmental and Recreational flows of the Colorado Basin Water Supply. The White River from Kenny Reservoir to the Green River and the Colorado River from the Gunnison River to the confluence of the Green River were chosen as two of the four focus reaches. The next phase will be to identify scientific uncertainties and opportunities to address those uncertainties, document mechanisms or programs that have been successful protecting environmental and river-based recreational resources, and explore and document opportunities and potential solutions that might be applied at a scale larger than the focus reaches.

Colorado

In Colorado, the appropriation of an instream water right follows a structured process developed by the Colorado Water Conservation Board (CWCB) in 1997. 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 the physical alteration of flow conditions by re-operating a reservoir or other component of an existing or new water project, various contracts with reservoir owners may be needed to legally protect the deliveries from storage from re-diversion. 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 his method has not been used 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 as follows in 2013 and 2017:

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, 2016-2019.

With the modeling complete and the report in preparation, 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 2018, the Bureau of Reclamation worked with the State of Utah to develop a draft 'Green River Block Exchange Contract' between those two parties. This contract, recently signed, will 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 recommended instream flows 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 contain large numbers of zooplankton and benthic organisms. 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 also 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 Green River as the wetland is drained in the fall months.

Passage barriers have 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 has been 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, and an O&M contract was finalized in 2018. 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 Colorado pikeminnow entrainment into diversion structures on the Yampa River determined the Maybell Ditch was not a significant source of entrainment. Evaluation of potential entrainment of endangered fishes at the Green River Canal near Green River, Utah has been considered by the Recovery Program for many years, Recent studies have documented high levels of entrainment. All four endangered species continue to be documented in the canal through 2018. Based on these findings, the Program has begun construction of a vertical weir wall paired with a fish screen in the Green River Canal below the Thayn Hydro facility to reduce entrainment at this site (instead of the wedge wire screens used in Grand Valley fish screens).

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 UDWR 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 threat to the recovery of four Colorado River endangered fishes. Unfortunately, in the upper Colorado River basin, despite years of significant effort, the nonnative threat remains largely uncontrolled. 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 and Ryden 2014), 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.

Warm water game fish, primarily stocked in reservoirs for recreational purposes, 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), esocids (northern pike), and percids (walleye). 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 and bluehead suckers. Recently, numbers of walleye have increased in the Green and lower Colorado rivers; Francis and Ryden documented juvenile Colorado pikeminnow in the guts of nonnative walleye and reported a simultaneous decline in Colorado pikeminnow abundance in the lower Colorado River between 2010 and 2014 (Francis and Ryden 2014). Burbot 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.

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 CSU provided the Program with guiding principles for nonnative removal in the entire basin. 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). Reservoir escapement is primarily prevented

through installation of physical screens on outlets or channels and nets on spillways. Currently Starvation[4], Elkhead, 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.

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 is scheduled for 2019.

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, 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.

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. 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.

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

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 need to be 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.

The Genetics Management Guidelines document provides the rationale, genetics concepts, and genetic risks to be considered in genetics-management planning and implementation. For example, it indicates that a fish population is the fundamental unit of genetics management and that its definition and characterization, relative to other populations, are important. Genetic surveys have been part of the identification and characterization process. Further, the prioritization and genetics management required for each population is determined by its relative population status, demographic trends, and genetics data derived from the surveys.

The Genetics Management Plan is the operational document. It tells the "what, who, when, where" of implementation. It identifies specific objectives, tasks, activities, and type of facilities necessary to accomplish Recovery Program goals, i.e., protect population genetic integrity or restore a self-sustaining population in the wild. It is the action plan developed for implementation, directed by the Recovery Program goals, and structured along the format presented in the Genetics Management Planning Guidelines document.

Facilities are required to meet long-term (5 years or more) augmentation and restoration stocking needs. The plans for these facilities are the Coordinated Hatchery Facility Plan and the Facilities 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 operates 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 operates 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 six years.

The Integrated Stocking Plan (Nesler et al. 2003) provides 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 continues to not meet expectations. Alternative diet studies, as well as flow training and 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 draft report on the genetics of *Gila* spp. (Bohn et al.in review), including humpback chub, indicates historical hybridization (not anthropogenic) occurred between humpback chub and roundtail chub in Black Rocks. The authors identified two management units in the upper basin: Desolation-Cataract and Black Rocks-Westwater. Authors did not recommend separate broodstocks, rather that both

management units be represented in a single Upper Basin broodstock, with individuals taken from multiple sites within each management unit to maintain genetic diversity.

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 is updating data management to track 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 has designed and built a web-based database that will store and query 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, the focus will switch to enhancing user tools and providing additional query options.

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 2018, the Program was present at annual meetings for Utah Water Users, Rocky Mountain Coal Mining Institute, Colorado River District, Colorado River Water Users Association and Colorado Water Congress. In addition, the Program was present at public events including Endangered Species Day, Ute Water Children's Festival, farmers markets, the Palisade Peach Festival and the Tour de' Vineyards Bike Race. Partners and volunteers provide a substantial workforce to staffing these outreach events.

In recent years, the 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. Fishing tournaments were held in both Ridgway and Elkhead reservoirs in 2018 to target undesirable species. Colorado's Nonnative Fish Management Work Group will consider illicit introductions as a component of a strategy to respond to Service's sufficient progress assessment.
The information and education element continues to develop a number of products including an annual *Swimming Upstream* field report (print and digital editions); up-to-date fact sheets; interpretive signs and displays; annual *Program Highlights* and other 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 2018, the proposed downlisting of razorback sucker and humpback chub, discovery of juvenile razorback sucker in the San Juan River and challenging flow conditions developed into several news stories at both the local and national level. Special educational publications are produced as needed. The Recovery Program also integrates social media into outreach strategies as appropriate.

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 tied together in Federal legislation (Public Laws 106-392, 107-375, 109-183, 111-11 and 112-270), an annual publication is produced that highlights accomplishments of both recovery programs. 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 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

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. Colorado pikeminnow adult abundance in the Green River has declined over the past decade. 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 be increased (Miller 2018). Humpback chub are spawning and recruiting in Desolation and Gray canyons in the Green River. 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 and 2018 and in floodplains off the middle Green River every year since 2013. 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.

The importance of the Green River to the endangered fishes has been established in Recovery Program planning. 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. Habitat in Desolation and Gray canyons supports a humpback chub population, and 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). 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).

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. Flows in the Green River are influenced by tributary inputs, especially the Yampa River, as well as Flaming Gorge Dam releases. 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). National Environmental Policy Act (NEPA) compliance on reoperation of Flaming Gorge Dam and a Record of Decision were completed in 2006. A new biological opinion was completed in 2005. 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. 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 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 for an experimental period of about six years[5] beginning in 2012. To date, LTSP operations have proven hugely successful, resulting in an autumn release of wild-produced Age-0 razorback sucker from floodplains to the Green River main channel; 2013-2016. 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.

Flow recommendations also have been developed for some tributaries to the Green River, such as the Yampa, White (revised draft flow recommendations developed in 2018; currently under review), 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.

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 and schedule to protect recommended year-round flows for the endangered fishes on the Green River in Utah, which is scheduled to culminate with legal streamflow protection in 2019 (Utah Department of Natural Resources 2010; Mike Styler and Henry Maddux, UDNR, personal communication).

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 Colorado pikeminnow. 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 are entrained, some at substantial levels. Construction on a weir wall and fish screen began in November 2018 to halt the entrainment of individuals. This project follows the reconstruction of the Tusher

[5] Full experimentation of the LTSP may take more than 6 years because a full variety of hydrologic conditions may not be available in six consecutive years.

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 (*Esox lucius)* 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, green sunfish, and burbot are other species of concern, but active management of these species has not been proposed by the Recovery Program.

Increased catches of walleye in the middle Green River are likely linked to escapement of individuals from Starvation Reservoir (Duchesne subbasin) and an illegally introduced population in Red Fleet Reservoir (Johnson et al. 2014). A temporary barrier has been installed for the Starvation Reservoir spillway since 2015, and a long term solution will be constructed in 2020. UDWR completed a rotenone treatment of Red Fleet Reservoir in the fall of 2015 to eliminate this source 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 2019. Lake Powell may be a source of walleye in the lower Green River; however, a solution to prevent their escapement has not yet been developed.

Refuge (captive) populations 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.

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 data indicates that population has 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 Colorado State University 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 describe population dynamics. Results are pending from a fourth 3-year sampling period, which was completed in 2018.

Population estimates for humpback chub in Desolation and Gray canyons were conducted in 2001 and 2002, and expanded in 2003 (Jackson and Hudson 2005). 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 resumed humpback chub population estimation in Desolation and Gray Canyons in 2014; 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 fall 2018 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. 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 is complete 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 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. As part of the pending Yampa River depletion accounting report, CWCB will make an estimate of current and projected future depletions and will recommend whether or not additional instream flow filings or other flow protection mechanisms should be considered.

Flow contributions from the Little Snake River, as they assist in recovery in the Yampa River, were identified after estimated future depletions were accounted for in the Yampa River Management Plan and Environmental Assessment (Roehm 2004).

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 began in 2007 and continued in 2011 and 2012. Only one endangered fish, a Colorado pikeminnow, was detected in 2012 (Speas et al. 2014). The Service's 2014 Sufficient Progress memo concluded that due

to relatively low rates of documented entrainment of endangered fish, an exclusion device would not be cost effective at this time. The Service recommended 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 very 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 began in 2003. The Recovery Program now removes smallmouth bass and northern pike at some level of intensity 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. CPW has completed several habitat remediation projects to reduce northern pike spawning habitat in the upper Yampa River near Steamboat Springs. Active removal of northern pike downstream of Hayden began in 2003. In 2004, the Recovery Program began tagging northern pike in the Yampa River upstream of the Hayden Bridge to determine if it is a significant upstream source of northern pike moving downstream into critical habitat. In 2005, CPW began work to determine sources of northern pike that may gain access to endangered fish critical habitat in the Yampa River. Prior to the 2011 sampling season, the Recovery Program recommended and CPW agreed to discontinuing the pike marking pass in the Yampa River buffer zone between Hayden and Craig. Translocation of pike to off-channel waters was discontinued in 2014.

In 2015, Colorado State University 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 in 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 upstream; however, only one pike confirmed to have escaped from Stagecoach Reservoir has been captured in Catamount Reservoir in the last 5 years.

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 a 12-mile treatment reach in Little Yampa Canyon, a 5-mile treatment reach in Lily Park, and in the lower Yampa River in Yampa Canyon began in 2004. The 12-mile treatment was expanded to 24 miles in 2006 in order to geographically include a greater portion of the targeted population. Removal was also expanded in 2006 to include the South Beach reach immediately upstream of the Little Yampa Canyon treatment reach in order to focus control on concentration areas. In 2009, smallmouth bass removal was expanded throughout critical habitat on the Yampa River. Prior to the 2011 sampling season, the Recovery Program recommended and CPW agreed to cease translocation of adult smallmouth bass from the Yampa River into Elkhead Reservoir due to concerns about the rate of escapement of translocated and resident smallmouth bass from the reservoir and the propagule pressure and proliferative capacity of these escapees within critical habitat. The Recovery Program's multi-year assessment of smallmouth bass escapement from Elkhead Reservoir is complete (Breton et al. 2013) and 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.

The programmatic synthesis of smallmouth bass (Breton et al. 2014) populations in the upper Colorado River basin is also completed. 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 2011 resulted in sustained reductions in density of smallmouth bass sub-adults and adults throughout the upper basin despite environmental conditions that favored smallmouth bass reproduction in some years (e.g. 2007 and 2009) (Breton et al. 2014).

The Recovery Program's Integrated Stocking Plan (Nesler et al. 2003) outlined plans for stocking bonytail in the middle Green River that included the confluence of the Yampa River. Stocking bonytail at the confluence of the Yampa and Green rivers was initiated in 2000. The Integrated Stocking Plan was revised (Integrated Stocking Plan Revision Committee 2015) and more and larger bonytail are currently being stocked at Echo Park, Deerlodge or Hell's Canyon (Mantle Ranch). In 2018, 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, in 2010 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, formalizes 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 and 2018 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 2020.

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 is a 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 2018, USFWS substantially revised its draft flow recommendations after reviewing data collected over the interim and evaluating hydrologic models of the river under current levels of development. Those draft recommendations are now under review. A White River management plan will ultimately serve as the basis for a White River programmatic biological opinion.

Development of that plan is currently on hold until a better characterization of anticipated future water development in the basin becomes available. 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. Further efforts need to investigate how to sufficiently disadvantage this emerging population in a native fish stronghold.

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 appear to have 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). 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 have remained stable since 1992 (Osmundson and White 2009). However, 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 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 third of three such capital projects), 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. 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.

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 from July through October.
- 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, which 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 1996 more than 33,000 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 released 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. low 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 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 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 secured 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. A 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 2018, 1,947,236 acre-feet of water has been released from reservoirs in the upper reaches of the mainstem (including Green Mountain, Ruedi, Wolford Mountain, Williams Fork, Granby, Windy Gap, Willow Creek, and the Palisade Bypass) to enhance spring and summer flows to improve habitat in the 15-Mile Reach near Grand Junction.

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. The Recovery Program will conduct monitoring under the PBO and the Aspinall Unit Study Plan (2011) 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 the Colorado rivers are sufficient for recovery in the Colorado River between the Gunnison River and Green River confluences. After this monitoring and assessment are completed, the Service's flow recommendations for the Colorado River at the Utah-Colorado state line (McAda 2003) may be revised, or others may be developed, as necessary.

Reclamation 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 has been necessary every year since screens were completed. From 2009-2017, the GVIC screen was operating, on average, 66% of the days during the irrigation season; during 2018, it was operational only 25% of the time because low flow conditions made operation difficult. From 2012-2017, the GVP screen was operating 92% of the days during the irrigation season; during 2018, the screen was by-passed for about 30 days (approximately 14% of the irrigation season), due to low flows and training a new facilities operator.

To restore floodplain habitats, levees have been breached at three sites (46 acres) and ten properties 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. UDWR and The Nature Conservancy are leading an effort to restore wetland habitat on the Scott Matheson Preserve near Moab, Utah. 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.

Nonnative fish are also a threat to recovery in the Colorado River drainage. Active removal of smallmouth bass began in 2004, and largemouth bass, northern pike, white sucker, and walleye are targeted. 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 the escape 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 two individuals captured in 2017 and again in 2018. 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. The 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.

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).

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 were 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. To prevent entrainment of adult and subadult endangered fish into diversion canals, a fish screen was installed at Redlands in 2005. In 2018, the Redlands screen was in operation 96% of the days during the irrigation season.

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 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. 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 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, yellow perch, and kokanee salmon) from McPhee Reservoir. 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), 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 pre-IME Plan 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 may be 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 and 2018. This stocking location is upstream of the PIT-tag antenna arrays. 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.

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.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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	X		Middle Green River is the priority reach at this time (Peak Flow Technical Supplement). 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 a sediment budget for this reach, to better understand Green River sediment dynamics. USGS collected these data throughout 2018, 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.
	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								
	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	Implement strategies via cooperative agreement. See General, VII.A.6.	The PDO will be meeting with flow protection experts in 2019 to begin identifying post-2023 flow protection priority needs, activities, and estimated costs in Colorado, Utah, and Wyoming.
	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]										Results of Colorado pikeminnow mercury exposure studies undertaken since 2008 published in Osmundson, B.C., and J.D. Lusk. 2018. Field Assessment of Colorado pikeminnow exposure to mercury within its designated critical habitat in Colorado, Utah, and New Mexico. Archives of Environmental Contamination and Toxicology 2018 September 26. Of concern is the conclusion that mercury concentrations in CPM are problematically high, particularly in the White and Green river basins.
	II.B.1.	Evaluate effects of selenium.	FWS-ES	Ongoing	X	X	X	X	X	X		Basin-wide, various selenium evaluations are underway:
	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	X		In the Green River basin, actions are underway to reduce or eliminate selenium impacts at Ashley Creek and Stewart Lake. 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. BRis 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, BRcontinues to fund a significant selenium remediation effort (Salinity Control Program) 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).

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
>*	II.B.2.a.	Ensure that all new petroleum product pipelines have emergency shutoff valves.	FWS-ES	Ongoing	X	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	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	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
	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								
	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 applying to fund 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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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	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 June 2019.
	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	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
>*	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	X	Maintain an active, robust nonnative fish removal program to suppress nonnative fish to levels sufficient to support native fish populations.	**!** The Program continues to adjust nonnative fish 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 2018. The Program will consider having a workshop in 2019. 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 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 2019. 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).
	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.
	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	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.).

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	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	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	X		
	III.A.2.e.	Increase law enforcement activity to decrease angling mortality.	STATES	Ongoing	X	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								158 report has been submitted for review. BC review delayed with lapse in appropriations.
>*	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	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.	! The flow spike study plan has been completed (Bestgen 2018) and approved by the BC. Experimental flow spike releases could be tested in the Green River below Flaming Gorge Dam in coordination with Bureau of Reclamation.
	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								
	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. Basin states met in 2018 to discuss this and other stocking agreements; this agreement was considered a model providing certainty to state and federal stakeholders for balancing the needs of native and sport fisheries.
	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 do develop and implement actions on this important issue.

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>*	III.B.7.b.	Implement actions	STATES	Ongoing	X	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 Basin wide Strategy on Recovery Program website (updated in 2015). List of compatible species for stocking updated as needed, 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.	All translocation ceased as of FY14.
	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	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, 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	Must-kill regulations are in place.

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	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	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 stakeholders, including the Recovery Program, 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.
	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	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). X 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 under design review. See Gunnison III.A.3.a. X Starvation Reservoir permanent screen construction delayed (in 2018), but new location chosen and project now progressing. See Duchesne III.A.3.b (3)
	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	Must-kill regulations are in place.
	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	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.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	III.H.	Reduce burbot numbers through all means practicable (including targeted removal) throughout the UCR Basin.	States / USFWS	Ongoing	X	X	X	X	X	X	Continue to work to prevent burbot establishment and will respond to any instance of burbot introduction.	One burbot captured in the Green River in Dinosaur National Monument in 2018 (see Green River). X Burbot Risk Assessment should be finalized. In light of burbot escapement and high runoff in 2017, burbot escapement risk should be fully understood. 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	Must-kill regulations are in place.
	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	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	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.
	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	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 Basin wide Strategy and Nonnative Fish Stocking Procedures. The States and FWS are collaborating on this topic where appropriate and possible. Utah continue 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. 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	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	Maintain genetic refuge for each of the species.	The 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), Colorado pikeminnow (Southwest Native ARRC). Upper Basin refuge humpback chub held at Ouray-Randlett (Desolation/Gray) and Grand Valley (Black Rocks). The Genetics Management Plan is becoming dated, potentially needing updates.
	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	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	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	X	Maintain genetic refuge for each of the species.	Upper basin bonytail broodstock are currently maintained and in active use at Southwestern Native Aquatic Resources and Recovery Center (Southwest Native ARRC). Because bonytail survival remains minimal, the Program has convened a working group to work through potential issues, including diet studies or stocking in new locations such as Lake Powell.
	IV.A.4.c.	Humpback chub.										A draft report (Bohn et al.) that summarizes the findings of Gila genetic analyses is under review. The original report was supplemented with chub samples from Westwater Canyon and reanalyzed.
	IV.A.4.c.(1)	Black Rocks ~~Canyon~~.	FWS-FAC	Ongoing	X	X	X	X	X	X	Maintain genetic refuge for each of the species.	One adult HBC from Black Rocks was lost during 2018, however 27 adult HBC are still being held at Horsethief Canyon Native Fish Facility. The adult HBC once again spawned voluntarily and produced several hundred age-0 HBC, however, only 18 age-0 HBC remained when the pond was drained in the fall due to biological control by age-1 Colorado pikeminnow. See IV.A.4.c.
	IV.A.4.c.(2)	Westwater Canyon.	UDWR	Ongoing	X	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	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	X	Maintain genetic refuge for each of the species.	25 humpback chub from Desolation Canyon were brought into Ouray NFH in 2009. Eleven 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.										

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	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	X	It is important to maintain a broodstock of Colorado pikeminnow for genetic integrity.	Additional collection of young of year Colorado pikeminnow has been requested by Southwest Native ARRC to replenish broodstock. 2018 collection efforts by field crews were unsuccessful. Program Office will continue to work with Southwestern Native ARRC and provide information to field crews.
	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	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	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								
	IV.C.	Operate and maintain facilities.										
	IV.C.1.	Ouray NFH: Randlett Unit.	FWS-FAC	Ongoing	X	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.2.	Ouray NFH: Grand Valley Unit.	FWS-FAC	Ongoing	X	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.3.	Wahweap.	UDWR	Ongoing	X	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	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 adults continue to accumulate in the Green and Colorado sub-basins (including Colorado inflow to Lake Powell). Spawning activity observed in numerous locations in the Green River, Colorado River, White River and Lake Powell. Pop estimates ranged from 25,482 (95% CI 10,184-67,749) in 2011 to 36,355 (95% CI 17,941-74,854) in 2013 in a report by Zelasko et al. finalized in January of 2018. Post-stocking survival of bonytail does not meet expectations. Stocking locations are being evaluated and the Program continues to try stocking bonytail in new locations in an effort to improve post-stocking survival (i.e. Dolores River). Flow training and predator avoidance are still being considered, as well as an alternative diet study.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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	X			X Post-stocking survival of bonytail does not meet expectations. Stocking locations are being evaluated and the Program continues to try stocking bonytail in new locations in an effort to improve post-stocking survival (i.e. Dolores River). Flow training and predator avoidance is still being considered, as well as an alternative diet study. Wahweap, 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. ! However, in May 2018 a 12-year old 495 mm bonytail was recaptured downstream of Westwater Canyon nearly 11 years post stocking and in excellent condition.
	IV.E.3	Modify stocking plans to ensure successful stocking.	Program	Ongoing	X	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	X		STReaMS continues to improve and stores data on over 1 million individual fish. Quality control and flagging tools have been added. Advanced query builders are scheduled for 2019 after delays were caused by funding uncertainties.
	V.A.1.a.	Develop basin wide razorback monitoring program (implementation to be reflected in sub-basin worksheets). Bestgen et al. 2012.	LFL	Complete								A species status assessment completed for razorback sucker demonstrated that improving species condition, largely the result of stocked individuals, warrants initiation of a robust monitoring program. This monitoring program may need to be designed differently than those of Colorado pikeminnow and humpback chub, because the population is largely comprised of stocked adults. Re-evaluation of Bestgen et al. (2012) may be warranted to determine if additional recommendations should be prioritized and implemented.
	V.A.1.a.(1)	Standardize light trap sampling	LFL	Ongoing	X							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.
	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	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; on the same order of magnitude as previous years. Colorado pikeminnow, bonytail and other native species were also detected.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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*	*X*	*Permanently installed antennas will need maintenance and periodic replacement to continue providing data.*	The need for periodic maintenance of permanent antenna arrays has been identified. In 2018, repairs were made as staff and funds were available. In 2019, a SOW will be developed to fund this activity specifically in 2020 and beyond.
	V.A.2.	Evaluate population estimates.	PD	Ongoing	X	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	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	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	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	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	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	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.
	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	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.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	V.H.	Reevaluate effects of disease and parasites and identify actions to ensure adequate protection.	FWS-ES	Ongoing	X	X	X	X	X			Diseases and parasites are considered during FWS species status reviews. Completed SSAs and 5year 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	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, American Water Resources Association Western Seminar, Rocky Mountain Coal Mining Institute Annual Conference, and CRWUA. Attended Ute Water Children's Water Festival, and Endangered Species Day, May, 2018 at the Denver Aquarium. Had display at Palisade Farmer's Market, Palisade Peach Festival, Palisade, CO. Did not attend photograph RBS release 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*	*X*		UDWR educates 4th grade classes about native fish. The Recovery Program provides them with outreach materials. In 2018, Ouray NFH Grand Valley Unit provided 33 tours and presentations of the 24 Rd. hatchery facility which included roughly 1013 visitors, comprised of 26 school groups and 7 professional or community groups. Ouray NFH Grand Valley Unit provided endangered fish for 4 community events reaching an audience of roughly 17,520 visitors. Additionally, Ouray NFH Grand Valley Unit provided endangered fish for 3 permanent fish tank exhibits which were seen by an estimated 35,500 visitors. The estimated total participants reached from our outreach efforts in 2018 was 54,083 people.
	VI.C.	Promote technical publication of study results.	PD	Ongoing	X	X	X	X	X	X		The Program supports authors' publishing their technical reports in professional journals (may use Program funds for publishing costs).

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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 reduced from 24 pages down to 20 and offers more color pages. Produced a four-page brochure called "On the Path to Recovery" for distribution to Congressional aides to highlight progress made in the recovery of the endangered fishes. Produced News releases; Individual press releases were produced for the recommended downlisting actions for humpback chub and razorback sucker. Additionally, a combined press release was produced with BR regarding partner water releases for the benefit of the endangered fish. Multiple news articles were produced as a result of these press releases, including regional and national outlets. We saw articles published in various newspapers across the basin. Web, radio and television events originated from the press releases. 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	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. Installation of signs continues into 2019 along the Green and Colorado rivers.
	VI.F.	Maintain Recovery Program technical library and library web page.	PD	Ongoing	X	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. 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	X			Existing recovery goals 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	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	VII.A.2.	Recognize the role of the Upper Colorado River Recovery Program in revised recovery plans.	FWS	Ongoing	X	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	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*	*X*				! USFWS completed 5-year reviews for humpback and razorback sucker in 2018, which recommended reclassifying the species as threatened and revising the recovery plans for both species. USFWS is working on the reclassification documents and will convene recovery teams in the near future to renew recovery goals. An SSA for Colorado pikeminnow will be competed in 2019, with a 5-year review. After completion of these two documents, the draft recovery plan will be revisited. 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	*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	*X*		
	VII.A.7.	Monitor and assess Recovery Program accomplishments annually.	PD	Ongoing	X	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	X			Biennial workplan will be completed in 2019.
	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	X			Program stakeholders and Program Director's Office hold committee meetings at appropriate time intervals.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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.								! Non-federal stakeholders responded to a 2018 OMB directive that cancelled the use of hydropower revenues for the Colorado River environmental programs in FY19 (and likely beyond), by passing legislation that secures appropriations at full funding levels. ! A number of specific projects were not completed in late FY18 / early FY19 because funding uncertainties caused multiple offices to send seasonal workers home early. For example, fall walleye removal in the Green and Colorado Rivers and late season smallmouth bass removal in the middle Green did not take place.
	VII.B.2	*Secure annual funding for the Programs (Upper Colorado and San Juan), 2020 through 2023.*	*Program*	*Ongoing*	*x*	*x*	*x*				*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 draft PL 106-392 reauthorization language in 2017. In response to the OMB directive (see VII.B.1; line above) language was revised to change the source of funding from hydropower revenues to appropriations. Language commits the recovery programs to work with the Secretary of Interior to draft a Report to Congress by the end of FY21, which describes recovery actions and associated costs needed post - 2023. ! These bills were signed by the President on March 12, 2019 under P.L. 116-9.
	VII.C.	Manage, direct, and coordinate Recovery Program activities.	PD	Ongoing	X	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 coordinator position and one admin officer 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 2018				
Facility	**Species**	**Target**	**Stocked**	**Percent**
Grand Valley (USFWS)	razorback sucker	6,000	7,423	124%
	bonytail	10,000	11,360	114%
Ouray Randlett	razorback sucker	6,000	6,259	104%
	bonytail	10,000	11,939	119%
Wahweap (Utah)	bonytail	10,000	10,333	103%
Mumma (Colorado)	bonytail	5,000	5,859	117%

Razorback sucker stocked by river 2018

Facility	**River**	**Stocked**
Grand Valley	Upper Colorado	4,385
	Gunnison	2,801
Ouray Randlett	Green River	6,167
	White River	92

Bonytail stocked by river 2018

Facility	**River**	**Stocked**
Grand Valley	Colorado River	11,630
Ouray Randlett	Green River	9,605
	Leota Complex	506
	White River	1,828
Wahweap	Green River	6,906
	Dolores River	3,427
Mumma	Colorado River	2,504
	Yampa River	2,592
	Salt Creek	763

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)	6,259	104%	385	7,423	124%	365
	Total by Facility	39,866			39,748		
	Total	**79,614**					

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					
	Total by Facility	113,002			53,308			175,482			33,392		
	Total	**375,184**											

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X		Unregulated Apr-July flow into Flaming Gorge Reservoir in 2018 was approximately 114% of the 1981-2010 average. Flaming Gorge releases were ramped-up to power plant capacity (~4600 cfs) on May 22-23 in order to boost larval RZB entrainment into Stewart Lake and other floodplain wetlands (resulting in ~11,000 cfs flow in the Green River at Jensen) -- see I.D.2.b.(4)(a) and II.A.5.a. In response to a supplemental Program flow request, an additional 2,000 cfs of bypass release (~6,600 total) was provided on May 29-30 for the same purpose, resulting in a bump in Green River flow at Jensen that peaked at ~12,600 cfs. The peak mean daily flow at Jensen of 12,100 cfs occurred on May 30, 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 June 23 and less than 2,500 cfs by June 30, establishing more favorable conditions for drifting pikeminnow larvae. Average August and September baseflows recorded at the Jensen gage (Reach 2) were 2,299 cfs and 2,215 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). **X** Water temperature differences: Bestgen and Speas reports that in 2018, in the period when Colorado pikeminnow larvae were present (20 June to 3 August), the Green River was cooler than the Yampa River by 5°C or more (i.e., exceeding the maximum difference recommended in Muth et al. 2000) on 17 days. Mean water temperature difference in that period was 4.6°C, with a maximum of 5.7 to 7.1°C. For additional details, see the 2018 Hydrologic Conditions Summary RIPRAP supplement.
	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	X		The first larval razorback sucker was detected on May 17 at the confluence of the Stewart Lake outlet canal with the middle Green River by the Green River Basin Fish and Wildlife Conservation Office (GRBFWCO); this and other RBS observations informed decisions regarding the timing and magnitude of spring releases from Flaming Gorge Reservoir for larval entrainment into floodplain wetlands.
	I.A.4.	Legally protect identified flows.										

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	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. ! Two proposed Bureau of Reclamation contracts with Utah (drafts of both undergoing NEPA review) would help ensure that up to ~145KAF of future new depletions on the Green River in Utah, exercised under Utah's existing Ultimate Phase water rights, would either be satisfied with water that remains in the river to Lake Powell (Lake Powell Pipeline Exchange Contract), or be offset with releases from Flaming Gorge Reservoir in a manner that continues to meet the recommended instream flows in Reaches 1 and 2 of the Green River (Green River Block Exchange 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	~~In progress~~ *Ongoing*	X	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	X							
	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								
	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, and (2) FWS's perspectives on legal protection for 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*						

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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 2018, as Utah's Green River Utah Water Acquisition Team (GRUWAT) was not active during the year. Discussion of possible long-term Green River flow protection strategies continue between Utah, FWS, TNC, USBR, and others. Implementation of two proposed agreements between BRand 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: 1. A Flaming Gorge Reservoir Exchange Contract to service ~73 kaf of Utah's 'Ultimate Phase' water rights with water exchanged out of Flaming Gorge. (Currently undergoing NEPA evaluation that includes evaluation of impacts to the flow targets of Muth et al. 2000). 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. (Also 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								
	I.C.2.	Determine winter use and seasonal flow needs for Colorado pikeminnow in the Price River.	UT/FWS	Complete								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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*	*X*		**!** In September 2018, UDWR in association with TNC received $660,000 from NRCS (PL-566 funds) to complete a watershed plan and EA for the Olsen Reservoir Project, which would support the conservation of native fish in the Price River system by securing excess irrigation water, storing it in an enhanced Olsen Reservoir, and releasing it to the lower river during dry periods. **!** In addition, the Price Municipal Corporation was awarded $670,200 in NRCS funds for planning and preliminary design of the "Price River Watershed Restoration and Enhancement Project." The funds will be used over a 24-month period, beginning January 2019, for work related to establishing a new reservoir at Garley Wash, replacing open irrigation canals with pressurized pipelines, and upgrading to more efficient irrigation systems. Among potential benefits are removal of diversion structures in the Price River that inhibit fish passage, removal of invasive plant species from the riparian corridor, and provision of higher and more consistent base flows in the late summer months that could benefit native fishes including Colorado pikeminnow. The PDO and FWS Utah Ecological Services Office provided letters of support for these funding requests.
>	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	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	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	X		Species composition during the draining phase of Stewart Lake included 10 age-0 razorback sucker and three speckled dace (Rhinichthys oculus), whereas the majority of the species composition (~100,000 fish total) was comprised of small-bodied nonnative fishes (99.97%).
	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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*	*X*				See General I.A.4.a	Throughout FY18 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, 25 calibrated-pump suspended-sediment samples were collected at the above Jensen station and 57 calibrated-pump suspended-sediment samples were collected at the above Ouray station, and 5 EWI measurements (measurements made using depth-integrating samplers deployed across the entire cross section) were made at each of these stations. Based on these measurements, USGS estimates that during FY 2018, between 110,000 and 260,000 metric tons of silt and clay and between 44,000 and 180,000 metric tons of sand were eroded from the segment of the Green River between these stations. All measurements and user-interactive sediment budgets for FY 2018 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 FY 2021 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 the Program 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	X	We expect BRwill use observed and/or predicted larval emergence to schedule spring releases from Flaming Gorge Reservoir.	The first RZB larvae in the middle Green River were detected on May 17 at the Stewart outlet. BRincreased Flaming Gorge flows beginning May 21, achieving 4,600 cfs release on May 22. The one-day peak at Jensen was 12,100 cfs on May 30 (12,600 cfs instantaneous peak) after a one-day peak release of 6,600 cfs from Flaming Gorge on May 29.
	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	*X*							LTSP synthesis being performed as part of the GREAT review, see I.D.2.i.
	I.D.2.c.	Develop baseflow and flow spike study plan. *Bestgen 2018.*	PDO/USBR/ ANL/LFL	In progress	*X*							! A flow spike study plan (to evaluate biological effects) was reviewed with the BC and finalized in 2018. A study plan to evaluate the biological effects of modified base flows is under development, along with a study plan to also evaluate the geomorphic / physical habitat effects of modifying base flows and implementing flow spikes.
	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 the Program during the base flow period in 2008.

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	I.D.2.c.(2)	Implement plan	PDO/USBR/ ANL/LFL/NPS	*In progress*	X	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	X		
	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*	*X*		See I.D.2.c -- a study plan to evaluate the geomorphic / physical habitat effects of modifying base flows and implementing flow spikes is under development.
	I.D.2.f.(1)	Conduct annual monitoring of larval Colorado pikeminnow.	*LFL*	Ongoing	X	X	X	X	X	X		
	I.D.2.f.(2)	Monitor age-0 Colorado pikeminnow in backwaters.	UDWR	Ongoing	X	X	X	X	X	X		
	I.D.2.f.(3)	Evaluate response of native fish to nonnative predator removal	UDWR	Ongoing	X	X	X	X	X	X		
	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*	*X*						Project is assessing the surface area and depth of backwaters in the middle Green River by integrating GPS sonar groundtruthing and remote sensing techniques. Surveys were conducted by WAPA and Argonne in FY17, and a summary report is anticipated in summer 2019.
	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	X						Technical Report for project FR-115 "Effects of Flaming Gorge Dam releases on the Lodore and Whirlpool Canyon fish communities" expected in 2019. Despite a high catch of northern pike in 2017, numbers of northern pike in 2018 were low in Browns Park (n=2). The catch rate for northern pike increased for Whirlpool in 2018.
	I.D.2.h.	Determine ~~entrainment~~ *escapement* (see also Green River Study Plan) of nonnative fish at Flaming Gorge Dam.	UDWR	Ongoing	X	X						X Burbot Risk Assessment is overdue. As called for in recent Flaming Gorge flow request letters, UDWR, NPS, PDO, WAPA agreed to develop a risk assessment of burbot escapement. The impetus for this risk assessment was anticipated spills to achieve endangered fish flow targets. Reclamation has more recently determined that spills will not occur to meet fish flows, therefore the risk assessment should consider flow analyses and potential future operations as described in the GREAT report. One burbot was collected in Whirlpool Canyon in 2018. 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.

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	I.D.2.i.	Integrate and synthesize reports for evaluation and recommended revision of flow and temperature recommendations.	PD/FWS	Ongoing	*X*							**X** This evaluation is behind schedule. The GREAT team met regularly in 2018 via conference calls plus one in-person meeting to complete writing assignments and refine the organization and content of the flow recommendations document. The team reviewed additional hydrologic modeling (developed by USBR) to inform the flow and temperature recommendations, and to better characterize relevant limitations, uncertainties, and concerns associated with their implementation. The GREAT report is currently undergoing final review and editing to produce a draft document suitable for a broader technical review in early 2019.
	I.E.	San Rafael River										
	I.E.*1.*	Assess need for tributary management plan for San Rafael River.										
	I.E.~~1.~~*2.*	Estimate future water demands on San Rafael River.	PD/Utah	Complete								
	I.E.~~2.~~*3.*	Develop tributary management plan for San Rafael River. Laub 2013.	BLM/Utah	Complete								The "Restoration and Monitoring Plan for Native Fish and Riparian Vegetation on the San Rafael River, Utah" (Laub, 2013) serves as the management plan as it includes fish passage, ecological flows, water quality, and monitoring plans.
	I.E. ~~3.~~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.										
>*	II.A.1.a.(1)	Construct water control structure and fish kettle.	BR	Complete								
	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)										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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 will incorporate 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 will incorporate 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.										
	II.A.5.a.	Stewart Lake	Program /UDWR	Ongoing	X	X	X	X	X	X	Ongoing site management by UDWR	Before the 2018 spring operations, UDWR had their habitat staff dredge the inlet canal (Dec. 2017). ! UDWR coordinated with Utah Forestry, Fire, and State Lands (FFSL) to approve a comprehensive burn plan to address extensive growth of cattails within the wetland. The first burn was completed on March 24 and April 11, 2018, and the burn plan will be conducted annually when cattail reduction is needed. Following the burn, UDWR requested some of the wetland supplemental water from the UIntah Water Conservancy District in order to flood the remaining rhizomes, but water delivery was delayed and occurred at a reduced rate (4 cfs). Cattails growth resumed in the spring, and the UDWR Habitat section applied herbicide on June 8 across 170 acres. Alternative control measures are being considered, such as goat grazing. First RZB larvae in the middle Green River were detected on May 17 at the Stewart outlet. BRincreased Flaming Gorge flows beginning May 21, and UDWR opened the outlet gate May 24-31. The inlet gate was then opened from May 31 to June 4. The wetland depth achieved a maximum of 4.78 feet on June 1. Larval RZB were detected in the wetland May 25 from 3 of 6 traps. Supplemental water deliveries began June 11 at a rate of 3 cfs through August 15, for a total of 762 acre-feet delivered. Despite this, low dissolved oxygen levels were recorded from early July until the wetland was drained beginning August 15. Wetland depth at the commencement of draining was 3.8 feet. Draining ceased on August 25. Wetland sampling in late July produced 2 RZB (43 and 55mm TL) and sampling was hampered by shallow water (0.3m) outside the dredged channel. Ten age-0 RZB were collected during draining. 100,960 fish were collected during draining, comprised of 99.97% nonnative species. These were entirely small-bodied fishes.
	II.A.5.b.	Johnson Bottom	Program/ FWS-NWR	Ongoing	X	X	X	X	X	X	Ongoing site management by FWS.	X Johnson Bottom was not inundated in 2018 in an attempt to reduce cattail density. The wetland was completely dry by the end of May. Being drained and dry since October 2017 should impact cattails in most of the wetland. This site should be ready for fish operations in 2019.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	II.A.5.c.	Old Charlie Wash.	Program/ FWS-NWR	~~Pending~~ *Ongoing*	*X*	*X*	*X*	*X*	*X*	X	Ongoing site management by FWS.	**!** The Ouray NWR was successful in renewing the lease with the Uintah and Ouray Ute Tribe, which restores Program access to this managed floodplain. This site was dry at the end of September.
	II.A.5.d.	Sheppard Bottom	Program/ FWS-NWR	Ongoing	X	X	X	X	X	X	Ongoing site management by FWS.	Sheppard Bottom was not inundated in 2018 due to low peak flows. It was dry by the end of September.
	II.A.5.e.	Stirrup	PDO / BR/ BLM / UDWR	Ongoing	X	X	X	X	X	X		! BR has developed drawings for the Stirrup site which include a water control structure and fish kettle. The PDO has met with the BLM Vernal FO and District Office to determine roles and start NEPA review. Reclamation is tracking $518K in capital funds for this project in FY20.
	II.A.5.f	Other sites	Program/ various	Ongoing, as needed	X	X	X	X	X	X	Ongoing site management (various agencies).	Leota: Ouray NFH stocked 506 adults bonytail and 192,860 RZB larvae into L-10. The larvae were part of a light trap efficiency study by CSU-LFL. Despite inflows of Pelican Lake water to L-10, the unit dried to a depth of 0.4m by September. Passive (PIA) and active sampling methods yielded no native fishes. L-7 was dry by the end of September. Above Brennan and Wyasket Lake: Dry by end of September. Stirrup: Completely dry in autumn 2018.
	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/~~Water users~~ Green River Canal Company	Ongoing	X	X	X	X	X	X	Maintain fish passage through O&M contract with local water users	! O&M contract was executed with Green River Canal Co. April 2018. X Fish passage was clogged with debris in spring and summer, but tags were detected on the antennas in each month except September. The fish passage documented presence of tags inserted in bonytail (n=419), Colorado pikeminnow (n=65) and razorback sucker (n=780). The vast majority of the bonytail were stocked in Green River, UT within a week of being documented at the passage, but fish stocked in 2015, 2016 and 2017 were present. Razorback sucker were commonly seen in July and August and represent multiple year classes.
	II.B.2.	Screen Green River Canal to prevent endangered fish entrainment.										
	II.B.2.a.	Assess need.	~~UDWR~~ *Program*	Complete								In 2018, 118 individual fish were detected on the siphon antenna, 58 were razorback sucker, 18 were bonytail, 12 were Colorado pikeminnow. The remainder were three-species or unidentified fish. In November 2017, UDWR and FWS staff captured and transferred five Colorado pikeminnow, one bonytail, four razorback sucker and thirty-three other native chubs to the mainstem Green River.
	II.B.2.b.	Design.	BR~~, NRCS~~	~~In progress~~ *Complete*								! Designs complete, see below. Environmental Assessment completed July 2018.
>*	II.B.2.c.	Construct.	~~Utah,~~ BR	~~Pending~~ *In progress*	X							! A construction contract was awarded in Sept. 2018. Construction began November 2018, with an anticipated completion in spring 2019.
>*	II.B.2.d.	Operate and maintain.	*FWS* /BR/Water users	~~Pending~~ *In progress*	X	X	X	X	X	X	Maintain fish screen through O&M contract with local water users	! O&M contract executed. See II.B.1.a

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	BR operates selective withdrawal structure at Flaming Gorge and monitors downstream temperature.	**X** In 2018, during the period when Colorado pikeminnow larvae were present (20 June to 3 August), the Green River was cooler than the Yampa River by 5°C or more on 17 days. The mean water temperature difference in that period was 4.6°C, with a maximum of 5.7°C. This is the third year in a row the temperature difference between these two rivers has met or exceeded the 5°C recommended maximum for 8 days or more during the CPM larval drift period, a concerning pattern now being considered by the Green River flow recommendations evaluation team (GREAT).
	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	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. BRis 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								
v*	III.A.2.	Control escapement of nonnative fishes from Ouray National Wildlife Refuge originating from Pelican Lake.	FWS-NWR	Complete								
v*	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.										
v*	III.A.4.a.	Northern pike in the middle Green River.	UDWR/ FWS	Ongoing	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	The total captures of northern pike (n=60) were down from 2017 (n=71), but catch rates during main channel electrofishing increased from 0.046 fish/h to 0.101 fish/h. 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.										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
>*	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								158 report finalized.
>*	III.A.4.b.(3)	Smallmouth bass in middle and lower Green River.	UDWR/FWS	Ongoing	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Echo-Split: Catch rates for SMB >100mm more than doubled from 2017, but were still much lower than 2013 and 2014. The majority of SMB captured were subadults and age-0. The distribution of small SMB increased near the confluence, point to successful reproduction in the Yampa River in 2017. Middle Green River: Catch rates increased for all size classes of smallmouth bass compared to 2017. Despite the drought conditions, large numbers of age-0 bass were not collected, unlike other reaches. Desolation Canyon: Catch rates increased from 2017 but were still comparable to 2015-16 and previous years. The size structure of this reach was skewed towards larger bass, particularly those classified as piscivores.
>*	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?	UDWR removed 2 catfish >450mm in Desolation Canyon, and 3 in Echo-Split.
>*	III.A.4.d.	Walleye in the middle and lower Green River	Program	Ongoing	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Crews removed 271 walleye throughout the Green River subbasin (a 15% increase from 2017), with the increase entirely attributed to captures in the lower Green River. Both total numbers and catch rates increased in this reach. Catch rates on the middle Green River were much lower for targeted removal. PIs hypothesized that the clogged fish passage at the Tusher Dam may have limited walleye movement to upstream reaches. X 4 bonytail and 1 Colorado pikeminnow were identified in the stomach contents of walleye in the lower Green.
	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 as forage and Wipers as the dominant predator. Multiple species are below optimal relative weights. Sterile Walleye stocking is not very effective and adjustments will be made in 2019 to stock larger individuals.
>*	III.A.4.f.	Install *& operate* permanent fish barrier at Red Fleet Reservoir.	UDWR	Ongoing	X	X	*X*	*X*	*X*	X	Maintain integrity of barrier long term.	Design is a coanda screen on Big Brush Creek below the dam outlet and temporary stilling basin screen when needed (reservoir spills infrequently). 95% design is under review and environmental compliance (NEPA and section 7) is ongoing. Estimated construction in Fall 2019 at estimated total cost of $400,000+.
>*	III.A.4.g.	Other emerging nonnative fishes.	UDWR/FWS	Ongoing	X	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 GRBFWCO captured a burbot in Whirlpool Canyon. Crews also noticed an increase in creek chub in the Echo-Split reach in 2018. X There were 7 grass carp caught in the lower Green, specifically between the Tusher Dam and the San Rafael confluence. 4 were diploid, 1 was undetermined, and 2 have not been analyzed yet.
	IV.	**MANAGE GENETIC INTEGRITY AND AUGMENT OR RESTORE POPULATIONS (STOCKING ENDANGERED FISHES)**										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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								
>	IV.A.1.c.	Implement plan. Superseded by ~~Basinwide~~ *Revised* Integrated Stocking Plan (2015), see General IV.B.2.	UDWR	Ongoing	X	X	X	X	X	X		In 2018, Ouray Randlett (USFWS) stocked 6,167 razorback sucker into the Green River. 16,511 bonytail were stocked in the Green River by Wahweap and the Ouray Randlett Unit. Ouray Randlett also stocked 506 bonytail into Leota 10, a wetland on Ouray NWR (see II.A.5.e.)
	IV.A.1.c.(1)	Conduct high-priority lab/field studies identified i	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	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.
	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	X	Continue to estimate abundance of humpback chub in Desolation/Gray canyons.	UDWR returned to Desolation / Gray canyons to reinitiate humpback chub population estimates in fall 2018. Sites included the four long-term sites with two additional sites chosen from previously sampled sites. They report an extrapolated total canyon populations estimate of N = 4,410 adults, which was heavily qualified by the PI because only two sampling locations met the prescribed capture criterion. UDWR incorporated more hoop nets and PIT antenna (PIAs) into their sampling protocol. Hoop nets provided good information on reproduction and recruitment. The PIAs yielded 27 detections. First year adults comprised 13% of the catch, which was the highest catch of this life stage since 2003. 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; 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.										

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	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	X	Continue to estimate abundance of Colorado pikeminnow in Middle Green River.	Sampling occurred throughout the Green River subbasin for the final year of this 3 year estimate. Total adult captures in 2018 (n=141) were the lowest since 2000. Recruit sized fish captures were low in 2016-2018. Juvenile captures were slightly higher in 2017 and 2018, particularly in the lower Green River. Bestgen et al. 2018 technical report found reduced captures and capture probabilities in the 2011-2013 sampling period. This study also concluded adult abundances have declined since the 2000-2003 estimates for the Green River subbasin. Declines were most apparent in the middle Green and White rivers. High numbers of recruits and juveniles in 2011 did not translate into adult abundance, and this lack of recruitment was hypothesized to result from increased incidence of walleye in the subbasin. There was a strong relationship between abundances of adults and young fish produced 7-10 years prior, underscoring the importance of strong year class production. Bestgen et al. 2018 was corroborated by analyses in the Population Viability Analysis (Miller 2018)
	V.C.2	Lower Green River. See Bestgen et al. 2005, 2010, *and 2018* .	LFL/UDWR/ FWS	Ongoing	X	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	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** For 2018 UDWR reported low (n=5) captures of age-0 pikeminnow in the middle Green River and moderately low numbers in the lower Green River. Suitable habitats for sampling were limited in the lower Green River. During lower Green River sampling for other projects, UDWR encountered high numbers of age-0 pikeminnow (total of 529) in July and August (before ISMP sampling).
	V.C.4	*Monitor larval Colorado pikeminnow.*	*CSU/FWS*	*Ongoing*	*X*	*X*	*X*	*X*	*X*	*X*	*Continue monitoring larval Colorado pikeminnow.*	The first larval pikeminnow was captured from the lower Yampa River on June 20, and reproduction occurred over a 44 day period (August 3). Abundance of larvae was below average in 2018.
	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	X		In 2018, razorback sucker larvae were captured from May 17 through June 8. Samples are still being identified and processed. 321 razorback larvae were collected in 2017, which is similar to the 2014-2016 results. PIT antennas under two programs (169 and 172) detected thousands of unique razorback sucker in the Green River at known spawning locations; on the same order of magnitude as previous years. Colorado pikeminnow, bonytail and other native species were also detected.

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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	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 at the Maybell gage location. Results 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	X		
	I.B.	Yampa River above the Little Snake River										
	I.B.1	Initially identify year-round flows needed for recovery.	FWS-FAC	Complete								
	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.										

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	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.	CWCB, CDWR	Complete								CWCB is working with Colorado Division Water Resources. 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	X	Continue delivering Elkhead flows.	In anticipation of a low runoff year, the PDO in April reserved 500 AF of 'short term water' in Elkhead Reservoir (in addition to the 5,000 AF available annually). Weekly Yampa River flow coordination calls began July 11. The base flow target for the Yampa River at Maybell was 93 cfs for the months of Aug through Oct. Releases of Elkhead water to augment instream flow began July 25 and continued through Oct 8. Continued drought and the rapid deterioration of streamflow conditions (for the first time in history, an administrative call was placed on the lower Yampa River) spurred the PDO to lease an additional 1,500 AF of water from Elkhead Reservoir on Sept 4. **X** A total of 7,000 AF was released for endangered fish over the course of the irrigation season (5,000 AF permanent pool + 2,000 AF leased 'short term supply'). Nevertheless, flow at the Maybell gage dropped below the 93 cfs target for a total of 47 days in 2018, reaching a minimum of 38 cfs on Oct 2 (provisional USGS data). Some lower Yampa River reaches were observed with days of zero flow. **!** Observations of low-flow hydrology in 2018 led the Division 6 Engineer to reduce transit losses assessed on Elkhead Reservoir releases from 0.5% per mile to 0.1%. This allows substantially more Program water released from Elkhead to be protected from diversion downstream. This winter, the Division Engineer will further review and possibly adjust her Yampa transit loss assumptions. For additional details, see the 2018 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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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, and may already be out of date with respect to future water demands or modified project operations. USFWS's position is that downlisting the endangered fish must presume current flow protections remain in place, and longer-term protections would be established. 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	X		! CWCB provided draft depletion accounting for the Yampa River on March 5, 2019. [Note: this does not, at this time, include a 'back-casted baseline of current depletions', as questions on the best methodology need discussion with a broader group.]
	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								
	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		See I.B.3.e. The Yampa PBO includes coverage for new water development in the Little Snake River basin. 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 ~3,000 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								

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	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 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 against storage releases. Losses were reduced from 0.5% per mile to 0.1% in summer 2018. Further review by the Division Engineer this winter may result in further adjustments to transit losses. Lower transit losses allow more Program water released from Elkhead Reservoir to be protected from diversion downstream.
	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								
	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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.	CPW monitored the reservoir behind the spillway net. No fish were captured at the spillway site during pre-spill sampling. Post spill sampling at the spillway site yielded a total of 41 fish from four species. It is likely that fish moved into the spillway site in between pre- and post- spill sampling as a result of the spillway net being submerged (see III.B.1.a.(2) below).
>*	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	~~Complete~~ *Ongoing*	*X*	*X*	*X*	*X*	*X*	*X*	CPW will monitor and maintain Elkhead net per agreement with Program; CRWCD will maintain outlet screens.	CRCWD observed the spillway net submerged during a modest spill level in April 2018, and altered releases to use the outlet instead. The net manufacturer, PNP, subsequently evaluated the net twice and determined the submersion was likely from dense algal growth and insufficient buoying. PNP made modifications to improve performance. They also recommended rigorous cleaning of the top portion of the net. A review of 2018 reservoir operations and hydrology suggests there may have been other times during the April runoff period when the spillway net may have been compromised (overtopped) when water flow exceeded 600 cfs. Although the total time that FY 2018 the spillway net was compromised is unknown, this situation presented an opportunity for fish to pass over the spillway net and enter the spillway site. CPW managed six total spillway net cleanings and inspections. Four spillway net inspections/cleanings by local contractors, and two by the net manufacturer. CPW plans to continue with at least four net spillway cleanings/inspections in 2019 to maximize performance of the net. ! Costs of cleaning ($12K) 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	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 third Elkhead Classic harvest tournament in 2018. Anglers removed over 300 northern pike and over 500 smallmouth bass in 9 days.
	III.B.1.a.(2)(a)(i)	Revise Lake Management Plan	CPW	Complete								
	III.B.1.a.(2)(a)(ii)	Install screen	CRWCD	Complete								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	CPW will stock replacement fisheries until populations no longer warrant stocking.	CPW stocked largemouth bass (300K fry), bluegill (100K fry), and black crappies in accordance with the LMP.
>*	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	X	Continue addressing nonnative fish escapement at upstream reservoirs in the Yampa Basin through maintenance of escapement prevention devices and control actions.	! CPW completed a rotenone treatment of Chapman Reservoir in November 2018. CPW expects the treatment to be fully effective, and will evaluate in the spring.
>*	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 no longer tags northern pike under standard sampling; all are removed. CPW removed 55 walleye in 2018. CPW would require Program funding to implement a targeted removal effort of northern pike and walleye (currently CPW conducts monitoring and removes pike). CPW continues to work with Upper Yampa Water Conservancy District on northern pike control options at Stagecoach Reservoir. CPW continues to support harvest tournament at Stagecoach, and requires removal of walleye and northern pike.
	III.B.1.b.(2)	Install escapement prevention at Lake Catamount	CPW / Program	Ongoing	X	X	X	X	X	X		CPW has continued work at Catamount to reduce northern pike population. Population has shifted to smaller individuals and other species have increased in abundance. CPW removed 750 northern pike in spring 2018. X A working group to hear local stakeholder concerns and plan for potential alternatives did not meet in January 2018 because of government shutdown; meeting has not been rescheduled because PDO has not had staffing capacity to work on this location (has prioritized other reservoir screening projects). Working group should be convened in 2019.
	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	X		! CPW and FWS removed 203 northern pike in five weeks of netting in 2018. This project has shown yearly declines in total catch (including electrofishing downstream of Craig) since 2015 when this project began in earnest. Only 7% of mature female northern pike had spawned prior to capture.

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	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)*	~~CPW / Program / BR~~ *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	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.).
	III.B.1.e	Other emerging nonnative species	Program	Ongoing	X	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										
	III.B.2.a.	Estimate nonnative abundance, status, trends & distribution (YS I-3)	Program	Ongoing	X	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 will perform a mark-recapture estimate of northern pike in the upstream 98c reach in 2019. Because electrofishing catch rates of northern pike have declined subsequent to backwater gill-netting (see III.B.2.d and d.(1) below), Program will undertake 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).
	III.B.2.b.	Develop and refine nonnative fish removal criteria (YS K-1)	Program	Ongoing	X	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	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	X	CPW will monitor and continue removal actions at appropriate levels.	! Northern pike electrofishing catch rate and total numbers have declined for the third consecutive year, to the lowest level since 2004. Intensive backwater netting and main channel electrofishing continue to impact this population.
>*	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	X	Monitor and continue removal actions at appropriate levels.	! The number of northern pike removed declined again since CPW began using gill nets to remove northern pike from the Yampa River in 2014. Total numbers and catch rates of northern pike in the Hayden to Craig (98b) reach increased slightly from 2017, but were still generally low.

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>*	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	X	Monitor and continue removal actions at appropriate levels.	For Little Yampa Canyon, the estimated adult abundance decreased and catch rates remained low. Subadult catch rates increased slightly, and overall increases in catch were driven by a large year class of bass produced in 2017, which was similar to levels observed from the 2012 and 2013 year classes. Effort for all gear types in the middle Yampa River increased in 2018. In Yampa Canyon, the catch rate for bass >100mm nearly tripled. In addition, a large year class produced in 2017 (mostly <100mm) was apparent, and exhibited 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	X	Monitor and continue removal actions at appropriate levels.	GRBFWCO removed 56 channel catfish larger than 400mm. It is likely low flows made sampling these fish more effective.
	III.B.2.g.	Develop and refine native fish response criteria (YS K-2)	Program	Complete								
	III.B.2.h.	Monitor native and endangered fish response (YS L-2)	Program	Ongoing	X	X	X	X	X	X	Monitor endangered fish populations under a monitoring plan.	Project 110 continues to find native fishes are common within Dinosaur N.M. Native fish species richness increased from 2003 until a peak of 2011, but has declined and remained low through 2017. Likewise, the frequency of samples with native fish increased through 2011, showed a decline, and has remained relatively stable at a moderate level from 2013-2017. Roundtail chub exhibited a delayed response to large year classes of smallmouth bass produced in 2012 and 2013, and declined in 2013-2017. A synthesis report is expected for Project 140 in 2019.
	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	X			In June 2018, Colorado's Mumma (NASRF) State Hatchery stocked 2,592 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 ~~translocating~~ reintroducing humpback chub to Yampa River	NPS / WAPA / CO / UT / BR/ PDO	Ongoing	X							Stakeholders are developing a proposal to reintroduce humpback chub.
	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	X			Gila are monitored under project 110. Project 169 (PIT antennas) detected 6 bonytail at Echo Park. All of these fish were stocked at Mantle Ranch: 2 in 2016 and 4 in 2017.

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	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 106 unique Colorado pikeminnow, one razorback sucker, 8 bonytail, and other native species. This is a notable increase in Colorado pikeminnow from previous years.

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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	X							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. The White River Planning Team plans to define in 2019 a future development scenario(s) to model for the Management Plan.
	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	X							! The draft report "Review of Fish Studies and Flow Recommendations for Endangered Fishes of the White River, Colorado and Utah" was substantially updated from the 2012 version and distributed in 2018 for technical review. FWS incorporated considerable information on endangered species use of the river since 2012, and used Wilson Water Group's recent modeling of historic and current baseline hydrologic conditions, together with historic and recent river studies, to recommend flows to protect important components of the current annual hydrograph. FWS Water Resources (Tom Econopouly) assisted with this effort. FWS solicited comments on this document in 2018 from the BC, WAC, and White River Planning Team; in 2019 FWS plans to review with interested parties its proposed revisions to the document in response to those comments.
	I.B.3.	Develop and implement a White River management plan	Program	Pending	~~X~~	X						The White River Planning Team will work on a White River Management Plan after the Wolf Creek Reservoir feasibility study becomes available, expected at end of 2019. In 2018 CWCB sent a draft RFP to White River Planning Team to contract writing the Management Plan. The Workgroup also prepared a draft annotated outline of Plan contents. In 2018, the Northern Ute Tribe became actively engaged as a partner in this process.
	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	X					FWS expects to eventually prepare a PBO based on the White River Management Plan, but this will not occur in 2019. Timing of that PBO depends upon the timing of developing the Management Plan (see I.B.3). In 2018 the FWS Western Colorado Ecological Services Field Office became engaged in the Planning Team's discussions of possible Management Plan contents and strategies. They have indicated that finalized endangered fish flow recommendations will provide an important metric in their future Section 7 consultation analyses.
	I.C.	Evaluate how identified flows will be legally protected.	CWCB	Pending	X							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								
	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).										

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	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*	*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*	*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.	X CPW discovered one northern pike in Kenney Reservoir in October 2018. No additional pike, nor any smallmouth bass or other unexpected fish were collected during subsequent extensive reservoir sampling. The upstream fish assemblage was as-expected, with no smallmouth bass, northern pike, yellow perch or other novel fish being collected.
	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	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	Monitor and implement appropriate actions.	X 4 gizzard shad were caught in the Colorado reach of the White River in 2018. This species has only been observed in this river with the capture of a single fish in 2012. White sucker hybridization is an ongoing concern. 2 northern pike were caught in the White River in 2018. One was captured in 167 work in Colorado and another in the Ute Tribe reach during Colorado pikeminnow estimates. The one caught during Project 128 had two PIT tags in it from recently stocked bonytail.
	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	X	Monitor and continue removal actions at appropriate levels.	**X** Smallmouth bass continue to successfully spawn and recruit in the White River. Catch rates in the Colorado portion for 2018 were the highest yet. While the population's size structure is largely comprised of two year classes produced in 2016 and 2017, adult catch rates are high. Adult catch rates show a gradient of high density near Taylor Draw Dam decreasing in a downstream direction. Subadult catch rates were high throughout the reaches sampled. UDWR was not able to conduct multiple passes in their most upstream reach to disrupt spawning, due to low flows in 2018. **!** Rio Blanco Water Conservancy District conducted a flow spike on July 19, which was mainly focused on dislodging algae from the river banks (90-minute release from Kenney Reservoir at 1,100 cfs, and a reported rise in river elevation of 3.07 feet at the Town of Rangely diversion structure). While this spike flow did not produce a clear effect on SMB reproduction, it did show some level of flow manipulation may be possible. Program partners will continue to coordinate with RBWCD and try to determine if these flows can be timed for mutual benefit.
	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	X			In 2018, Ouray Randlett stocked 92 razorback sucker and 1,828 bonytail in the White River at the Enron boat ramp.
	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 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 2018, the PIT antenna at Bonanza detected tags implanted in 247 bonytail, 41 Colorado pikeminnow and 3 razorback sucker. All of the bonytail were stocked in 2018, but detections of the bonytail continued through December. Adult Colorado pikeminnow population estimation efforts in the White River are a component of the Green River abundance estimates and are reported there. YOY monitoring for three species in the Utah portion of the White River demonstrate declining catches, concurrent with increases in smallmouth bass catches.

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	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	X		At its Oct 2018 meeting, the Duchesne River Working Group (DRWG) indicated they've drafted the 5-year update to their 2013 water management report. PDO is awaiting that draft for comment and finalization.
	I.C.	Legally protect and deliver identified flows.	UT, CUWCD, FWS	Ongoing	X	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-through-July runoff at the Randlett gage was only 24% of average. In a dry year, there is no peak flow target. The 'Priority 4' target in 2018 was 115 cfs at the Randlett gage from March to June, and the 'Priority 1' target was 50 cfs through the low-flow season. **X** Because of the dry conditions and Starvation Reservoir spilling in spring 2018, CUWCD used all the fish pool water in the Duchesne River (6,584 AF total deliveries) by late August/early September. Nevertheless there were 108 days where flow dropped below 50 cfs at Randlett, the second-highest since fish flow releases began in 2004. From March to June, there were 73 days of flow below the 115 cfs target. For additional details, see the 2018 Hydrologic Conditions Summary RIPRAP supplement.
	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	~~Pending as opportunity arises~~ *In progress*	*X*	*X*	*X*	*X*	*X*	*X*		Temporary Sec 207 contracts are in place for the 2016-2020 delivery seasons. In 2018, 1,500 AF of Sec 207 water was leased from Big Sand Wash Reservoir 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								
>*	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	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 2018 to support Duchesne River base flows.
	I.D.	Coordinate reservoir operation.										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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								DWR operated the Myton Diversion fish passage from March 27 to May 23. The passage passed 36 native fish including 35 speckled dace and one age-1 bluehead sucker. DWR removed 78 invasive species at the fish passage. In 2018, the number of fish handled at the fish passage was barely half what was handled in 2016 (114 compared to 203). The low water year probably contributed to the low passage numbers, as flow cues were minimal at the passage. Water Rights and the river commissioner stated they were adequately notified of the fish passage operation.
	I.E.	Examine the feasibility of other options for obtaining water.	BR/DOI/PD/ Ute Tribe	Ongoing	X	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, but available volumes and delivery constraints continue to preclude consistently meeting base flows during the summer period in drier years. Since 2004, flows have fallen short of the 50 cfs late-summer target an average of 46 days/year (maximum 109 days in 2013). 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								
	I.G.	Evaluate and revise as needed, flow regimes to benefit endangered fish populations	FWS/ Program	Pending			X					Utah DWR sampled fish at three locations above the Myton Diversion in September 2018: The majority of the fish were native species (largely mountain suckers and speckled dace), but there were several non-native species including brown trout and white sucker. One flannelmouth sucker was found. 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 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.)										

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	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								
>*	III.A.3.b (3)	Implement recommendations from the escapement strategy.	UDWR/ CUWCD/ USBR/ Program	Ongoing	X	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 has been in place during spills since 2015. Stilling basin treatments have taken place to remove fish that are present post-spill. X Construction was postponed in 2018 because of late arising questions of design and location. Location has been moved below the Primary Jurisdiction Zone and design has been approved by stakeholders. Construction is possible in 2020.
>*	III.A.3.c.	Remove nonnative fish (smallmouth bass, ~~channel catfish,~~ *walleye,* and northern pike). See III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.	FWS-FAC/ Ute Tribe/ UDWR	~~On hold~~ *Ongoing when possible*	X	X	X	X	X	X	UDWR and FWS will work with the Ute Tribe to implement removal at appropriate levels.	One triploid grass carp removed from the Duchesne in 2018. This is the first grass carp confirmed to be triploid since samples have been analyzed for ploidy. One juvenile walleye removed from the Duchesne (TL=286mm) in 2018

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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	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		**X** Still overdue. CWCB is still working to finalize internal review. CWCB has provided the PDO with some draft results that can be used by the PBO to initiate compliance review, but final results are still being processed and will be needed to complete the PBO review. We are optimistic that CWCB will deliver this report to the Program in 2019.
	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	Pending	*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. That report was originally anticipated in 2016. Comments were received in 2016 from water user and environmental representatives, but finalization has been delayed awaiting CWCB delivery of their depletions report for the basin (see I.A.3.c). Using the summary depletions information provided by CWCB in 2018 (still awaiting the report), the PDO is moving ahead with a final draft PBO Review, which they expect to circulate for partner review in early 2019. Any determination for additional flow protections rests with the Program and WAC, but will be recorded within the CWCB depletions report. 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 been no significant new net depletions in the Colorado River since that time. Post-2023 planning efforts should evaluate what kind of long-term flow protection (e.g., conservation agreements) would be appropriate to succeed the Program.
	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								

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	I.A.4.c.	15-Mile Reach.										
	I.A.4.c.(1)	Instream flow water right secured - 581 cfs (July - September).		Complete								
	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 2018 was near normal, but dry soil conditions and early melt resulted in only 55% of average Apr-Jul runoff at the Cameo gage. No Coordinated Reservoir Operations (CROS) were implemented in 2018 due to the low runoff conditions. Peak mean daily flow (May 14) was 6,500 cfs at the Cameo gage (compared to long-term average 14,000 cfs), and 5,780 cfs at the Palisade gage. The formal base flow target for the 15-Mile Reach Aug-Oct was 810 cfs. However it was apparent by July that due to drought conditions it would likely be prudent to operate to lower targets (e.g., 400 cfs) to help ensure adequate water later in the season. A total of 30,909 AF Program water was released from Ruedi, Wolford, and Granby Reservoirs to augment base flows. An additional 18,812 AF was released from Wolford Reservoir by CRD for maintenance purposes which was protected to and through the 15-Mile-Reach from mid-July through the end of August. Additionally, BRin April released 2,356 AF from the Green Mountain Reservoir HUP 2017 carryover pool to alleviate problematically low 'April Hole' flows. Collectively, these reservoir releases in 2018 totaled 52,077 AF for the benefit of the 15-Mile Reach. X In spite of substantial releases to augment flow in 2018, monthly mean flows in the 15-Mile Reach fell short of the 810 cfs dry-year target August through October: Aug 642 cfs; Sep 265 cfs; and Oct 764 cfs (provisional USGS data). Flows in the 15-Mile Reach fell below 200 cfs for 12 days in Sept-Oct. ! As dire as flow conditions became in the 15-Mile Reach during the 2018 irrigation season, they would have been much worse if not for the exceptional cooperation and contributions of Program stakeholders. As noted, CRD coordinated with the Program to provide 18,812 acre-feet of Wolford Reservoir maintenance releases timed to benefit the 15-Mile Reach. In addition, ExxonMobil subsidiary XTO Energy freed-up 5,000 acre-feet of contract water in Ruedi Reservoir that became available for endangered fish releases, and CWCB leased 6,000 acre-feet of water from Ute Water to benefit instream flow. Reclamation played an important role in facilitating the contributions, exchanges, and deliveries.
>*	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	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 39,909 AF of 2018 Program water releases mentioned under 1.A.5 includes 5,000 AF of water from the annual Ruedi environmental account + 3,084 AF of water delivered from the "4 out of 5 year" account. At the start of the 2018 irrigation season, Reclamation declared that **no** 4-in-5-year water would be available due to the failure of Ruedi to fill. The status of the 4-in-5 pool changed in late September after ExxonMobil subsidiary XTO Energy voluntarily freed-up 5,000 AF of its own contracted water in Ruedi, at which point Reclamation declared 5,000 AF of 4-in-5 water available. Releases from this pool began Oct 4 and terminated Oct 14 when natural flow conditions rebounded.
>*	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, representing the West Slope's contribution to the 10,825 AF commitment.
>*	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 provides an additional 6 KAF to 12 KAF of 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 provided 6,000 AF of augmentation water in 2018, bringing total 2018 Ruedi releases to benefit 15-Mile-Reach baseflows to 19,496 acft.

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	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								
	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	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/FWS/ CWCB	Ongoing	X	X	X	X	X	X	Continue to deliver available water	See I.A.5. In 2018, 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, and crucially important in this extreme drought year, CRWCD released 18,812 AF from Wolford Reservoir in July and August (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	X	Continue to deliver available water	Due to poor spring runoff conditions, no Coordinated Reservoir Operations (CROS) were implemented in 2018. This is the first year since 2014 that CROS did not supplement peak flows in the 15-Mile Reach.
	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								

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	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								
	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							No Program expenditures were made in 2018 for OMID efficiency improvements. BR did gather some data and undertake some design work in anticipation of completing the design of an automated outlet valve in winter 2018-19. Plans are to proceed with constructing those improvements in spring 2019, prior to the irrigation season.
	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 will distribute this document in early 2019 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	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	X		See I.A.4.a.(3) above; a draft 2015 15-Mile Reach PBO Review is being revised based on comments received.
	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.										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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								
	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	X		Reclamation continues to hold two Aspinall Operations meetings annually with stakeholders.
	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								
	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 the Program 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 the Program 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	X		Monitoring of the fish community response in the lower Gunnison and upper Colorado Rivers (18-mile reach) occurs annually under Project 163. In 2018, three razorback sucker were captured in the 18-mile reach. The native fish communities are monitored using CPE data. PDO received a draft report for 2011-2016 (also see Gunnison I.D.1.b.(1) and V.A.2). 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	X		see Program Element V. Monitor Populations, below

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	I.B.6.	Integrate and synthesize information to evaluate *and revise the endangered fish flow recommendations as necessary.* ~~recommend necessary revision of the proposed action~~	Program	Pending	X					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	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								
>*	II.A.2.c.	Construct.	BR	Complete								
>*	II.A.2.d.	Operate and maintain.	BR	Pending, as needed								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X		
	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. The PDO recommended using these funds to install a water control gate and screens to exclude nonnative fishes. UDWR plans to test run the wetland in 2019 after current construction is complete in order to evaluate the ability to entrain razorback sucker larvae. Current Phase I construction entails excavating the channel from the river to the wetland, and excavating a central channel within the wetland. Phases II and III will involve expanding the wetland habitat and acquiring supplemental water for the site. UDWR/TNC are seeking funding for the remaining work.
	II.A.7.a.	*Develop and approve management plans.*	*UDWR*	*In progress*	*X*							
	II.A.7.b.	*Site design/complete environmental compliance.*	*UDWR/ TNC*	*in progress*	*X*							
	II.A.7.c.	*Construct.*	*UDWR/ TNC*	*in progress*	*X*	*X*	*X*					
	II.A.7.d.	*Operate and maintain.*	*UDWR*	*Ongoing*	*X*	*X*	*X*	*X*	*X*	*X*		
	II.A.7.e.	*Monitor and evaluate success; modify as needed.*	*UDWR*	*Ongoing*	*X*	*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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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.										The PDO and Reclamation met with GVIC staff and with the GVIC Board in 2018 to discuss the Recovery Program and the GVIC's concerns with fish passage and fish screen operations.
	II.B.1.b.(1)	Design.	BR	Complete								
>*	II.B.1.b.(2)	Construct.	BR	Complete								
>*	II.B.1.b.(3)	Operate and maintain.	FWS-FAC/BR	Ongoing	X	X	X	X	X	X	The GVIC screen will need to be maintained and operated in perpetuity.	**X** GVIC's fish screens were operated only 25% of the time during the irrigation season in 2018, primarily due to the difficulty of operating under the very low flow conditions. Ongoing challenges operating GVIC fish screens led to a meeting between GVIC, Reclamation, and FWS in March 2018 to discuss possible long-term improvements. One outcome was a recommendation to evaluate 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 future screens. The Program funded an initial floodplain impacts analysis of this concept.
	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	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	X		The Price-Stubb PIT tag antennas (at river mile 188.3) detected over 600 unique fish in 2018. Six native species were detected including endangered bonytail (n=49). razorback sucker (n=167), and Colorado pikeminnow (n=12). The remainder are either 3-species or unidentified tags. The most movement occurred in May.
	II.B.3.	Restore fish passage at Government Highline (aka Grand Valley Project, Roller Dam, *Grand Valley 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	X	The GVP passage will need to be maintained and operated in perpetuity.	Again in 2018, the roller closest to the fish passage was opened to sluice sediment from the passage, but benefits were limited by reduced summer flows and summer rainstorms. The Program recommends continuing this maintenance annually.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	II.B.3.a.(4)	Monitor and evaluate success.	FWS-FAC/BR	Ongoing	X	X	*X*	*X*	*X*	*X*		In 2018, the fish passage operated for 58 days, between 1 May and 28 June, before it was closed because of low-flow conditions in the river. 10,210 fish used the passage, including four endangered razorback sucker and two humpback chub. The majority of the fish that used the passage were native species (88.7%). 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								
>*	II.B.3.b.(3)	Operate and maintain.	FWS-FAC/BR	Ongoing	X	X	X	X	X	X	The GVP screen will need to be maintained and operated in perpetuity.	Operation of the GVWUA fish screen in 2018 began on Apr 16 and terminated Oct 29. These screens operated 86% of days during the irrigation season (213 days total), with some interruptions for minor operational needs and low-flow challenges.
	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	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 Aspinall 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	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	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	III.A.3.b.	Remove nonnative centrarchids from backwaters and other low velocity habitats.	FWS	Complete								
	III.A.4.	Preclude escapement from ponds in critical habitat as needed and feasible.										! Northern pike numbers are declining in Mamm Creek Pit#1 in response to continued removal using the Merwin Trap and other sampling techniques. No northern pike were collected in Pits #2 or #3. USFWS removed over 7,500 nonnative fish from three off-channel ponds in the Grand Valley (Beswicks, CDOT, and Butch Craig). Black bullhead and largemouth bass dominated at Butch Craig; bluegill and black crappie dominated CDOT and Beswicks.
	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, 2018 was the second year of three for fertile walleye removal paired with sterile walleye stocking. CPW removed 57 females (87 in 2017).
	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	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								
>*	III.A.6.	Develop and implement program to identify required level of smallmouth bass control.	FWS/CPW	Ongoing	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	Despite limited sampling due to low flows, crews removed 8,945 smallmouth bass. The majority of these fish were age-0 and subadults, with the highest catch rates observed for both size classes. 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	X	Monitor and continue removal actions at appropriate levels	Northern pike continue to be uncommon in the Colorado River. There were two individuals captured in 2018: one below Westwater Canyon, and one in the Gunnison near Delta (see Gunnison tab). Addressing off channel habitats appears to be the most effective control strategy to prevent escapement and in-river establishment.
>*	III.A.8.	Walleye in the Colorado River	FWS / UDWR / CPW	Ongoing	X	X	X	X	X	X	Monitor and continue removal actions at appropriate levels	X There was reduced effort in the Colorado River subbasin this year due to a variety of factors. Only 76 walleye were removed, mainly during projects that target this species. 36 walleye were removed from the reach just below Westwater Canyon, which raises concern since this reach supports a core population of humpback chub.
	III.A.9	Other emerging nonnative fishes.	FWS / UDWR / CPW	Ongoing	X	X	X	X	X	X	Monitor fish community of the Colorado River and respond appropriately to any new introductions or proliferation of nonnative species.	2018 produced the 2nd highest catch of gizzard shad in the Colorado River (n=2,057). Largemouth bass captures in the river main channel increased substantially in 2018. PIs are looking into a potentially new off-channel source in the Grand Valley. Largemouth bass in this reach tend to be smaller subadults that do not appear to be self-sustaining in the main channel. No grass carp were collected in 2018, however effort was limited. X Three striped bass were collected between Moab and Coates Creek (Cisco). Another 2 were collected in the Grand Valley (Clifton and Redlands Fish ladder). The two in the Grand Valley are the first observations of striped bass above Westwater Canyon.

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>*	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	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 Rifle and Parachute, and from Debeque to Beavertail. 59% of smallmouth bass (n=75) were collected in a single backwater at RMI 228.8. Investigation into the source of these bass is recommended. No northern pike were collected in 2018, and no adult smallmouth bass were collected.
	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								
	III.B.1.a.	Operate and maintain Highline Reservoir net.	CPW	Ongoing	X	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 2018. CPW oversaw 5 net cleanings in 2018; the long, hot summer necessitated the fifth cleaning because of increased algal growth in 2018. Issues with net performance (gaps between lake bottom and net) were noted and repaired in 2017. CPW monitored the area between the spillway and the net twice in 2018, pre- and post-irrigation. A total of 673 fish, including 362 gizzard shad were surveyed during the pre-irrigation survey in 2018. This represents the largest number of gizzard shad surveyed between the spillway net and the spillway that CPW has seen during these annual surveys. The post-irrigation season survey yielded 135 fish which was a substantial decrease and consisted primarily of green sunfish 60-100 mm in total length, with only four gizzard shad. 2018 Mack Wash sampling data do not show any substantial increases in the number of non-native fish present in Mack Wash downstream of Highline Lake despite increases in non-native fish abundance behind the spillway net, and the canal surge in the fall of 2018 which likely reduced the effectiveness of the spillway net.
	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	X		
	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.										
>	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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								
>	IV.A.3.b.	Implement razorback sucker integrated stocking plan. Superseded by Basinwide Integrated Stocking Plan (2015), see General IV.B.2.	CPW/~~PD~~ */FWS*	Ongoing	X	X	X	X	X	X		4,622 razorback sucker were stocked into the Colorado River from the Ouray Grand Valley Unit. 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	X			Stocking success has not been specifically evaluated, but populations of stocked razorback sucker are increasing in the Colorado. 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 from Palisade to Loma.	CDOW	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	Ongoing	X	X	X	X	X	X		In 2018, 13,864 bonytail were stocked into the Colorado by Mumma (NASRF) and the Ouray NFH - Grand Valley Unit. Each hatchery performs several stocking events at multiple stocking sites.
	IV.A.5.c.	Evaluate stocking success as identified in monitoring plan for stocked fish.	Program	Ongoing	X	X	X	X	X			
	IV.A.6.	Develop integrated stocking plan for the four endangered fish in the Colorado River in Utah.										
	IV.A.6.a.	Prepare plan.	UDWR	Complete								
	IV.A.6.b.	Program acceptance.	UDWR	Complete								
>	IV.A.6.c.	Implement plan. Superseded by ~~Basinwide~~ *Revised* Integrated Stocking Plan (2015), see General IV.B.2.	UDWR	Ongoing	X	X	X	X	X	X		The Revised Integrated Stocking Plan no longer sets stocking requirements by basin. In 2018, Wahweap exceeded goals stocking bonytail into the Green and Dolores. No bonytail were stocked into the Colorado.
	IV.A.6.d.	Evaluate stocking success as identified in monitoring plan for stocked fish. Zelasko et al. 2009, 2011.	LFL/FWS/ STATES	Ongoing	X	X	X	X	X			
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**										Between November 19, 2015 and December 20, 2018, two antennas logged a combined total of 2,906 PIT tag detections representing 751 individuals; 520 of those individuals were bonytail that were stocked in Salt Creek, and largely detected relatively soon after stocking. The remaining 231 individuals are other species or bonytail who had been released in the Colorado River. A total of 118 bonytail stocked in the Colorado between 2014 and 2018 were detected in Salt Creek, one of which was detected in 2016, 2017 and 2018.
	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.										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X			
	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	X			
	V.B.3.	Revise population indices to conform to recovery goals.	FWS	Complete								
	V.B.4.	Monitor incidental take.										
	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	X	Canal salvage will likely be needed into the future, unless screen structures are modified.	Fish salvage was performed in the GVIC system in November 2017, collecting a total of 1,964 stranded native fish, but no endangered fish were captured. Fish salvage in the GVWUA Canal in 2017 collected a total of 38,722 native fish (including roundtail chub, speckled dace, flannelmouth sucker, and bluehead sucker), but no endangered species. The majority of these fish were collected from a short section of the canal (dubbed the “Hotspot”) between 35 3/10 and 35 8/10 roads in Palisade, CO.
	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	X	Continue to estimate abundance of humpback chub in Black Rocks.	Data analysis and final report writing will occur in FY 2018/2019. Robust design parameter estimation will include Westwater Canyon data.
	V.C.2.	Westwater. See Hudson and Jackson 2003, Elverud 2012; Hines et al. 2016.	UDWR	Ongoing	X	X	X	X	X	X	Continue to estimate abundance of humpback chub in Westwater Canyon.	No sampling took place in 2018, per sampling schedule.
	V.C.3.	Cataract Canyon	UDWR	Ongoing	X	X	X	X	X	X	Continue to estimate CPUE of humpback chub in Cataract Canyon.	No sampling took place in 2018, per sampling schedule.
	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	X	Continue to estimate abundance of Colorado pikeminnow in upper Colorado River..	X Population estimation field work did not occur in 2018 due to delays in FWS HR hiring seasonals. Three year field work cycle will begin in 2019, assuming crews can be assembled under government shutdown conditions. Final report for 2013-2015 data expected in 2019.
	V.D.1	Monitor age-0 Colorado pikeminnow in backwaters	UDWR	Ongoing	X	X	X	X	X	X	Continue monitoring age-0 Colorado pikeminnow.	78 age-0 Colorado pikeminnow were collected in Colorado River nursery habitats during ISMP sampling. This represents the 6th highest catch rate.
	V.E.	Implement razorback sucker monitoring plan. See Osmundson and Seal 2009.	FWS, UDWR	Ongoing	X	X	X	X	X	X	Continue to estimate abundance of razorback sucker.	! Ten age-0 razorback sucker (TL= 45-81mm) were collected in July between RMI 54-32 (Matheson is around RMI 62). This is the second time age-0 RZBs have been seen in Project 160 (first time was in 2012). All life stages being monitored through projects 127, 138, and 163. See General, V.A.1.a.

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	X	BR will continue coordination & releases.	
	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	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
>*	I.C.3.e.(3)	Deliver flows.	BR	Ongoing	X	X	X	X	X	X	BR will continue coordination & releases.	The May 1, 2018, forecast Apr-Jul inflow to Blue Mesa Reservoir was a "Dry" 350 KAF, resulting in a 2018 peak flow target of only 900 cfs for the Whitewater gage. The observed peak mean daily flow at Whitewater was 2,030 cfs (May 13). Base flow was maintained above the minimum 750 cfs target for the entire Aug-Dec period, with supplemental flows exceeding 890 cfs provided through Nov 26, which helped maintain flows for the Redlands fish ladder & screens in excess of the ~750 cfs typically diverted at Redlands. For additional details, see the 2018 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 2018. Project 85f 2018 sediment monitoring efforts were focused on Green River in Utah.
	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 2018. Project 85f 2018 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 2018.
	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 2018.
	I.D.1.a.(5)	Repeat depth-to-embeddedness (DTE) surveys in the Escalante area.	BR	Pending								Lower priority site; no activity in 2018.
	I.D.1.a.(6)	Evaluate the effect of operations to meet the Proposed Action on the Gunnison River thermal regime.	PDO	~~Pending~~ *In Progress*	X							Jana Mohrman, Program volunteer, reviewed the data and original purpose for two river temperature sites monitored by PDO (below Crystal Reservoir and above the North Fork Gunnison confluence). Based on her evaluation both sites were discontinued in 2018, having served their purpose of demonstrating the accuracy of the temperature modeling assumptions in the BiOp. (The Program continues monitoring temperatures at 8 other Gunnison Basin sites). Jana will provide her report to the PDO in 2019.
	I.D.1.b.	Monitor Biological Responses in the Gunnison River to the Proposed Action.										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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*	*X*		Monitoring of the fish community response in the lower Gunnison and upper Colorado Rivers (18-mile reach) occurs annually under Project 163. In 2018, 177 razorback sucker were captured along with 1 Colorado pikeminnow. Native fish communities are monitored using CPE data. PDO received a draft report for 2011-2016 (also see Colorado I.B.5.b.(1)). Also see Gunnison I.D.1.b.(1) and V.A.2..
	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 was published in 2018. It concludes 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 required 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 2018.
	I.D.1.c.(2)	Investigate selenium toxicity in razorback sucker.	FWS	In Progress	X							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. USGS has prepared a draft report, "Mercury and Selenium Concentrations in Fishes of the Upper Colorado River Basin: Spatial Patterns and Threats to Fish Conservation", upon which FWS (Dale Ryden) provided comments. The format and timing of the final USGS report is unknown at this time.
	I.D.2.	Integrate and synthesize information to evaluate and recommend necessary revision of the proposed action (implement flow recommendation)	Program	In Progress	X							
	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								
	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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	X	The Redlands fish ladder will need to be maintained and operated in perpetuity.	! In 2018, the Redlands fish passageway was operational from 18 April to 27 September for the 23rd year of operation. A record 39 Colorado pikeminnow were captured, 21 of which were previously untagged. One was found as a mortality. In total, 201 Colorado pikeminnow have used the passage, 25 have used it in more than 1 year. Two razorback sucker and eight bonytail were also captured. A total of 6,635 fish were handled at the ladder, 82.8% of which were native fish. The 38 live Colorado pikeminnow and six of the bonytail were translocated up to various locations along the Gunnison River (RM 29.1-57.0).
	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	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								
>*	II.B.1.h.	Operate and maintain fish screen.	Redlands Water & Power	Ongoing	X	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 18 April and taken off-line on 27 September, a month early due to funding concerns.
	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)**										

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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	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	X	Monitor and implement appropriate actions.	One northern pike (TL=1,002 mm) was removed near Delta. Ototliths have been preserved if studies to determine origin resume. ! Gunnison River remains free of smallmouth bass.
>*	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	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 escarpment from reservoir spilling. A working group focused on installing a nonnative fish escapement solution met multiple times in 2018, including a Value Engineering group in September. This group evaluated many screening options and put forth two primary options for stakeholder review. BR and stakeholders will select and design a preferred alternative in 2019, 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 over 1,400 smallmouth bass in three weeks in 2018. Monitoring estimates that four years of tournaments have reduced the population of smallmouth at Ridgway Reservoir by 58%. TriCounty Water Conservancy District successfully avoided spills from 2014 through 2018; dry conditions in 2018 precluded any need for spill.
	III.A.3.b	Implement control measures to prevent escapement of northern pike at Crawford Reservoir.	CPW	Ongoing	X	X	X	X	X	X		Northern pike management at Crawford Reservoir continues; CPW removed 200+ northern pike this spring. Post removal population estimate is 68 adults. Additional water management options to further impact the population are not feasible at this time.
	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								

		ACTIVITY	WHO	STATUS	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	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 ~~Basinwide~~ *Revised* Integrated Stocking Plan (2015), see General IV.B.2.	CPW/FWS	Ongoing	X	X	X	X	X	X		The Ouray NFH - Grand Valley Unit (USFWS) stocked 2,801 razorback sucker into the Gunnison River.
	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	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	X		
	V.A.2.	*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*	*X*		Fish community monitoring is ongoing (Project #163). Two sampling trips captured 177 razorback sucker, one Colorado pikeminnow 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	FY 19 10/18-9/19	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, 2018 - January 31, 2019)
	I.	***PROVIDE AND PROTECT INSTREAM FLOWS (HABITAT MANAGEMENT)***										! CWCB secured a decreed instream flow right on the Dolores River in 2018 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), 200 cfs (3/16-4/14).
	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	X		No targeted smallmouth bass removal took place because of flows. Annual warmwater and coolwater sampling did take place. Sampling documented no expansion of the smallmouth bass population and no escapement of bass from McPhee Reservoir.
>*	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*	*X*			Wahweap stocked 3,427 bonytail into the Dolores River at Rio Mesa in 2018.
	V.	**MONITOR POPULATIONS AND HABITAT AND CONDUCT RESEARCH TO SUPPORT RECOVERY ACTIONS (RESEARCH, MONITORING, AND DATA MANAGEMENT)**										! In 2018, Reclamation provided their 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". 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 pre-IME Plan 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."
	V.A.	Survey native and nonnative fish in Dolores River (UDWR funding outside of Program).	UDWR/ USBR/ CPW	Complete								X The Dolores antennas did not provide data in 2018 because of power outages and connection issues. The PDO and Reclamation are working on a scope-of-work to provide funding to resolve these kinds of issues in the future, ensuring more continuous coverage from permanent antenna arrays.

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
CDOP	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

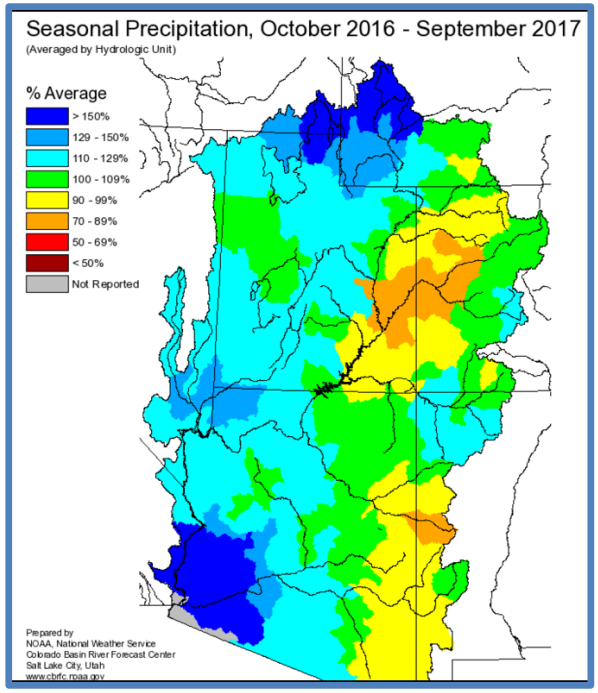
Color	Significance
Light blue	Denotes actions that are completed and need no additional attention.
Dark grey	Denotes header columns for activities detailed underneath - no cell content.
Bright green	Denotes cells with changes/updates from previous year proposed by PDO or technical committee. *only used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

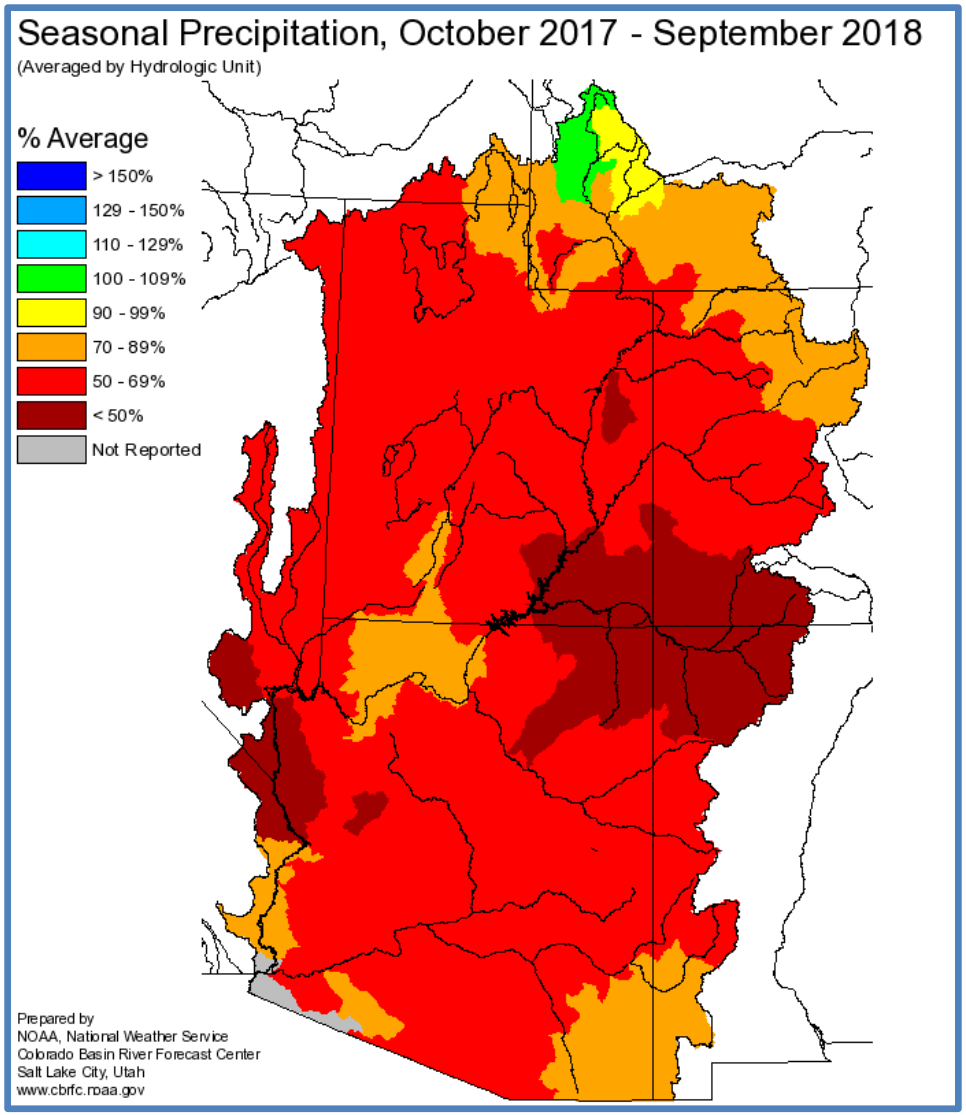
Total April-July 2018 runoff, as a percentage of the 1981-2010 average

April-July runoff was well below normal throughout the entire upper Colorado River basin, with the exception of the Green River Basin above Flaming Gorge Reservoir, which had somewhat above-normal runoff.

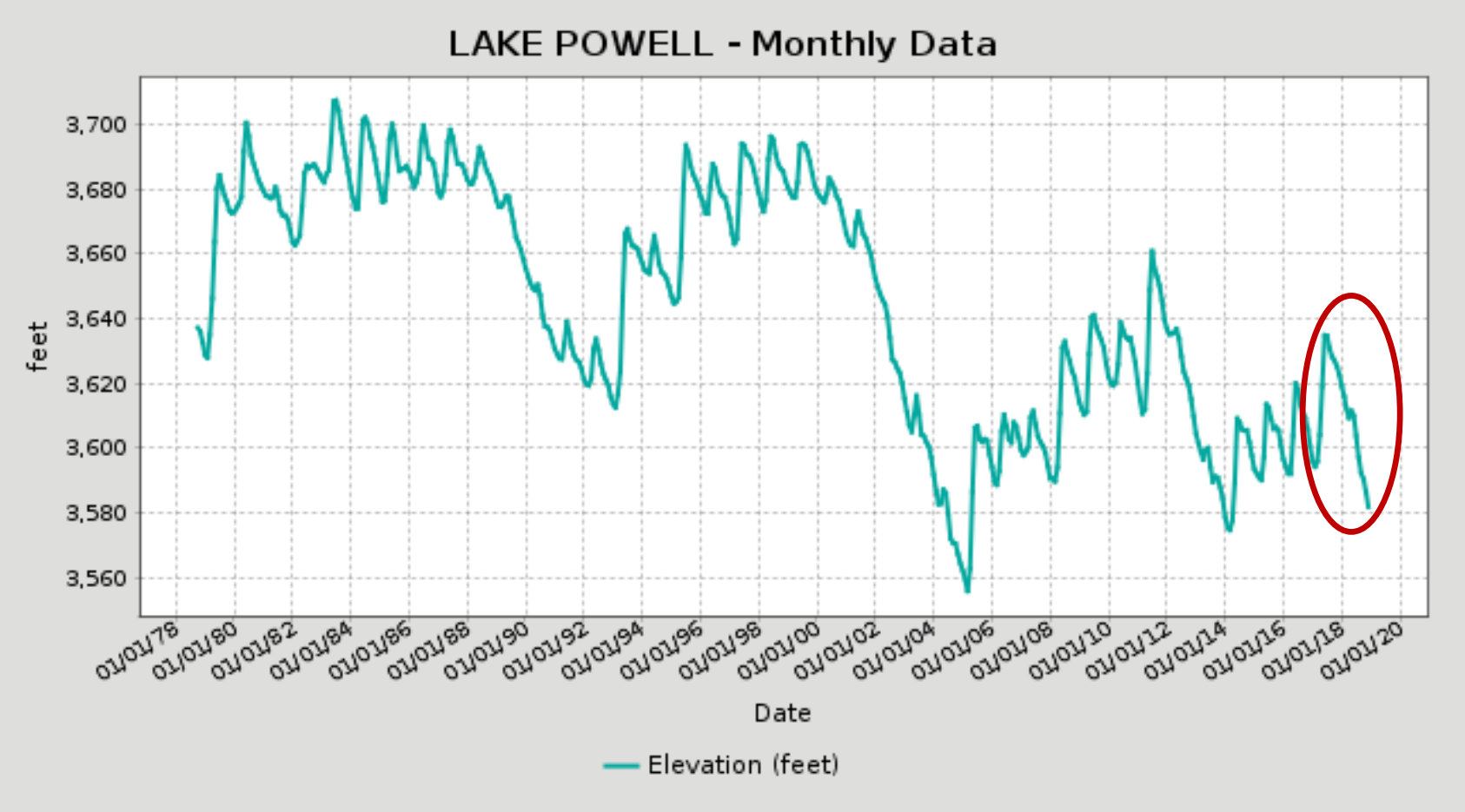
Water Year 2018: Precipitation was lesser everywhere in the Upper Colorado River Basin than in 2017, and it was well below normal everywhere except for certain headwater areas of the Green River basin.

Water Year 2017





Lake Powell WY 2018 inflow: 43% of average (4.6 MAF)
EOWY elevation 35 ft lower than one year ago (47% capacity)



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

2018 Spring Peak Flows

River	Location	Mean Daily Peak (cfs)	2018 Peak (cfs)	% of Avg Peak
Yampa	*Deerlodge Park*	12,500	8,690	70%
Green	*Jensen*	16,500	12,100	73%
White	*Watson*	2,400	1,360	57%
Duschesne	*Randlett*	1,800	105	6%
Gunnison	*Grand Junction*	8,000	2,030	25%
Colorado	*Cameo*	19,000	6,650	29%
San Juan	*Bluff*	11,730	1,380	12%

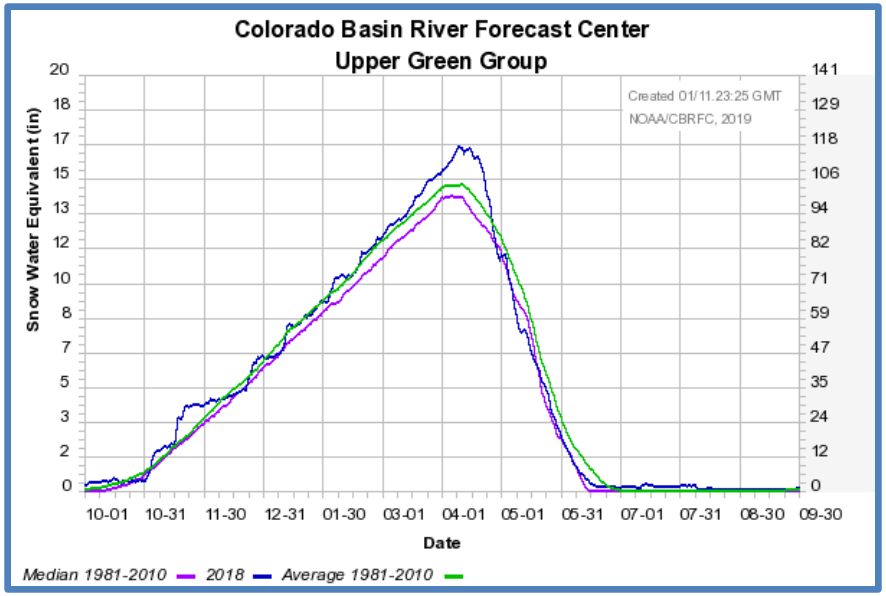
2018 Base Flows

River	Location	Total Aug-Oct Runoff as % Avg	Minimum (cfs)
Yampa	*Maybell*	39%	38
Yampa	*Deerlodge Park*	35%	33
White	*Watson*	52%	27
Green	*Jensen*	105%	1,890
Green	*Green River*	76%	1,710
Gunnison	*Grand Junction*	57%	920
San Juan	*Bluff*	37%	361
Colorado	*Cameo*	69%	1,320
Colorado	*Palisade*	44%	137
Colorado	*Cisco*	58%	1,890

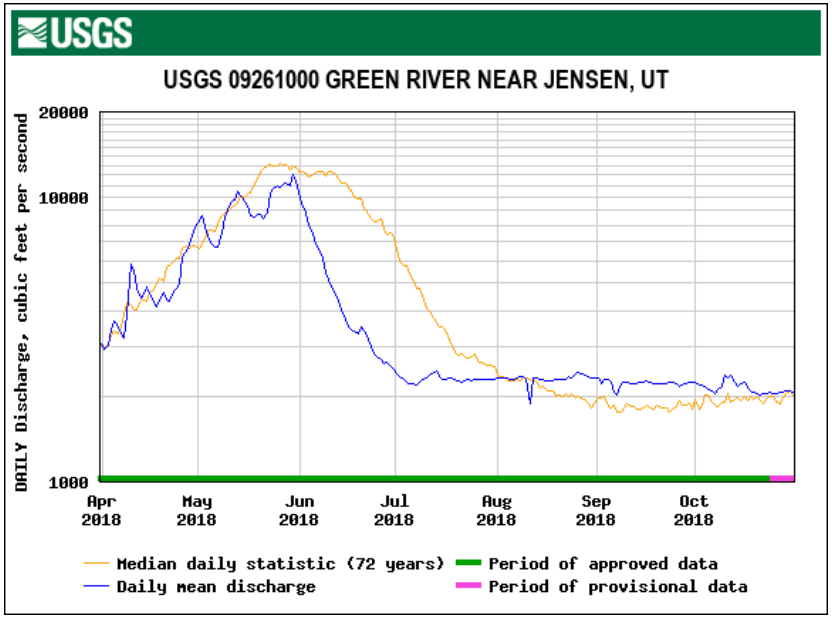
Averages are based on 1981-2010 period of record; in some cases some years from this period are missing.

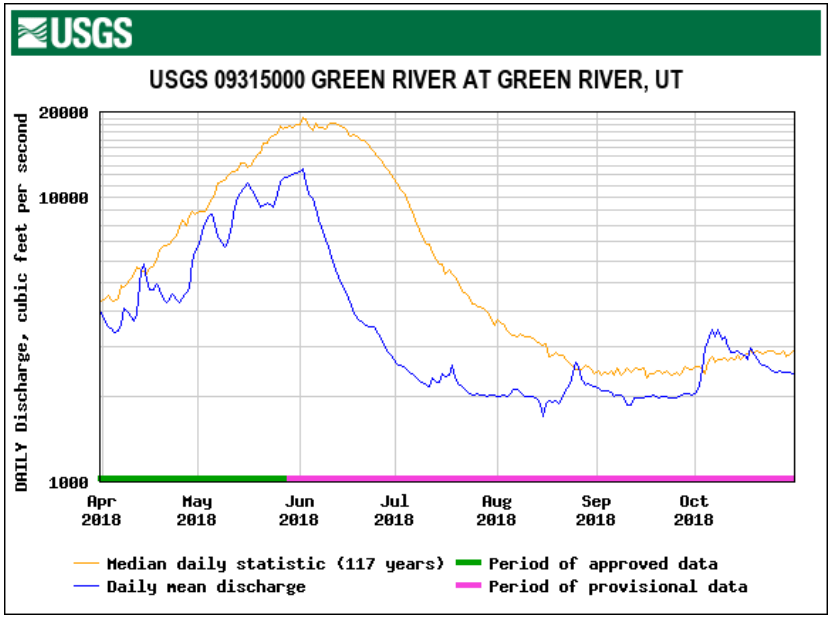
USGS gage data are provisional as of January 2019.

Snow accumulation in the basin upstream of Flaming Gorge Reservoir tracked close to normal throughout the season, with late accumulation in April pushing the total above-average:

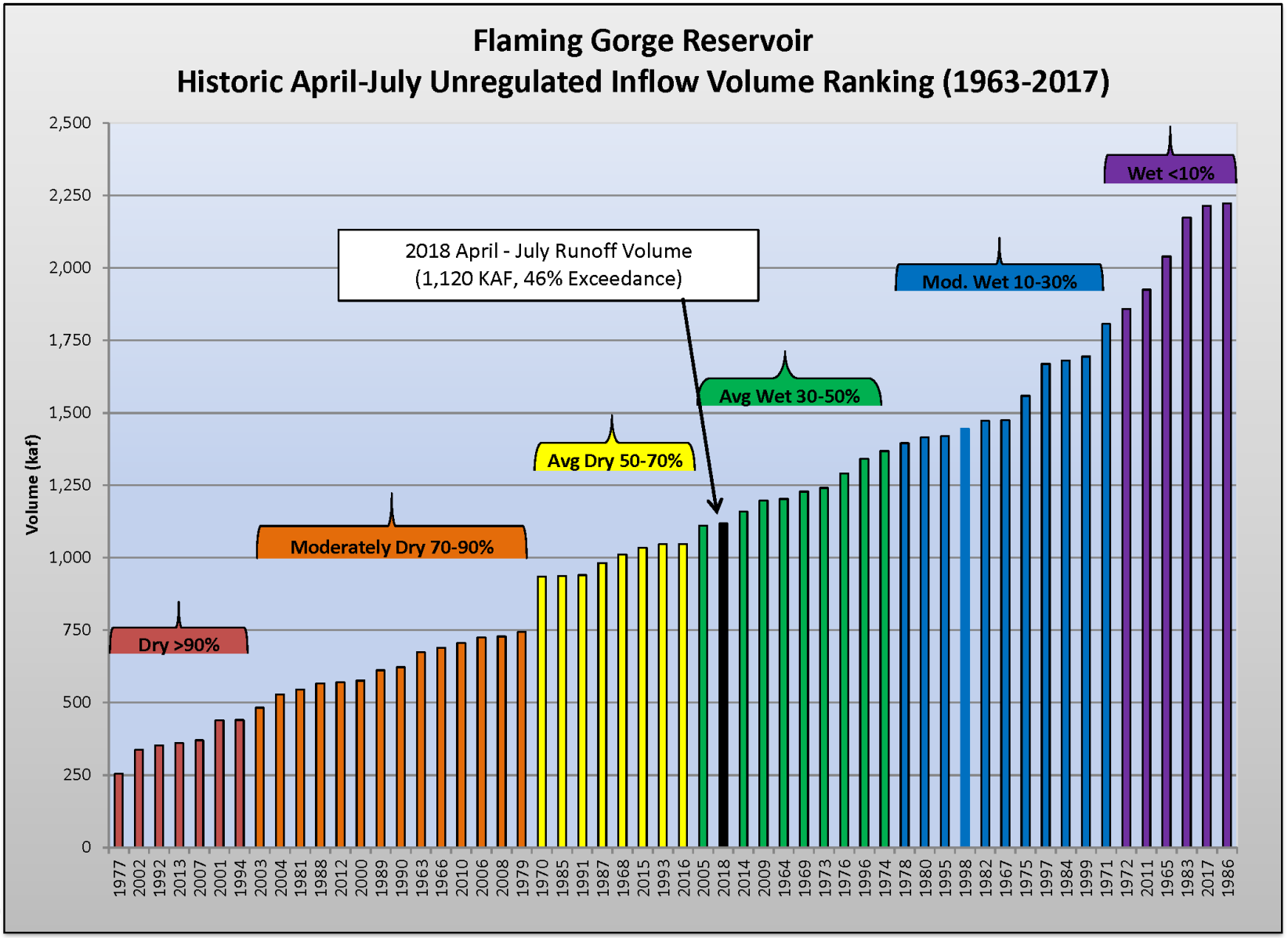


April through October2018 Hydrographs:

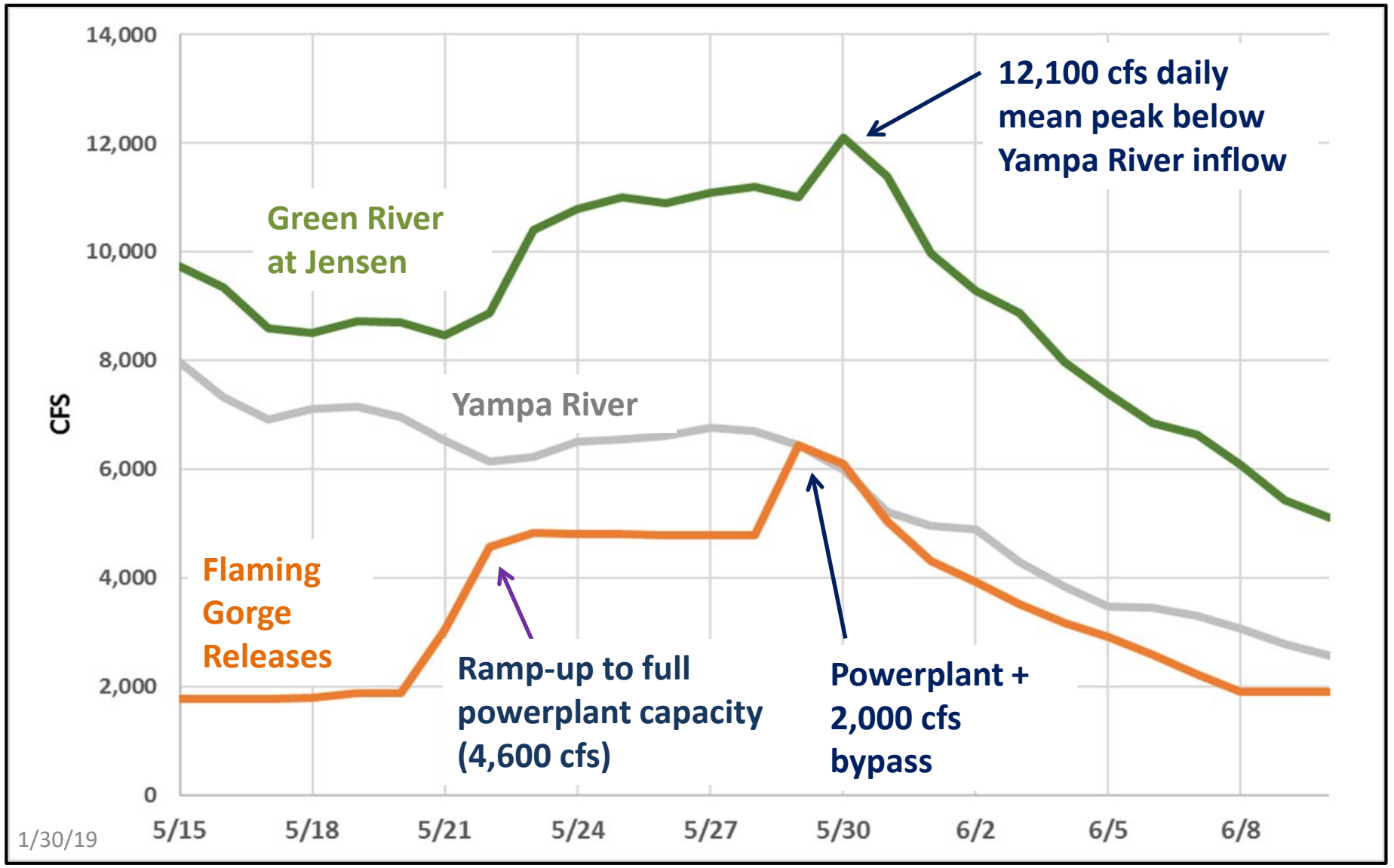




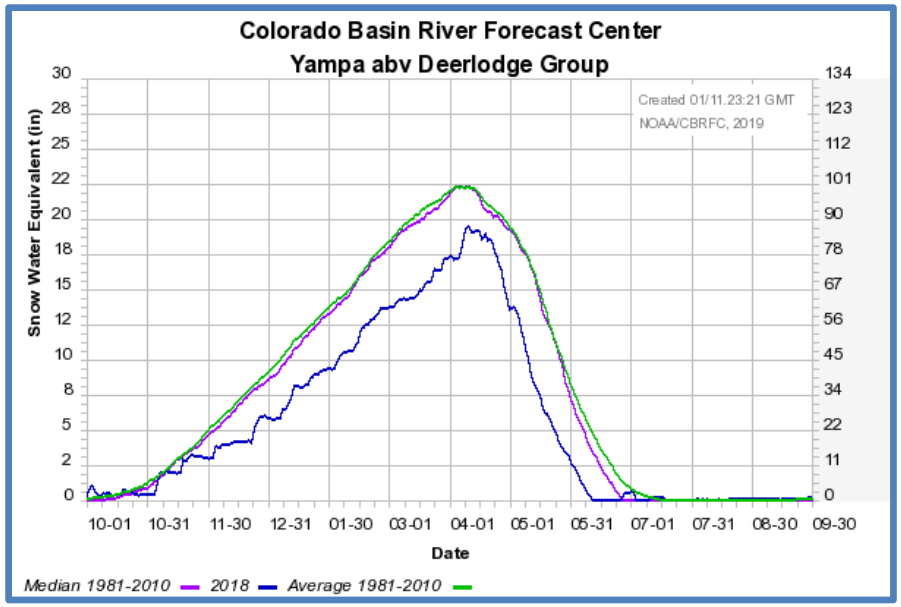
April-July runoff above Flaming Gorge in 2018 was somewhat above average, and fell into the "Average-Wet" category, at 46% exceedance:



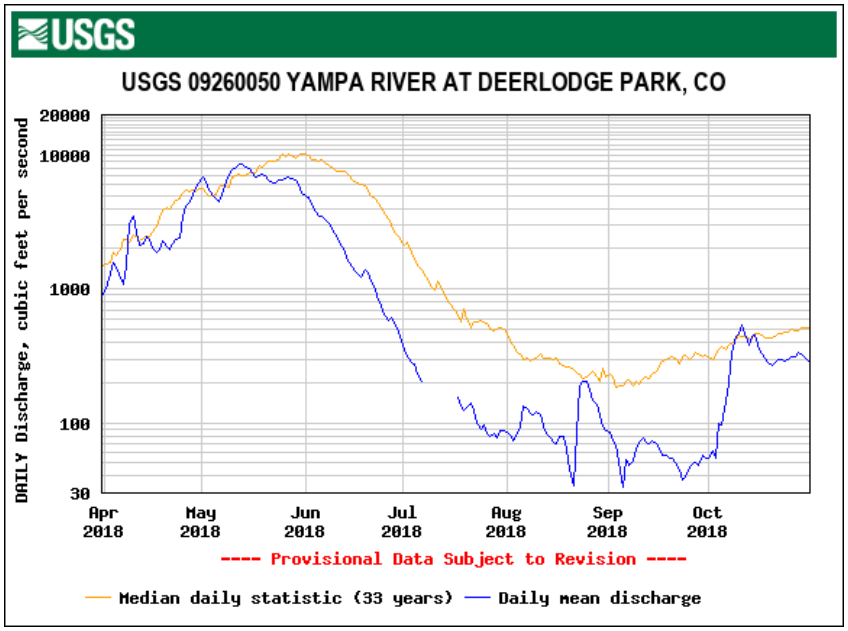
LARVAL-TRIGGERED PEAK FLOW OPERATIONS on the Green River, 2018:
Detection of first razorback sucker larvae May 17 led to ramped-up Flaming Gorge releases beginning May 20 and peaking at ~6,600 cfs May 29, to generate a peak at Jensen on May 30

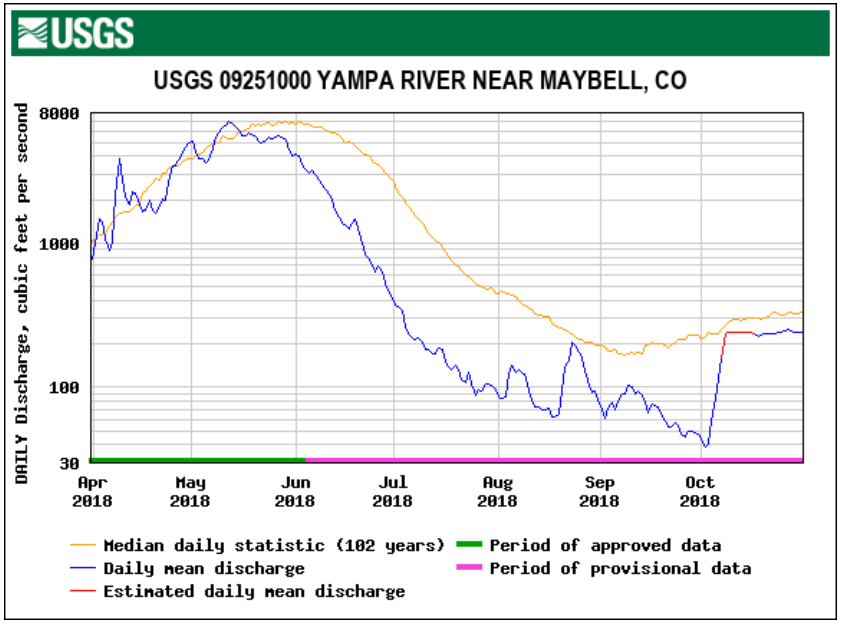


Yampa River Basin snow accumulation was below-normal for the entire snow accumulation season, and it melted off rapidly beginning in April:

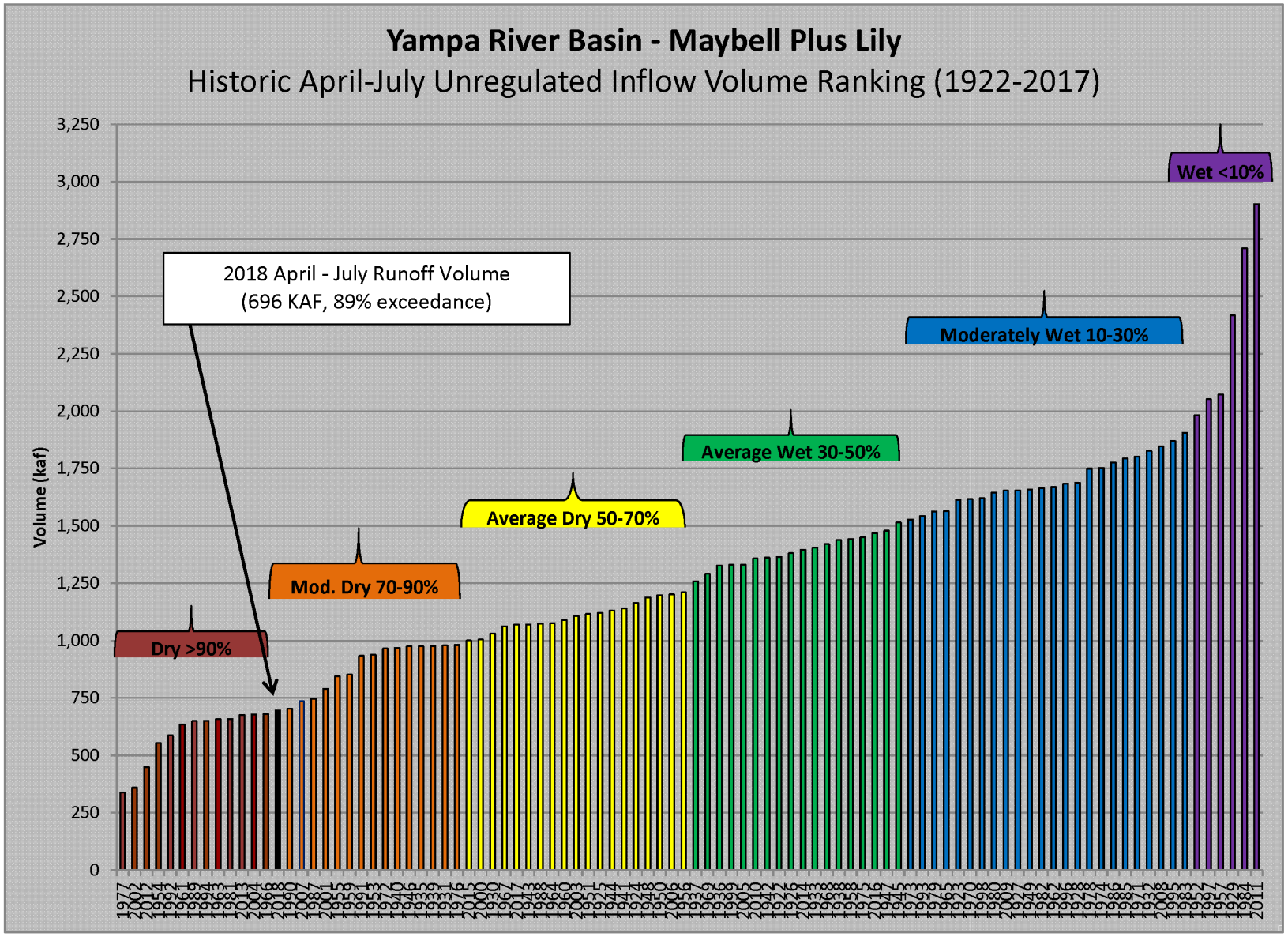


April through October 2018 Hydrographs:

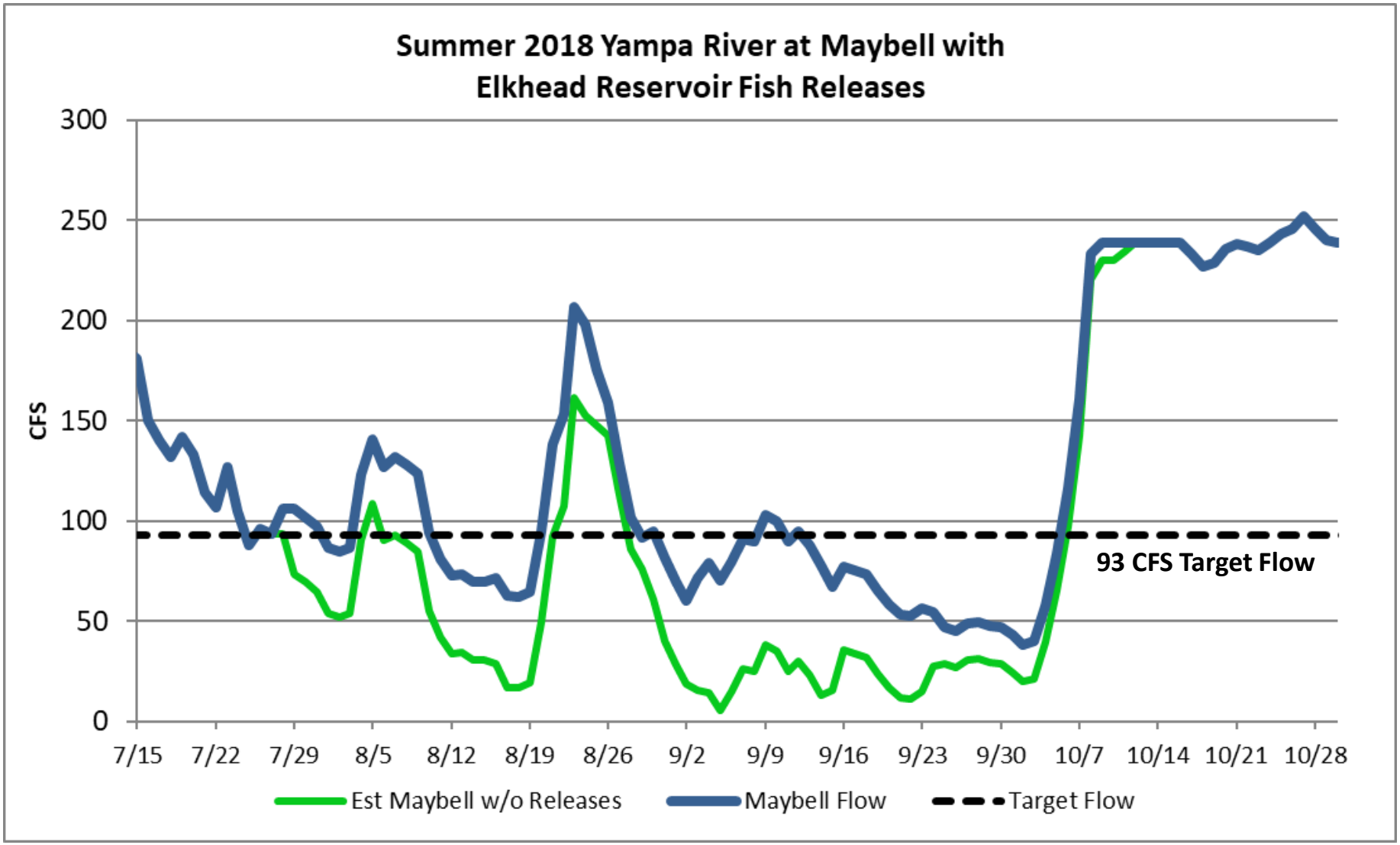




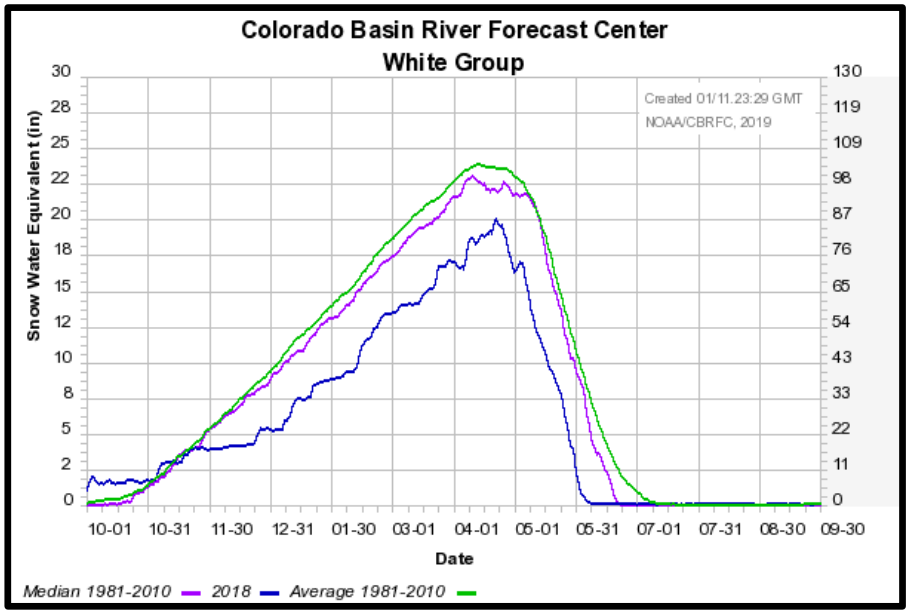
April-July runoff in the lower Yampa River Basin in 2018 (including Little Snake River inflow) fell into the " Moderately Dry" category, at 89% exceedance:



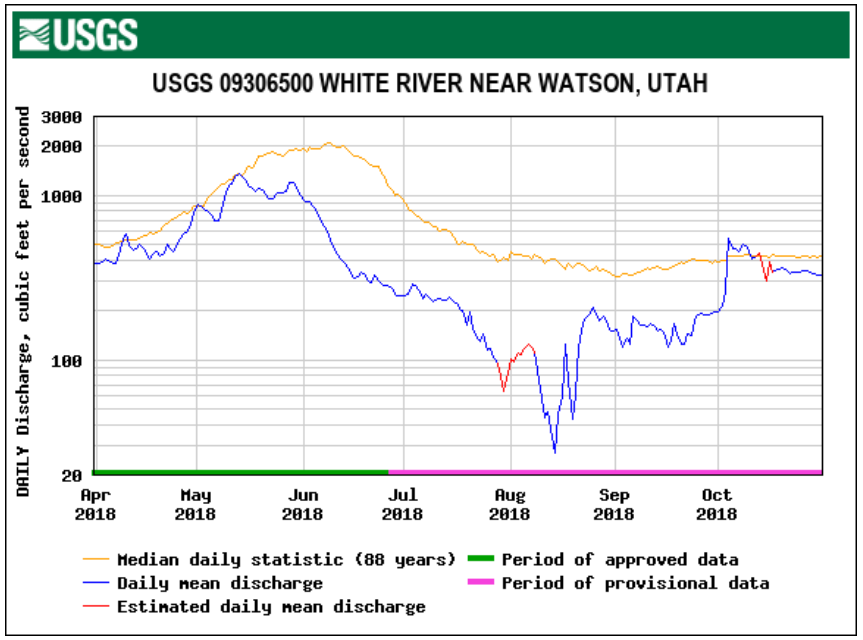
A total of 7,000 acre-feet of Elkhead Reservoir fish pool water was released during the 2018 irrigation season to augment base flows for endangered fish in the Yampa River:



Snow accumulation in the White River basin was well below-normal throughout the snow accumulation season, with a rapid melt-off beginning in late April:

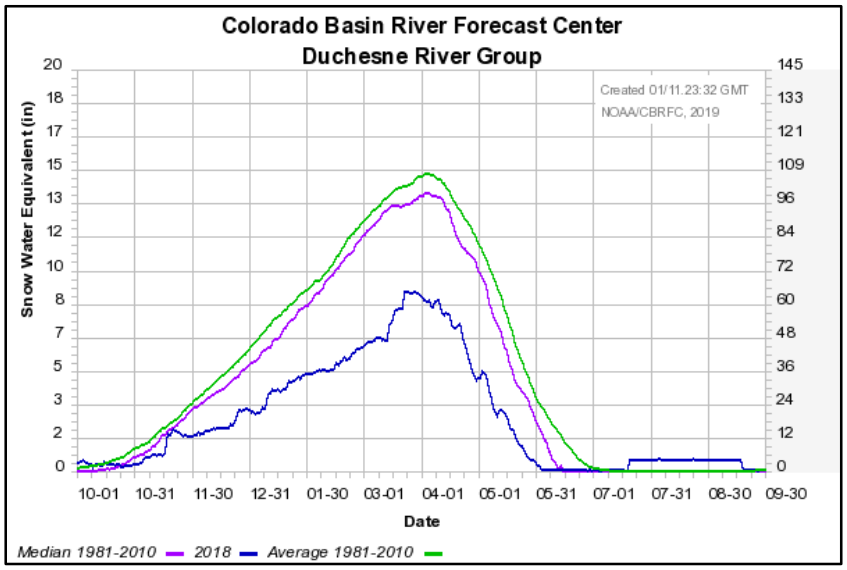


April through October 2018 Hydrograph:

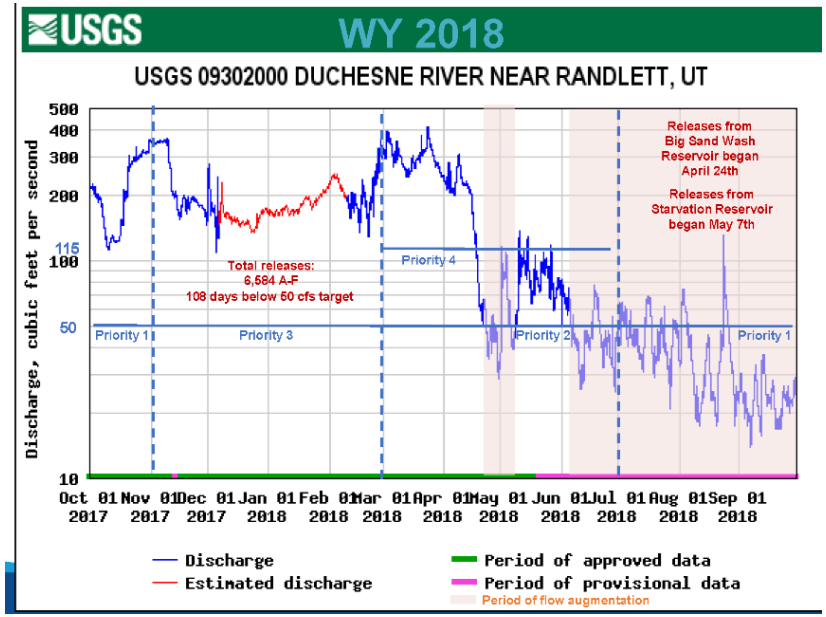


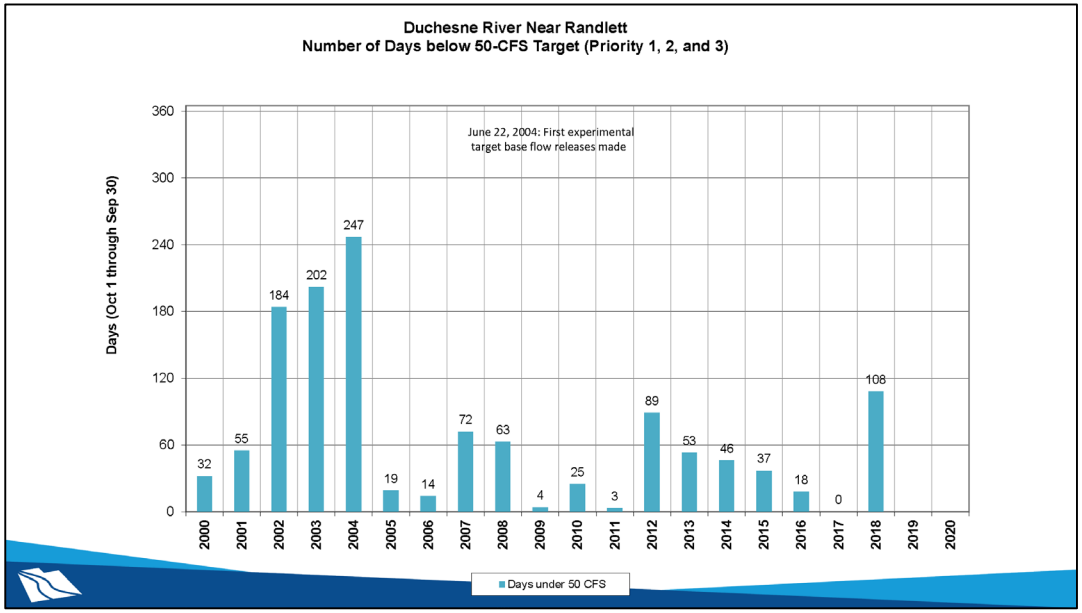
Duchesne River

Snow accumulation in the Duchesne River basin was well below-normal throughout the season:



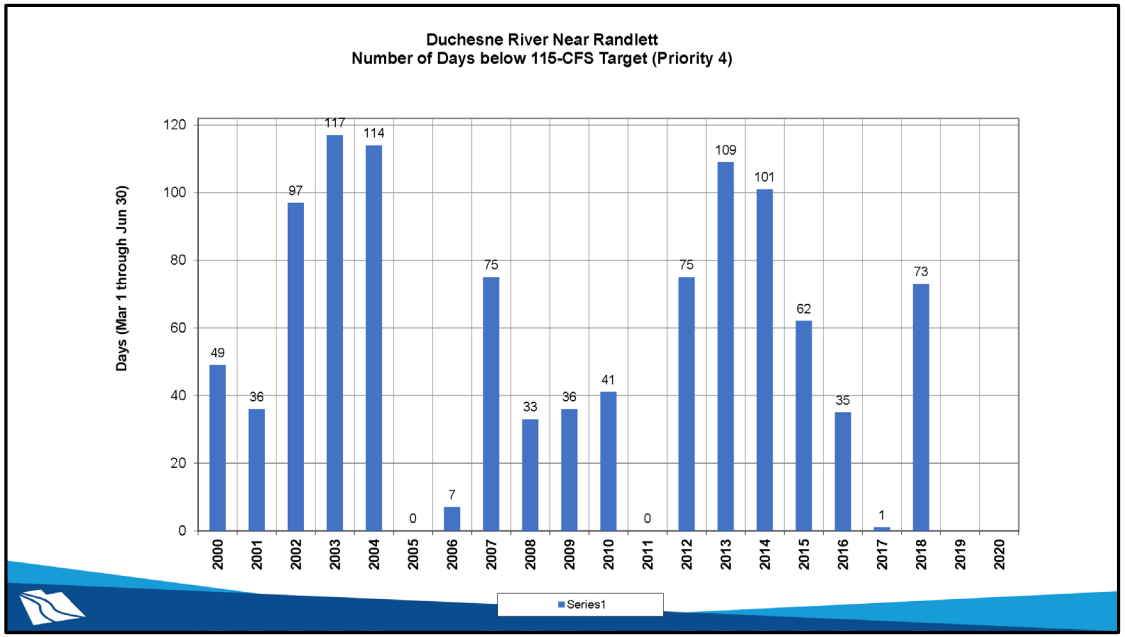
Full 2018 Water Year (Oct-Sep) Hydrograph:





The 'Priority 1, 2 and 3' flow targets at the Randlett gage are 50 cfs flow from Jul-Oct, Nov-Mar, and Mar-June, respectively. In 2018, 108 days dipped below this target, the most since releases for base flows began in 2004.

The 'Priority 4' flow target at the Randlett gage is 115 cfs flow from March 1 through June 30. In 2018, flows fell short of this target on 73 days, the most since 2014:



A total of 6,584 acre-feet of water was delivered to support instream flows in the Duchesne River in 2018, from the following sources.

WY 2018 Water Supply:

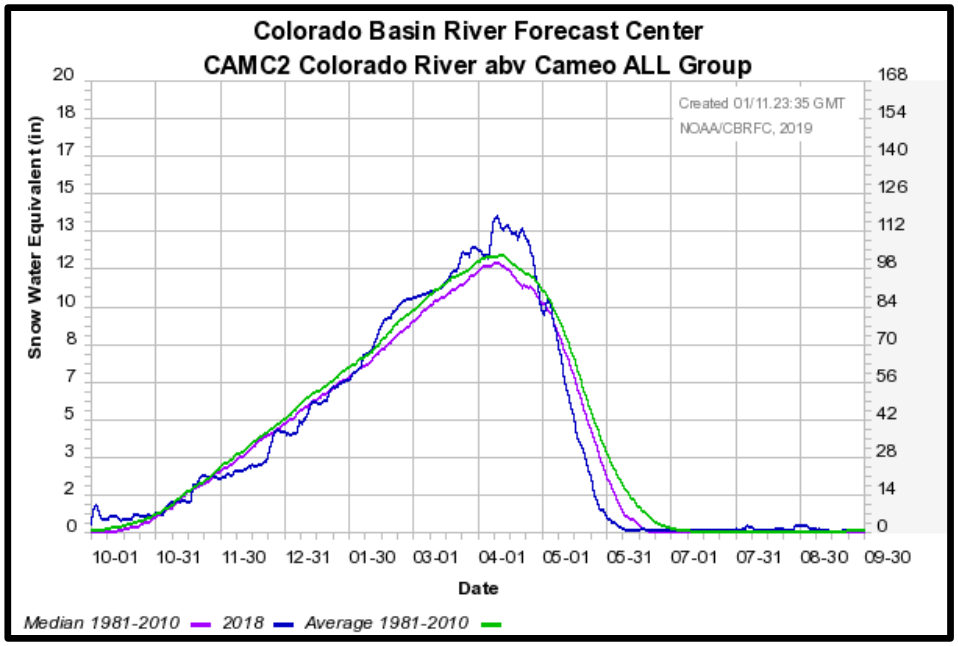
Daniels Replacement Project (Starvation)	*2,900 A-F*
*DOI Section 207 (Starvation) (1,754 Banked + 430)^*	*2,184 A-F*
*Rediverted "44,400" Water (Starvation)**	*0 A-F*
*DOI Section 207 (Big Sand Wash)^*	*1,500 A-F*
	6,584 A-F

**Value as of October 1, 2017*
**Subject to Spill*

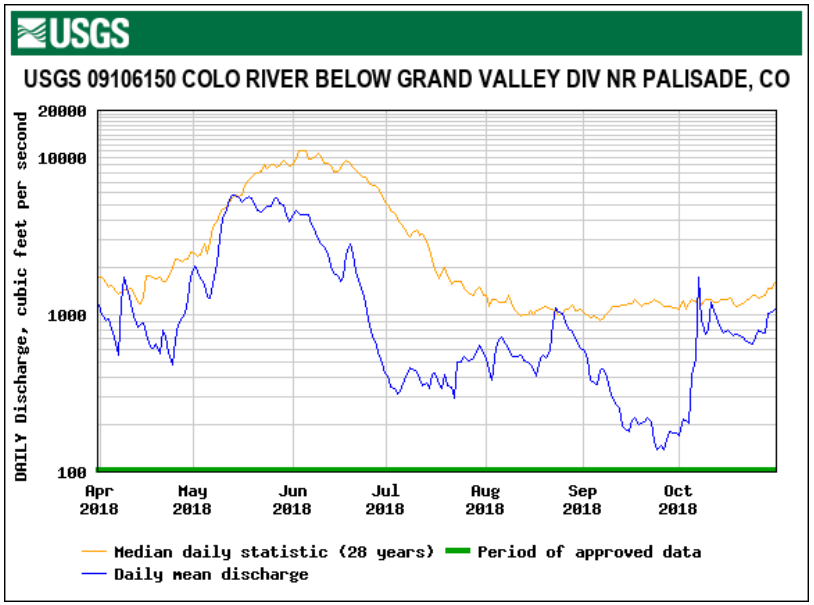
^Temporary 207 Contracts for 2016-2020 Delivery Seasons

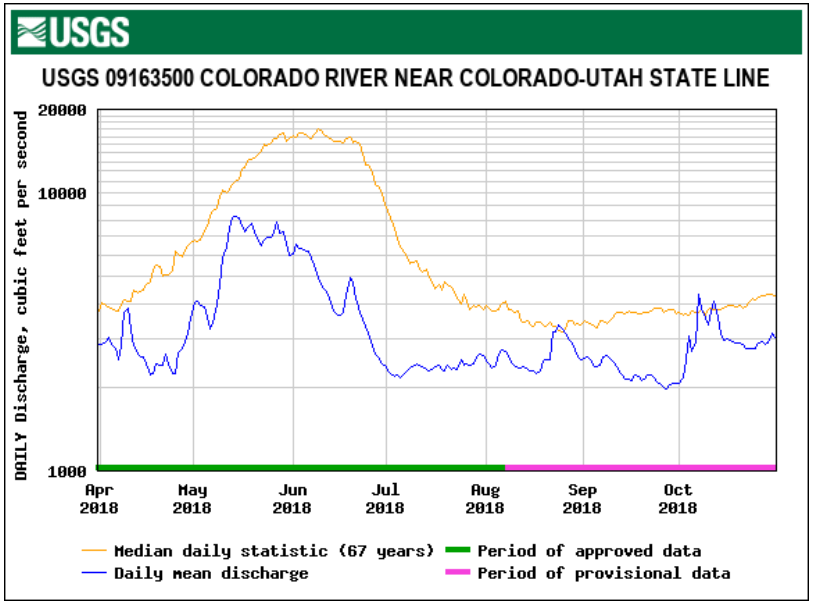
Upper Mainstem Colorado River

Snow accumulation in the upper mainstem Colorado River basin was close to normal through early April, but then melted off extremely rapidly in late April and May:



April through October 2018 Hydrographs:





No Coordinated Reservoir Operations (CROS) were implemented in 2018 due to the poor spring runoff conditions. This was the first year since 2014 there was no CROS.

Below is a summary of coordinated Reservoir Operations (CROS) implemented to boost 15-Mile-Reach peak flows since 1997 (years with no CROS operations are not listed).

Coordinated Reservoir Operations (CROS) **Augmentation of Peak Flows (AF released)**

Reservoir	Homestake	Lake Granby	Green Mtn	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	8,000	906	4,587		**32,117**
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**
Sum	**1,430**	**26,517**	**119,062**	**49,562**	**46,731**	**24,475**	**2,967**	**72,254**	**4,039**	**348,467**

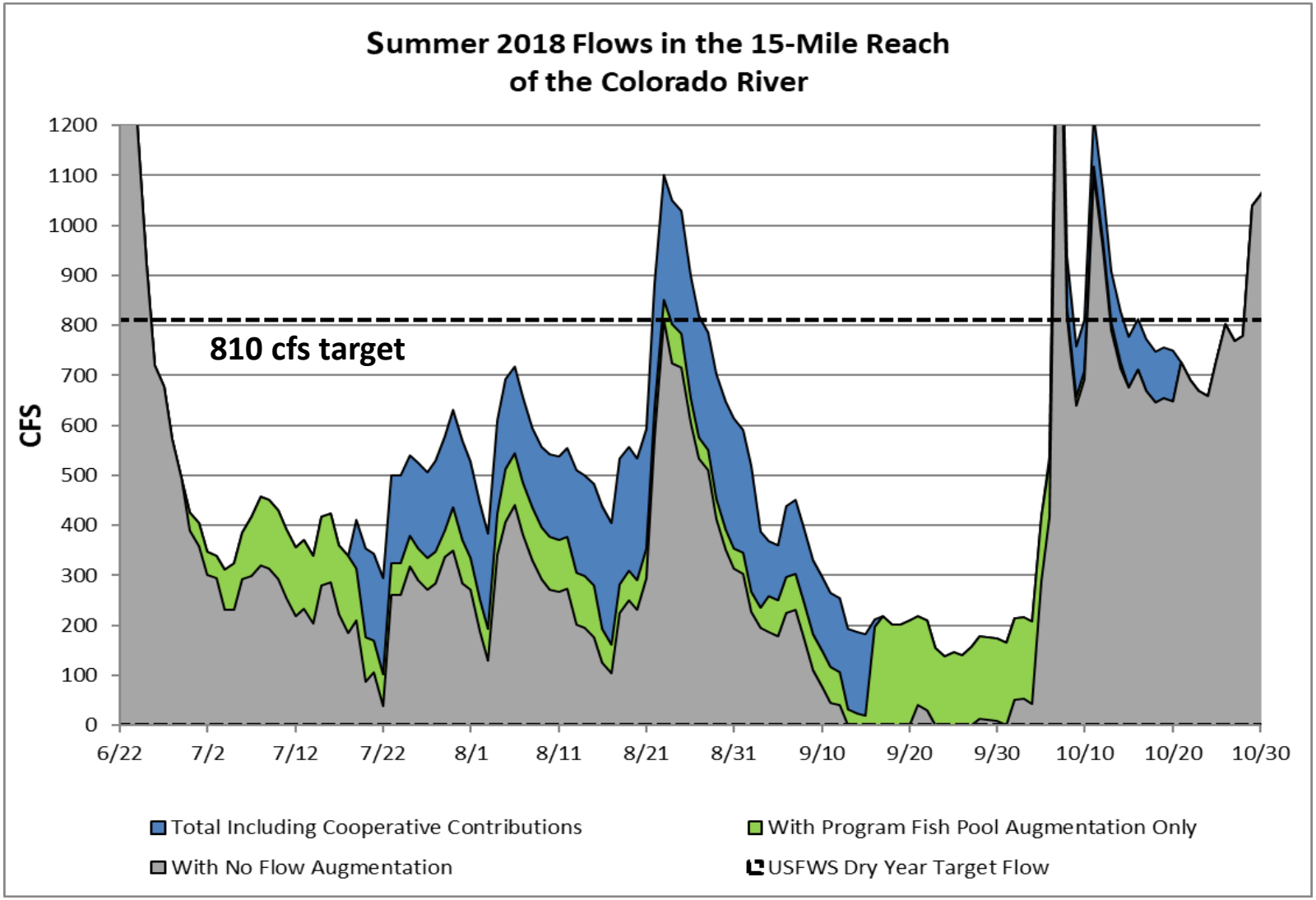
Summary of reservoir releases to augment 15-Mile Reach base flows since 1998 (AF)

Reservoir	Lake Granby	Green Mtn	Palisade Bybass	Ruedi	Williams Fork	Willow Ck	Windy Gap	Wolford Mtn	Total AF
1998		31,736		20,803				11,516	**64,054**
1999	26,914	29,277		20,418	1,825	649		4,939	**84,022**
2000		47,187		19,064	3,858			11,072	**81,181**
2001		34,656		21,345	5,369			8,577	**69,947**
2002		0	2,053	10,975	3,757			308	**17,093**
2003		47,526	10,161	20,434	3,757			286	**82,164**
2004		119	13,654	15,981	2,678			-	**32,431**
2005		31,200	19,143	17,163	3,814			1,000	**72,321**
2006		25,358	10,812	20,045	5,712			10,842	**72,769**
2007		32,745	10,625	14,650	2,624			7,037	**67,681**
2008	849	61,433	15,997	20,423	9,389		764		**108,855**
2009	3,144	56,290	18,302	20,822	5,411			8,747	**112,716**
2010	992	57,813	20,617	20,825	5,113		893	8,413	**114,666**
2011		37,132	20,466	15,251	5,412			8,413	**86,674**
2012		0	14,616	20,596	5,412			5,320	**45,944**
2013	5,412	2,514	15,937	10,412				1,501	**35,776**
2014	5,413	59,342	19,317	15,413				3,000	**102,485**
2015	5,415	54,610	8,162	24,412	1289*			4,712	**97,311**
2016	5,413	55,390	12,210	27,413	234*			5,766	**106,192**
2017	5,409	46,216	20,272	21,413	139*			6,000	**99,310**
2018	4,805	2,356	10,198	19,496	307*	607		24,812	**62,274**
Sum	**63,766**	**712,900**	**242,542**	**397,354**	**64,131**	**1,256**	**1,657**	**132,261**	**1,615,866**

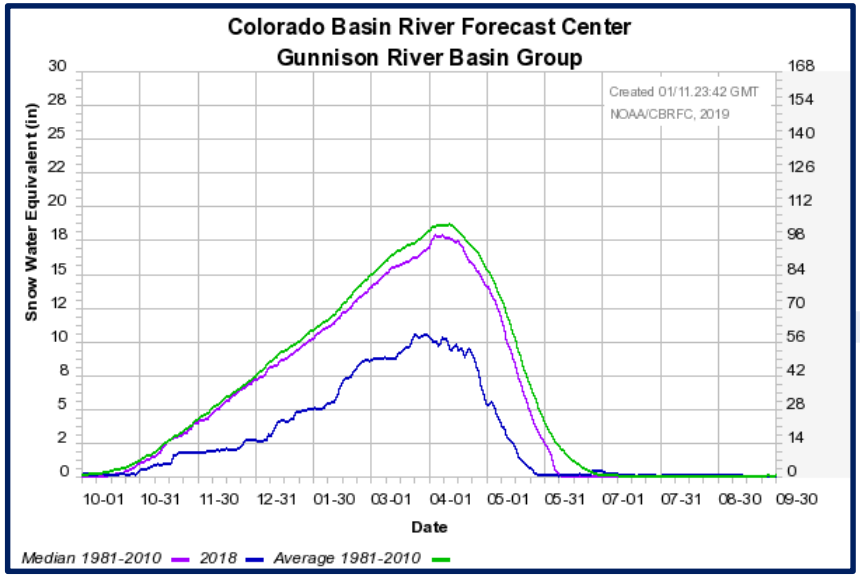
* Denotes water exchanged from Granby or Willow Creek Reservoir temporarily; these numbers are not additive to the total volume released for flow augmentation.

Upper Mainstem Colorado River

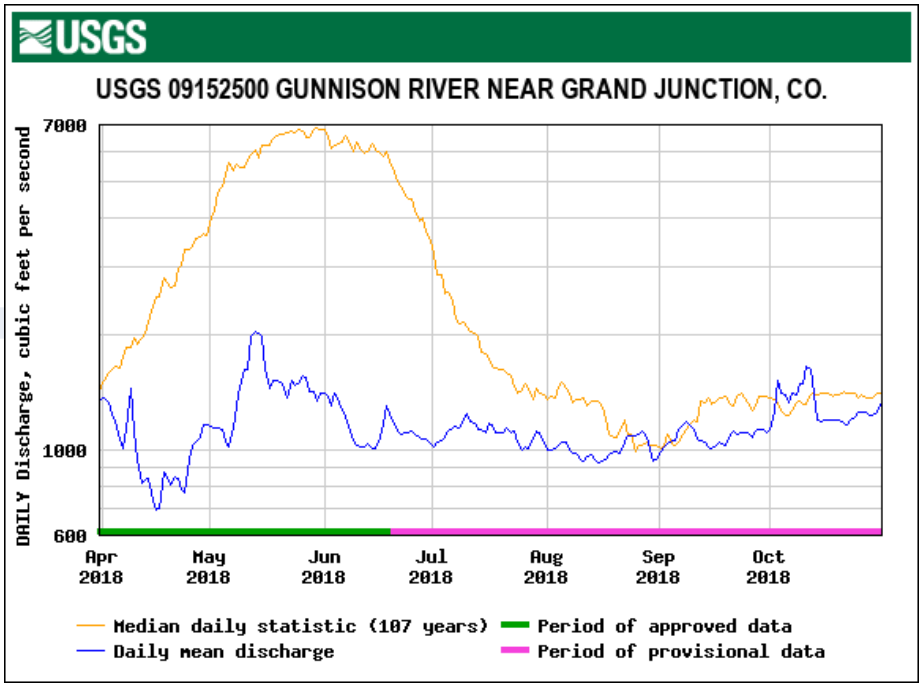
Without reservoir releases for endangered fish, flows in the 15-Mile Reach (gray) would have dropped to zero for around 12 days in September and October 2018. Water in this reach was augmented with 16,425 ac-ft of reservoir releases from the Program's dedicated fish pools at Granby, Wolford Mountain, and Ruedi Reservoirs (green), plus an additional 27,896 ac-ft of releases (blue) made available through special efforts of the Colorado River Water Conservation District (18,812 ac-ft of maintenance releases from Wolford Mountain Reservoir in July-Aug), CWCB and Ute Water Conservancy District (6,000 ac-ft lease from Ruedi Reservoir), USBR, and ExxonMobil subsidiary XTO Energy (making 3,084 ac-ft of water available to deliver from Ruedi Reservoir's 4-in-5 year pool).



Snow accumulation in the Gunnison River basin was well below-normal throughout the snow accumulation season, with rapid melt-off in April and May:



April through October 2018 Hydrograph:



6.0 LITERATURE CITED

Alder, L.H., and T.A. Crowl. 1995. The role of introduced fishes in the Green River: Exotic predators in nursery habitats of the endangered Colorado squawfish. Honors Thesis, Utah State University, Logan.

Alexander, C.A.D., E. Olson, J. Carron. 2013. Integrated Water Management in the Colorado River Basin: Evaluation of Decision Support Platforms and Tools. Final Report. Prepared by ESSA Technologies Ltd. and Hydros Consulting for the Colorado River Program of The Natural Conservancy. Boulder, Colorado. 107 pp + appendices.

Anderson, R.M. 1997. An Evaluation of Fish Community Structure and Habitat Potential for Colorado Squawfish and Razorback Sucker in the Unoccupied Reach (Palisade to Rifle) of the Colorado River, 1993-1995. Final Report of Colorado Division of Wildlife, Fort Collins, Colorado to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Andrews, E. D., et al. (1996). Highlights of a Peer review and Roundtable Discussion on the Relationship of Streamflow, Geomorphology, and Food Web Studies in Recovery of the Endangered Fishes in the Upper Colorado River Basin, Grand Junction, Colorado, February 6-7, 1995. Final Report.

Aspinall Unit Study Plan *ad hoc* Committee. (2011) Study Plan to Evaluate Effects of Aspinall Unit Operations to Benefit Habitat and Recovery of Endangered Fishes in the Gunnison and Colorado Rivers. Coordinated by the Upper Colorado River Endangered Fish Recovery Program.

Ayres Associates. 1999. Yampa River research final synthesis report. Project No. 34-0683.00. Fort Collins, CO.

Badame, P. 2012. Population estimates for humpback chub (*Gila cypha*) in Desolation and Gray Canyons, Green River, Utah 2006-2007. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

BBC Research & Consulting. 1998. Yampa Valley water demand study, final report. Prepared for Recovery Program for Endangered Fishes of the Upper Colorado River, Denver.

Bestgen, K.R. 1997. Interacting effects of physical and biological processes on recruitment of Colorado squawfish. Colorado State University Doctoral Dissertation to Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K. R. 2018. Evaluate effects of flow spikes to disrupt reproduction of smallmouth bass in the Green River downstream of Flaming Gorge Dam. Final report to the Upper Colorado River Endangered Fish Recovery Program. Denver, Colorado. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins. Larval Fish Laboratory Contribution 214.

Bestgen, K.R., and L.W. Crist. 2000. Response of the Green River fish community to construction and re-regulation of Flaming Gorge Dam, 1962–1996. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K. R., J. A. Hawkins, G. C. White, K. Christopherson, M. Hudson, M. H. Fuller, D. C. Kitcheyan, R. Brunson, P. Badame, G. B. Haines, J. Jackson, C. D. Walford, T. A. Sorensen, and T. B. Williams. 2005. Population status of Colorado pikeminnow in the Green River Basin, Utah and Colorado. Final Report of Larval Fish Laboratory, Colorado State University to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K. R., and A. A. Hill. 2016a. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green and Yampa rivers, Utah and Colorado, 1979-2012. Final report to the Upper Colorado River Endangered Fish Recovery Program, Project FW BW-Synth, Denver, CO. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins. Larval Fish Laboratory Contribution 183.

Bestgen, K. R., and A. A. Hill. 2016b. River regulation affects reproduction, early growth, and suppression strategies for invasive smallmouth bass in the upper Colorado River basin. Final report submitted to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins. Larval Fish Laboratory Contribution 187.

Bestgen, K. R., G. B. Haines, and A. A. Hill. 2011. Synthesis of flood plain wetland information: Timing of razorback sucker reproduction in the Green River, Utah, related to stream flow, water temperature, and flood plain wetland availability. Final Report to the Upper Colorado River Endangered Fish Recovery Program, Denver. Larval Fish Laboratory Contribution 163.

Bestgen, K.R., J.A. Hawkins, G.C. White, C.D. Walford, P. Badame, and L. Monroe. 2010. Population status of Colorado pikeminnow in the Green River Basin, Utah and Colorado, 2006-2008. Final Report of the Larval Fish Laboratory, Colorado State University to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K.R., C.D. Walford, G.C. White, J.A. Hawkins, M.T. Jones, P.A. Webber, M. Breen, J.A. Skorupski Jr., J. Howard, K. Creighton, J. Logan, K. Battige, and F.B. Wright. 2018. Population Status and Trends of Colorado pikeminnow in the Green River Sub-Basin, Utah and Colorado, 2000-2013. Final Report of the Larval Fish Laboratory, Colorado State University to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen K., C. Walford, A. Hill, and J. Hawkins. 2015. Evaluating effects of non-native predator removal on native fishes in the Yampa River, Colorado. Annual Report of Project 140 for Upper Colorado River Endangered Fish Recovery Program. 9 pages.

Bestgen, K. R., K. A. Zelasko, and R. I Compton. 2006. Response of the Green River Fish Community to Changes in Flow and Temperature Regimes from Flaming Gorge Dam since 1996 based on sampling conducted from 2002 to 2004. Final Report of Larval Fish Laboratory, Colorado State University to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bestgen, K. R., K. A. Zelasko, R. I. Compton, and T. E. Chart. 2008. Survival, condition, habitat use, and predation on stocked bonytails (*Gila elegans*) in the Green River, Colorado and Utah. Southwestern Naturalist 53:488-494.

Bestgen, K. R., K. A. Zelasko, and G. C. White. 2012. Monitoring Reproduction, Recruitment, and population status of razorback suckers in the Upper Colorado River Basin. Final Report of Larval Fish Laboratory, Colorado State University to Upper Colorado Endangered Fish Recovery Program, Denver, Colorado.

Bezzerides, N. and K. Bestgen. 2002. Status review of roundtail chub *Gila robusta*, flannelmouth sucker *Catostomus latipinnis*, and bluehead sucker *Catostomus discobolus* In the Colorado River basin. Final Report to U.S. Bureau of Reclamation. Larval Fish Lab Contribution 118.

Bidelspach and Fairley. 2015. "Feasibility of Yampa River Walton Creek Confluence Reconstruction." Stantec Consulting. Steamboat Springs, CO.

Birchell et al. 2002. The levee removal project: assessment of floodplain habitat restoration in the middle Green River. Final Report of Levee Removal Evaluation Group to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Bissonette, G., and T. A. Crowl. 1995. Habitat preference of juvenile bonytail (*Gila elegans*) and spatial competition with the exotic red shiner. Honors Thesis, Utah State University, Logan.

Boyer, J. M. and A. Cutler. 2004. Gunnison River/Aspinall Unit Temperature Study - Phase II. Final Report of Hydrosphere Resource Consultants and U.S. Bureau of Reclamation to Upper Colorado River Endangered Fish Recovery Program.

Breen, M. J. and T. N Hedrick. 2009. Status of bluehead sucker, flannelmouth sucker, and roundtail chub populations in three drainages of northeastern Utah. 2008 Statewide Monitoring Summary, Publication No. 09-27. Utah Division of Wildlife Resources, Salt Lake City, Utah.

Breen, M.J. and Hedrick, T.N. 2010. Conservation Activities for Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub in Four Drainages of Northeastern Utah. Pages 2-1 to 2-52 in Three Species Monitoring Summary Statewide 2009. Utah Division of Wildlife Resources, Publication Number 10-25.

Breen, M.J., M. Swasey, P. Badame, K. Creighton. 2011. Upper Colorado River basin young-of-year Colorado pikeminnow (Ptychocheilus lucius) monitoring: Summary report 1986-2009. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Breen, M. J. and J. A. Skorupski. 2012. Use of the Stewart Lake floodplain by larval and adult endangered fishes: Annual report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Breen, M. J. and J. A. Skorupski. 2013. Use of the Stewart Lake floodplain by larval and adult endangered fishes: Annual report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Breton, A. R., J. A. Hawkins, K. R. Bestgen, D. L. Winkelman, and G. C. White. 2013. Escapement rates of translocated smallmouth bass (*Micropterus dolomieu*) from Elkhead Reservoir to the Yampa River – Final Report. Upper Colorado River Endangered Fish Recovery Program, Project 16, Bureau of Reclamation Agreement # 9-FC-81-0143 09FC402885, Larval Fish Laboratory Contribution 168

Breton, A. R, D. L. Winkelman, J. A. Hawkins, and K. R. Bestgen. 2014. Population trends of smallmouth bass in the upper Colorado River basin with an evaluation of removal effects. Final report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Larval Fish Laboratory Contribution 169.

Brown and Caldwell. 2003. Phase 2 coordinated facilities water availability study for the endangered fishes of the Upper Colorado River. Final Report. Prepared for the Colorado Water Conservation Board. Denver.

Brunson, R.E., and K.D. Christopherson. 2005. Larval razorback sucker and bonytail survival and growth in the presence of nonnative fish in the Baeser floodplain wetland of the middle Green River. Final Report of Utah Division of Wildlife Resources, Vernal, to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Brunson, R.E., K.D. Christopherson, and T.N. Hedrick. 2007. Evaluation of nonnative fish escapement from Starvation Reservoir. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 1994. Conceptual management plan for habitat enhancement in flooded bottomlands: Escalante State Wildlife Area, Gunnison River downstream of Delta, Colorado. U.S. Fish and Wildlife Service Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 1994. Conceptual management plan for habitat enhancement in flooded bottomlands: gravel pit at 29-5/8 Road near Grand Junction, Colorado. U.S. Fish and Wildlife Service Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 1995. Ichthyofaunal studies of the Gunnison River, Colorado, 1992–1994. Final Report of U.S. Fish and Wildlife Service, Grand Junction, Colorado to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 1997. Minimum flow recommendation for passage of Colorado squawfish and razorback sucker in the 2.3-mile reach of the lower Gunnison River: Redlands Diversion Dam to the Colorado River confluence.

Burdick, B.D. 1999. Evaluation of fish passage at the Grand Valley Irrigation Company Diversion Dam on the Colorado River near Palisade, Colorado. U.S. Fish and Wildlife Service Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B. D. 2001. Five-year evaluation of fish passage at the Redlands Diversion Dam on the Gunnison River near Grand Junction, Colorado: 1996-2000. U. S. Fish and Wildlife Service Project Number CAP-4b Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 2002. Evaluating the use of sloped gravel-pit ponds by listed and non-listed native fishes and removal of nonnative fishes from sloped gravel-pit ponds in the upper Colorado River near Grand Junction, Colorado. U.S. Fish and Wildlife Service Project Number C-6-GP Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D. 2003. Monitoring and evaluating various sizes of domestic-reared razorback sucker stocked in the Upper Colorado and Gunnison rivers: 1995–2001. Final Report of U.S. Fish and Wildlife Service, Grand Junction, Colorado to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D., and L.R. Kaeding. 1990. Biological merits of fish passage as part of recovery of Colorado squawfish in the upper Colorado River basin. U.S. Fish and Wildlife Service Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D., and F.K. Pfeifer. 1996. Discussion of the merits for fish passage at Hartland Diversion Dam on the Gunnison River near Delta, Colorado. U.S. Fish and Wildlife Service Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Burdick, B.D., R.S. Wydoski, and C.W. McAda. 1995. Stocking plan for razorback sucker in the Upper Colorado and Gunnison rivers. Final Report of U.S. Fish and Wildlife Service, Grand Junction, Colorado to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Carlson, C. A., and R. T. Muth. 1989. Colorado River: lifeline of the American southwest. Pages 220-239 In: Proceedings of the International Large Rivers Symposium. D. P. Dodge, editor. Special Publication 106. Canadian Fisheries Aquatic

Sciences, Ottawa, Ontario, Canada.

Carpenter, J. 2005. Competition for food between an introduced crayfish and two fishes endemic to the Colorado River Basin. Environmental Biology of Fishes 72:335-342.

Cavalli, P. A. 1999. Fish community investigations in the lower Price River, 1996-1997. Utah Division of Wildlife Resources: 53. Salt Lake City.

Cavalli, P.A. 2000. An evaluation of the effects of Tusher Wash Diversion Dam on movement and survival of juvenile and subadult native fish. Utah Division of Wildlife Resources Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

CDOW. 1998. Aquatic wildlife management plan: Yampa River basin, Colorado. Colorado Division of Wildlife, Denver, Colorado.

CDOW. 2002. Draft Upper Colorado River Basin aquatic wildlife management plan. Colorado Division of Wildlife Draft Report, Denver, Colorado.

CDOW. 2003a. Colorado River Basin aquatic wildlife management plan. Colorado Division of Wildlife, Denver.

CDOW. 2003b. Gunnison River Basin aquatic wildlife management plan. Colorado Division of Wildlife, Denver.

CDOW. 2007. Elkhead Reservoir Final Lake Management Plan. Colorado Division of Wildlife, Grand Junction, Colorado.

CDOW. 2010. Yampa River Basin Aquatic Wildlife Management Plan. Colorado Division of Wildlife, Denver, Colorado.

Central Utah Water Conservancy District. 2013. 2004 – 2011 Water Management Report Duchesne River Working Group, Duchesne, Utah, 40p.

CH2MHill. 1997. Duchesne River hydrology and water availability study. Report to the Upper Colorado River Endangered Fish Recovery Program. U.S. Fish and Wildlife Service. Denver.

Chafin, D.T. 2002. Evaluation of trends in pH in the Yampa River, northwestern Colorado, 1950–2000. U.S. Geological Survey Water Resources Investigation Report 02–4038, Denver, Colorado.

Chart, T.E., and J. L. Mohrman. 2012. The Upper Colorado River Endangered Fish Recovery Program's position on the role of the Price River in recovery of endangered fish and the need for minimum flow management. Prepared for U.S. Fish and Wildlife Service, Ecological Service, Utah Field Office. 42 p.

Chart, T.E., D.P. Svendson, and L. Lentsch. 1999. Investigation of Potential Razorback Sucker (Xyrauchen texanus) and Colorado Pikeminnow (Ptychocheilus lucius: Spawning in the Lower Green River, 1994 and 1995. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Christopherson, K.D., G.J. Birchell, and T. Modde. 2004. Larval razorback sucker and bonytail survival and growth in the presence of nonnative fish in the Stirrup floodplain. Final Report of Utah Division of Wildlife Resources, Salt Lake City, to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Colorado Water Conservation Board. 2008. Colorado River: 15-Mile Reach Programmatic Biological Opinion Depletion Accounting Pursuant to Appendix B Report Period 2001-2005.

Cranney, S.J. 1994. Lower Duchesne River fishery investigations - 1993. Draft Report. Utah Division of Wildlife Resources, Vernal, UT.

Crowl, T.A., and L. Lentsch. 1996. Estimating northern pike predation on Colorado squawfish in the middle Green River: A bioenergetics approach. Project Number F-47-R Final Report of Utah State University and Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Crowl, T.A., and S. Rivera. 2000. The importance of flow training for the successful stocking of bonytail. Chapter 4, Draft 1998 Annual Report, February 2000, Ecology Center, Department of Fisheries and Wildlife, Utah State University, Logan, Utah.

Czapla, T.E. 1999. Genetics management plan. Upper Colorado River Endangered Recovery Program, Denver, Colorado.

Denver Water and Colorado River Water Conservation District. 2002. Comparison of water supply alternatives associated with the Upper Colorado River Endangered Fish Recovery Program. Draft report.

Douglas, M.E. 1995. Gila Taxonomy Project - Morphology. Draft Final Report of Arizona State University to Bureau of Reclamation, Salt Lake City, Utah.

Douglas, M.R., and M.E. Douglas. 2007. Genetic structure of humpback chub Gila cypha and roundtail chub G. robusta in the Colorado River Ecosystem. Final Report of Department of Fish Wildlife and Conservation Biology, Colorado state University, Fort Collins, Colorado to Grand Canyon Monitoring and Research Center, U.S. Geological Station, Flagstaff, Arizona.

Dowling, T.E. No Date. Genetic diversity of the Gila complex as determined by analysis of mitochondrial DNA. Draft Final Report of Arizona State University to Bureau of Reclamation, Salt Lake City, Utah.

Elmblad, W.R. 1997. The outcome of an experimental stocking of Colorado squawfish in Kenney Reservoir near Rangely, Colorado. Final Report of Colorado Division of Wildlife to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Elmblad, W. R. 1998. Evaluation of Stocking Channel Catfish in Kenney Reservoir, Colorado. Grand Junction, CO, Colorado Division of Wildlife: 29.

Elverud, D., 2012 Population Estimate for Humpback Chub (*Gila cypha*) and Roundtail Chub (*Gila robusta*) in Westwater Canyon, Colorado River, Utah 2007-2008.

Finney, S. T., and G. B. Haines. 2008. Northern pike removal, smallmouth bass monitoring, and native fish monitoring in the Yampa River, Hayden to Craig Reach, 2004-2006. Upper Colorado River Endangered Fish Recovery Program, Project 143, Synthesis Report. U. S. Fish and Wildlife Service, Lakewood, Colorado. 37 pp.

Francis, T.A., and C.W. McAda. 2011. Population size and structure of humpback chub, Gila cypha and roundtail chub, G. robusta, in Black Rocks, Colorado River, Colorado, 2007–2008. Final Report of U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T.A., and D. Ryden. 2014. Removal of Smallmouth Bass in the Upper Colorado River between Price-Stubb Dam near Palisade, Colorado, and Westwater, Utah. Annual report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Francis, T., K. R. Bestgen and G. C. White. 2016. Population Status of Humpback Chub, Gila cypha, and Catch Indices and Population Structure of Sympatric Roundtail Chub, Gila robusta, in Black Rocks, Colorado River, Colorado, 1998-2012. Final Report to the Upper Colorado River Endangered Fish Recovery Program, Denver Colorado.
Fuller, M. H. and Jay Groves. 2010. Duchesne River Fishery Survey. Ute Indian Tribe. Project 154 Annual Report.

Gardunio, E. I., Myrick, C. A., Ridenour, R. A., Keith, R. M. and Amadio, C. J. (2011), Invasion of illegally introduced Burbot in the upper Colorado River Basin, USA. Journal of Applied Ichthyology, 27: 36–42.

Grand River Consulting Co. 2009. Selected alternative for 10,825 acre-feet per year of water for the Upper Colorado River Endangered Fish Recovery Program. Prepared for 10825 Water Supply Stakeholders. Glenwood Springs, Colorado.

Green River Study Plan ad hoc Committee. 2007. Study plan for the implementation and evaluation of flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Grippo, M. K.E. LaGory, D. Waterman, J. W. Hayse, L. J. Walston, C. C. Weber, A. K. Magnusson, and X. Hui Jiang. 2017. Relationships between Flow and the Physical

Characteristics of Colorado Pikeminnow Backwater Nursery Habitats in the Middle Green River, Utah. Environmental Science Division Argonne National Laboratory Argonne, Illinois. Prepared for the Upper Colorado River Endangered Fish Recovery Program.

Groves, J. and M. Fuller. 2009 Native fish monitoring and nonnative fish monitoring and control in the lower Green River and associated tributaries within the Uintah and Ouray Indian Reservation, Utah. Project 154 Annual Report.

Haines, G.B., D.W. Beyers, and T. Modde. 1998. Estimation of winter survival, movement and dispersal of young Colorado squawfish in the Green River, Utah. Final Report of U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Haines, G. B. and T. Modde 1996. "Evaluation of Marking Techniques to Estimate Population Size and First-Year Survival of Colorado Squawfish." North American Journal of Fisheries Management 16: 905-912.

Hamilton, S.J., K.M. Holley, K.J. Buhl, F.A. Bullard, L.K. Weston, and S.F. McDonald. 1996. The evaluation of contaminant impacts on razorback sucker held in flooded bottomland sites near Grand Junction, Colorado - 1996. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hamilton, S.J., K.M. Holley, K.J. Buhl, F.A. Bullard, L.K. Weston, and S.F. McDonald. 1997. The evaluation of contaminant impacts on razorback sucker held in flooded bottomland sites near Grand Junction, Colorado - 1997. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hamilton, S.J., K.M. Holley, K.J. Buhl, F.A. Bullard, L.K. Weston, and S.F. McDonald. 2003. Evaluation of flushing of a backwater channel: concentrations of selenium and other inorganic elements in water, sediment, invertebrates, forage fish, and Colorado pikeminnow. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hansen, J.D. 2004. Duchesne River coordinated reservoir operations. Bureau of Reclamation, Provo, Utah.

Hawkins, J.A. 2009. An evaluation of fish entrainment into the Maybell Ditch on the Yampa River, Colorado, 2007 and 2008. Project No. 146 Final Report for the Upper Colorado River Endangered Fish Recovery Program. Contribution 151 of the Larval Fish Laboratory, Colorado State University, Fort Collins, Colorado.

Hawkins, J., T. Modde, and J. Bundy. 2001. Ichthyofauna of the Little Snake River, Colorado, 1995 with notes on movements of humpback chub. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver.

Hawkins, J.A., and T.P. Nesler. 1991. Nonnative fishes of the upper Colorado River basin: an issue paper. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hawkins, J. A., and J. O'Brien. 2001. Research plan for developing flow recommendations in the Little Snake River, Colorado and Wyoming, for endangered fishes of the Colorado River Basin. Colorado State University, Larval Fish Laboratory, final report to the Upper Colorado River Endangered Fish Recovery Program. Denver.

Hawkins, J., C. Walford, and T. Sorensen. 2005. Northern pike management studies in the Yampa River, Colorado,1999–2002. Final Report of Colorado State University to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hedrick, T.N., et al, 2009. Entrainment of Semi-Buoyant Beads and Razorback Sucker, Xyrauchen texanus, Larvae into Flood Plain Wetlands of the Middle Green River, Utah.

Hedrick, T.N., Breton, A.R., and Keddy, S.P. 2012. Razorback Sucker survival and emigration from the Stirrup floodplain, Middle Green River, Utah 2007-2010. Publication Number 12-10, Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hill, C. G. 2004. Dynamics of northern pike spawning and nursery habitat in the Yampa River, Colorado. Colorado State University final report of project C-31 to the Upper Colorado River Endangered Fish Recovery Program.

Hines, B. A., K. R. Bestgen, and G. C. White. 2016. Abundance estimates for humpback chub (Gila cypha) and roundtail chub (Gila robusta) in Westwater Canyon, Colorado River, Utah 2011–2012. Final Report, Project 132. Upper Colorado River Endangered Fish Recovery Program, Lakewood, Colorado. Larval Fish Laboratory Contribution 198.

Holden, P.B. 1980. The relationship between flows in the Yampa River and success of rare fish populations in the Green River system. Final Report of BIO/WEST, Inc., to U.S. National Park Service, Denver, Colorado.

Howard, J. 2014. Project 129: Humpback chub population estimates for Desolation/Gray Canyons, Green River Utah. 2014 Annual Report.

Howard, J. and J. Caldwell. 2018. Population Estimates for Humpback Chub (Gila cypha) in Desolation and Gray Canyons, Green River, Utah 2001-2015. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hydrosphere. 1995a. Reconnaissance evaluation of Yampa River diversions structures: River mile 53 to river mile 179. Hydrosphere Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Hydrosphere Resource Consultants. 1995b. Yampa River Basin recommended alternative detailed feasibility study. Final Report. Boulder, CO.

Integrated Stocking Plan Revision Committee. 2015. Revised Integrated Stocking Plan for Razorback Sucker and Bonytail. Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Irving, D.B. 1997. A discussion of providing fish passage for adult Colorado squawfish at Taylor Draw Dam on the White River, Colorado. U.S. Fish and Wildlife Service Project Number 32 Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Irving, D.B. 2003. Northern Ute Indian Tribe's nonnative stocking policy. Memo to Bob Muth, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Irving, D. B. and B. D. Burdick. 1995. Reconnaissance inventory and prioritization of existing and potential bottomlands in the upper Colorado River basin, 1993-1994. Final report of U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Irving, D., B. Haines, and T. Modde. 2004. White River base flow study, Colorado and Utah, 1995–1996. U.S. Fish and Wildlife Service, Project Number 5D Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Irving, D., and M. Montoya. 2002. Bottle Hollow Reservoir nonnative fish control structure. FY-02 Annual Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Jackson, J. A. 2010. Population Estimate for Humpback Chub (Gila cypha) and Roundtail Chub (Gila robusta) in Westwater Canyon, Colorado River, Utah 2003-2005. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Jackson, J. A., and P. V. Badame. 2002. Centrarchid and channel catfish control in the middle and lower Green River; 1997 and 1998. Utah Division of Wildlife Resources Project #59 to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Jackson, J.A., and J.M. Hudson. 2005. Population Estimate for Humpback Chub (*Gila cypha*) in Desolation and Gray Canyons, Green River, Utah 2001-2003. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program.

Johnson, B. M., P. J. Martinez, J. A. Hawkins, and K. R. Bestgen. 2008. Ranking predatory threats by nonnative fishes in the Yampa River, Colorado, via bioenergetics modeling. North American Journal of Fisheries Management 28:1941-1953.

Johnson, B.M., B. Wolf, and P.J. Martinez. 2014. Chemically Fingerprinting Nonnative Fish in Reservoirs. Final Report of Project C18/19 to the Upper Colorado River Endangered Fish Recovery Program.

Keeler-Foster, C. 2010. A genetic management plan for captive and translocated humpback chub in the lower Colorado River Basin. Dexter National Fish Hatchery and Technology Center, Dexter, New Mexico, to Grand Canyon Monitoring and Research Center, U.S. Geological Station, Flagstaff, Arizona.

Kidd, G. T. 1977. An investigation of endangered and threatened fish species in the upper Colorado River as related to Bureau of Reclamation projects. Final Report to U.S. Bureau of Reclamation, Northwest Fishery Research, Clifton, Colorado.

Kitcheyan, D. C., G.B. Haines, M.H. Fuller, and D.R. Beers. 2001. The presence of non-native and native fishes in the raceway and Green River canal below the Tusher Wash Diversion Dam. U.S. Fish and Wildlife Service Final Report

Kitcheyan, D.C., and M. Montagne. 2005. Movement, Migration, and Habitat Use by Colorado Pikeminnow (*Ptychocheilus lucius*) in a Regulated River below Flaming Gorge Dam, Utah. Draft Final Report of U.S. Fish and Wildlife Service to Dinosaur National Monument and Central Utah Project.

Kuhn, G. and C. A. Williams. 2004. Evaluation of streamflow losses along the Gunnison River from Whitewater downstream to the Redlands Canal Diversion Dam, near Grand Junction, Colorado, water years 1995–2003. U.S.G.S. Scientific Investigations Report 2004-5095.

LaGory, K., T. Chart, and J. Mohrman. 2015. A strategy to evaluate peak flow recommendations for sediment transport and habitat maintenance in the upper Colorado River basin: a technical supplement to the Green River and Aspinall study plans. Upper Colorado River Endangered Fish Recovery Program.

LaGory, K. E.; J. W. Hayse; and D. Tomasko. 2003. Recommended priorities for geomorphology research in endangered fish habitats of the Upper Colorado River Basin. Final Report. Upper Colorado River Endangered Fish Recovery Program Project 134. Argonne National Laboratory. Argonne, IL.

Lanigan, S.H., and H.M. Tyus. 1989. Population size and status of razorback sucker in the Green River basin, Utah and Colorado. North American Journal of Fisheries Management 9:68–73.

Larval Trigger Study Plan *ad hoc* Committee. 2012. Study Plan to Examine the Effects of Using Larval Razorback Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam Peak Releases. Coordinated by the Upper Colorado River Endangered Fish Recovery Program.

Lentsch, L.D., Y. Converse, P.D. Thompson, T.A. Crowl, and C.A. Toline. 1996a. Bonytail reintroduction plan for the upper Colorado River basin. Project Number 25 Final Report to Upper Colorado Endangered Fish Recovery Program.

Lentsch, L. D., B. G. Hoskins, and L. M. Lubomudrov. 1998. The White River and endangered fish recovery: a hydrological, physical and biological synopsis. Final Report Prepared for the Colorado River Recovery Implementation Program, Project No. 21. Utah Division of Wildlife Resources, Salt Lake City Utah. 46p.

Lentsch, L.D., L.M. Lubomudrov and B.G. Hoskins. 2000. The White River and endangered fish recovery: a hydrological, physical and biological synopsis. Final Report 1998, updated and edited 2000, to the Upper Colorado River Endangered Fish Recovery Program. Project No. 21. Utah Division of Wildlife Resources, Publication No. 00-37. Salt Lake City.

Lentsch, L.D., R.T. Muth, P.D. Thompson, B.G. Hoskins, and T.A. Crowl. 1996b. Options for selective control of nonnative fishes in the upper Colorado River basin. Utah Division of Wildlife Resources Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Lentsch, L.D., C.A. Toline, T.A. Crowl, and Y. Converse. 1998. Endangered fish interim management objectives for the Upper Colorado River Basin Recovery and Implementation Program. Final Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Martin, L. M., and F. B. Wright. 2010. Middle Yampa River northern pike and smallmouth bass removal and evaluation; Colorado pikeminnow and roundtail chub evaluation: 2004-2007. Project 98a Synthesis Report of Colorado Division of Wildlife to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Martinez, A.M. 2004. An evaluation of nonnative fish control treatments in ponds along the Colorado and Gunnison rivers. Project Number C-18/19 Final Draft Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Martinez, P. J. 2001. Westslope warmwater fisheries. Colorado Division of Wildlife, Federal Aid in Sport Fish Restoration, Project F-325-R6, Progress Report, Fort Collins

Martinez, P.J. 2002. Westslope warmwater fisheries. Colorado Division of Wildlife Federal Aid Project F-325-R7, Job 1, Segment Objective 2, Grand Junction, Colorado.

Martinez, P. J. 2012. Invasive crayfish in a high desert river: implications of concurrent invaders and climate change. Aquatic Invasions 7:219-234.

Martinez, P. J., T. E. Chart, M. A. Trammel, J. G. Wullschleger, and E. P. Bergersen. 1994. Fish species composition before and after construction of a main stem reservoir on the White River, Colorado. Environmental Biology of Fishes, 40:227-239.

Martinez, P.J., and N.P. Nibbelink. 2004. Colorado nonnative fish stocking regulation evaluation. Final Report of Colorado Division of Wildlife and Wyoming Geographic Information Science Center to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Masslich, W.J. 1993. City of Craig, Colorado, Yampa River diversion fish passage study. Final Report of Bio/West, Inc., Logan, Utah, to City of Craig, Colorado.
McAda, C. W. 2000. Flow recommendations to benefit endangered fishes in the Colorado and Gunnison rivers. Draft Report to the Upper Colorado River Endangered Fish Recovery Program. Colorado River Fishery Project: 54. U.S. Fish and Wildlife Service, Grand Junction, CO.

McAda, C. W. 2003. Flow recommendations to benefit endangered fishes in the Colorado and Gunnison rivers. Final Report to the Upper Colorado River Endangered Fish Recovery Program. Colorado River Fishery Project: 54. U.S. Fish and Wildlife Service, Grand Junction, CO.

McAda, C.W., and R.J. Ryel. 1999. Distribution, relative abundance, and environmental correlates for age-0 Colorado pikeminnow and sympatric fishes in the Colorado River. Project Number 45 Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Miller, W.J., D.E. Rees, and J.A. Ptacek. 2005. Investigation of nonnative fish escapement from Elkhead Reservoir. Miller Ecological Consultants, Inc., Fort Collins, Colorado.

Miller, P. 2018. Population Viability Analysis for the Colorado pikeminnow (*Ptychochelius lucius*): An assessment of current threats to species recovery and evaluation of management alternatives. Draft report dated 8 October 2017. 38 pages.

Minckley, W. L. 1991. Native fishes of the Grand Canyon: an obituary? Pages 124-177, In: Colorado River Ecology and Dam Management, Proceedings of a Symposium May 24-25, 1990, Santa Fe, New Mexico. National Academy Press, Washington, D.C.

Modde, T., and G.B. Haines. 2005. Survival and growth of stocked razorback sucker and bonytail in multiple floodplain wetlands of the middle Green River under reset conditions. Final Report of U.S. Fish and Wildlife Service, Vernal, Utah, to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Modde, T. and C. Keleher. 2003. Flow recommendations for the Duchesne River with a synopsis of information regarding endangered fishes. Report to the Upper Colorado River Endangered Fish Recovery Program, Project No. 84-1. U.S. Fish and Wildlife Service. Vernal, Utah.

Modde, T., W. J. Miller, and R. Anderson. 1999. Determination of habitat availability, habitat use, and flow needs of endangered fishes in the Yampa River between August and October. Final Report to Upper Colorado River Endangered Fish Recovery Program. Denver.

Modde, T. and G. Smith. 1995. Flow recommendations for endangered fish in the Yampa River. Final report of the U.S. Fish and Wildlife Service to the Upper Colorado River Endangered Fish Recovery Program. Denver.

Mohrman, J. 2016. Geomorphology Work. Annual Report of Project 86 for Upper Colorado River Endangered Fish Recovery Program. 2 pages.

Moyle, P.B. 1976. Fish introductions in California: history and impact on native fishes. Biological Conservation 9:101–118.

Muth, R.T., L.W. Crist, K.E. LaGory, J.W. Hayse, K.R. Bestgen, T.P. Ryan, J.K. Lyons, R.A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Muth, R. T., G. B. Haines, S. M. Meismer, E. J. Wick, T. E. Chart, D. E. Snyder, and J. M. Bundy. 1998. Reproduction and early life history of razorback sucker in the Green River, Utah and Colorado, 1992–1996. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Muth, R. T. and T. P. Nesler 1989. "Marking Colorado Squawfish Embryos and Newly Hatched Larvae with Tetracycline." The Southwestern Naturalist 34: 431-436.

Muth, R.T., and E.J. Wick. 1996. Sampling for juvenile Colorado squawfish in the Colorado River inflow to Lake Powell, 1995 and 1996. Final Report of Colorado State University Larval Fish Laboratory to the U.S. National Parks Service, Fort Collins, Colorado.

Muth, R.T., and E.J. Wick. 1997. Sampling for larval razorback sucker in the lower Green and Colorado rivers (Canyonlands National Park) and Colorado inflow to Lake Powell (Glen Canyon Dam Recreation Area), 1993–1995. Final Report of Colorado State University Larval Fish Laboratory to the U.S. National Parks Service, Fort Collins, Colorado.

Nelson, P. 1998. Floodplain protection issue paper - Phase 1. Colorado River Recovery Program Project No. 75. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Nesler, T.P., K. Christopherson, J.M. Hudson, C.W. McAda, F. Pfeifer, and T.E. Czapla. 2003. An integrated stocking plan for razorback sucker, bonytail, and Colorado pikeminnow for the Upper Colorado River Endangered Fish Recovery Program (Addendum to State Stocking Plans). Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Nonnative Fish *ad hoc* Committee. 2014. Upper Colorado River Basin Nonnative and Invasive Aquatic Species Prevention and Control Strategy. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Orabutt, D. E. 2006. Northern pike in selected Colorado trout reservoirs. Master's Thesis. Colorado State University, Fort Collins, Colorado. 63 pp.

Osmundson, D. B. 2001. Flow regimes for restoration and maintenance of sufficient habitat to recover endangered razorback sucker and Colorado pikeminnow in the Upper Colorado River. Colorado River Fishery Project: 63. U.S. Fish and Wildlife Service, Grand Junction, CO.

Osmundson, D.B. 2003. Removal of non-native centrarchids from upper Colorado River backwaters, 1999–2001: summary of results. U.S. Fish and Wildlife Service Project Number 89 Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Osmundson, D. B. and L. R. Kaeding. 1991. Recommendations for flows in the 15-mile reach during October-June for maintenance and enhancement of endangered fish populations in the Upper Colorado River. Colorado River Fishery Project: 82. U.S. Fish and Wildlife, Grand Junction, CO.

Osmundson, D.B., and S.C. Seal. 2009. Successful Spawning by Stocked Razorback Sucker in the Gunnison and Colorado Rivers, as Evidenced by Larval Fish Collections, 2002-2007. Final Report of U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Osmundson, D.B., and G.C. White. 2009. Population status and trends of Colorado pikeminnow of the upper Colorado River, 1991-2005. Final Report of U.S. Fish and Wildlife Service to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Osmundson, D. B., and G. C. White. 2014. Population structure, abundance and recruitment of Colorado pikeminnow of the upper Colorado River, 1991–2010. Final Report. U. S. Fish and Wildlife Service, Grand Junction, Colorado.

Roehm, G.W. 2004. Management plan for endangered fishes in the Yampa River Basin and environmental assessment. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Denver.

Scheer, B.K. 1998. Walter Walker State Wildlife Area Ichthyofaunal survey, 1994–1998. U.S. Fish and Wildlife Service Final Report, Grand Junction, Colorado.

Schelly, R.C., Herdmann, J.T., and M.J. Breen. 2014. Use of Stewart Lake floodplain by larval and adult endangered fishes. Annual report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Schoenherr, A.A. 1981. The role of competition in the replacement of native species by introduced species. Pages 173–203 *in* R.J. Naiman and D.L. Soltz, eds. Fishes in North American deserts. John Wiley and Sons. New York.

Secretary of the Interior. 2010. Utilization of Power Revenues for Annual Base Funding of the Upper Colorado River and San Juan River Basin Recovery Implementation Programs: A Report to Congress.

Secretary of the Interior. 2016. Report to Congress: Utilization of Power Revenues for Annual Base Funding of the Upper Colorado River and San Juan River Basin Recovery Implementation Programs.

Skorupski, J. A., M. J. Breen, and L. Monroe. 2012. Native Fish Response to Nonnative Fish Removal from 2005-2008 in the Middle Green River, Utah. Utah Department of Natural Resources Final Report Project 144 to the Upper Colorado River Endangered Fish Recovery Program.

Smith, G.R., and R.G. Green. 1991. Flaming Gorge consolidated hydrology report. U.S. Fish and Wildlife Service, Division of Water Resources, Denver, Colorado.

Snyder, D.E. 2003. Electrofishing and its harmful effects on fish. Information and Technology Report USGS/BRD/ITR-2003-0002: U.S. Government Printing Office, Denver, Colorado.

Speas, D.W. 2018. Flow Management and Endangered Fish in the Dolores River during 2012-2017. U.S. Bureau of Reclamation, Grand Junction, Colorado. Prepared for the U.S. Fish and Wildlife Service.

Speas, D. W., J.A. Hawkins, P.D. Mackinnon, K.R. Bestgen and C. W. Walford. 2014 Entrainment of Native Fish in the Maybell Ditch, 2011-2012. U.S. Bureau of Reclamation, Salt Lake City, UT, final report for Upper Colorado River Endangered Fish Recovery Program.

Speas, D.W., M. Breen, T. Jones, and R. Schelly. 2017. A memo the to the Biology Committee entitled, Updated floodplain wetland priorities for recovery of endangered fish in the Middle Green River

Staffeldt, R., M. Partlow, B. Anderson, and M. Breen. 2017. Nonnative fish control in the middle Green River. Annual report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Tetra Tech. 2000. Concept development report: Hartland Diversion Dam fish passage structure, Delta, Colorado. Draft Report prepared for U.S.B.R., Grand Junction.

Tetra Tech. 2000. Floodplain protection issue paper - Phase II. Colorado River Recovery Program Project No. 75. Final Draft Report of Tetra Tech ISG Engineering, Inc., to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Tetra Tech. 2005. Floodplain habitat restoration 2005 monitoring final report, Green River, Utah. Final Report of Tetra Tech, Inc., Breckenridge, Colorado, to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Trammell, M., S. Meismer, and D. Speas. 2005. Nonnative cyprinid removal in the lower Green and Colorado rivers, Utah. Utah Division of Wildlife Resources Project Number

87a Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Trammell, M., R. Valdez, H. Johnstone, and L. Jonas. 2002. Nonnative fish control in backwater habitats in the Colorado River. SWCA, Inc., Project Number 87b Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Tyus, H.M. 1984. Loss of stream passage as a factor in the decline of the endangered Colorado squawfish. Pages 138–144 *in* Issues and technology in the management of impacted western wildlife. Proceedings of a National Symposium. Thorne Ecological Institute Technical Publication Number 14, Boulder, Colorado.

Tyus. H.M., and C.A. Karp. 1989. Habitat use and streamflow needs of rare and endangered fishes, Yampa River, Colorado and Utah. U.S. Fish and Wildlife Service Biological Report 89:1–27.

Tyus, H. M., and I. James F. Saunders. 1996. Nonnative fishes in the upper Colorado River basin and a strategic plan for their control. Final Report of the University of Colorado Center for Limnology to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Tyus, H.M. and J.F. Saunders, III. 2001. An evaluation of the role of tributary streams for recovery of endangered fishes in the Upper Colorado River Basin, with recommendations for future actions. Draft report to the Upper Colorado River Endangered Fish Recovery Program. Center for Limnology, University of Colorado at Boulder.

Upper Colorado River Endangered Fish Recovery Program. 2002. Protocols for Colorado pikeminnow and humpback chub population estimates. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Upper Colorado River Endangered Fish Recovery Program. 2004. Nonnative Fish Management Policy. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Upper Colorado River Endangered Fish Recovery Program. 2006. Evaluation of population estimates for Colorado pikeminnow and humpback chub in the Upper Colorado River Basin. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

U.S. Bureau of Reclamation. 2005. Operation of Flaming Gorge Dam Environmental Impact Statement. U.S. Bureau of Reclamation, Provo, Utah.

U.S. Bureau of Reclamation. 2006. Record of Decision, Operation of Flaming Gorge Dam, Final Environmental Impact Statement.

U.S. Fish and Wildlife Service. 1990a. Humpback chub recovery plan. U. S. Fish and Wildlife Service, Denver, Colorado. 43 pp.

U.S. Fish and Wildlife Service. 1990b. Bonytail chub recovery plan. U. S. Fish and Wildlife Service, Denver, Colorado.

U.S. Fish and Wildlife Service. 1991. Colorado squawfish recovery plan. U. S. Fish and Wildlife Service, Denver, Colorado.

U.S. Fish and Wildlife Service. 1992. Final biological opinion on operation of Flaming Gorge Dam. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Denver.

U.S. Fish and Wildlife Service. 1995. Final biological opinion – round II water sale from Ruedi Reservoir. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Denver.

U.S. Fish and Wildlife Service. 1996a. Procedures for stocking nonnative fish species in the Upper Colorado River Basin. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. Also Finding of no significant impact *in* 1996 Stocking Procedures.

U.S. Fish and Wildlife Service. 1998. Formal Section 7 Consultation for the Middle Green River Basin Study, Stewart Lake Wildlife Management Area, National Irrigation Water Quality Program. U.S. Fish and Wildlife Service. Utah Field Office, Salt Lake City, UT.

U.S. Fish and Wildlife Service. 2009. Procedures for stocking nonnative fish species in the Upper Colorado River Basin. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

U.S. Fish and Wildlife Service. 1996b. Final Environmental Assessment for Procedures for stocking nonnative fish species in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado.

U.S. Fish and Wildlife Service. 1998. Razorback sucker recovery plan. U. S. Fish and Wildlife Service, Denver, Colorado.

U.S. Fish and Wildlife Service. 1999a. Final amendment to the biological opinion – round II water sale from Ruedi Reservoir. U.S. Fish and Wildlife Service, Mountain-Prairie Region. Denver.

U.S. Fish and Wildlife Service. 1999b. Final programmatic biological opinion for Bureau of Reclamation's operations and depletions, other depletions, and funding and implementation of Recovery Program actions in the Upper Colorado River above the confluence with the Gunnison River, December 1999. Mountain-Prairie Region, Denver.

U.S. Fish and Wildlife Service. 2001. Ute Tribal Elder fishing pond construction and Bottle Hollow Reservoir fish screen installation. Draft Environmental Assessment

prepared for the Uintah and Ouray Indian Reservation Ute Tribe Fish and Wildlife Department, Fort Duchesne, Utah.

U.S. Fish and Wildlife Service. 2002a. Humpback chub (*Gila cypha*) recovery goals: amendment and supplement to the Humpback Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2002b. Bonytail (*Gila elegans*) recovery goals: amendment and supplement to the Bonytail Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2002c. Colorado pikeminnow (*Ptychocheilus lucius*) recovery goals: amendment and supplement to the Colorado Squawfish Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2002d. Razorback sucker (*Xyrauchen texanus*) recovery goals: amendment and supplement to the Razorback Sucker Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, Colorado.

U.S. Fish and Wildlife Service. 2009. Final Gunnison River Basin Programmatic Biological Opinion. U.S. Fish and Wildlife Service, Denver, Colorado. 123 pp.

U.S. Fish and Wildlife Service. 2011a. Humpback chub (*Gila cypha*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 26 pp.

U.S. Fish and Wildlife Service. 2011b. Colorado pikeminnow (*Ptychocheilus lucius*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 25 pp.

U.S. Fish and Wildlife Service. 2012a. Bonytail (*Gila elegans*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 26 pp.

U.S. Fish and Wildlife Service. 2012b. Razorback sucker (*Xyrauchen texanus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 35 pp.

U.S. Fish and Wildlife Service. 2017. Species Status Assessment for the Humpback Chub (*Gila cypha*). U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 220 pp.

U.S. Fish and Wildlife Service. 2018a. Humpback chub (*Gila cypha*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 15 pp.

U.S. Fish and Wildlife Service. 2018b. Species Status Assessment for the Razorback sucker (*Xyrauchen texanus*). U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 192 pp.

U.S. Fish and Wildlife Service. 2018c. Razorback sucker (*Xyrauchen texanus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado. 25 pp.

USGS. 2003. Selenium Contamination and Remediation at Stewart Lake Waterfowl Management Area and Ashley Creek, Middle Green River Basin, Utah. 6 pages.

Utah Department of Natural Resources. 2010. Utah Work Plan – 2010:_Green River Flow Protection for Endangered Fishes, Submitted to the U.S. Fish And Wildlife Service, Upper Colorado River Endangered Fish Recovery Program. Utah Department of Natural Resources. Salt Lake City, Utah. 7 pp.

Utah Division of Water Resources. 2000. State Water Plan, West Colorado River Basin, Utah Board of Water Resources, Salt Lake City, Utah.

Utah Division of Water Resources. 2012. San Rafael River and Muddy Creek Watersheds Study. Utah Division of Water Resources, Salt Lake City, Utah.

Utah Division of Water Rights. 1994. Policy regarding applications to appropriate water and change applications which divert water from the Green River between Flaming Gorge Dam, downstream to the Duchesne River. Policy adopted on November 30, 1994, State Water Engineer, Robert L. Morgan.

Utah Division of Wildlife Resources. 2014. Positive Barriers to Sportfish Escapement from Starvation Reservoir. August 2014. UDWR Publication Number 16-22. Utah Division of Wildlife Resources, Salt Lake City, Utah.

Utah Division of Wildlife Resources. 2016. Starvation Lake Fishery Management Plan. Utah Division of Wildlife Resources, Salt Lake City, Utah.

Valdez, R. A. P. Mangan, M. McInerny, and R. P. Smith. 1982. Colorado River Fishery Project, Tributary Report (Gunnison and Dolores River) Final Report, U.S. Fish and Wildlife Service, Grand Junction, Colorado.

Valdez, R.A., W.J. Masslich, and A. Wasowicz. 1991. Dolores River native fish habitat suitability study: Annual Summary Report, 1990. BIO/WEST Inc., Logan, Utah.

Valdez, R.A., and P. Nelson. 2004a. Green River Subbasin Floodplain Management Plan. Final Report of R.A. Valdez and Associates, Inc., to Upper Colorado Endangered Fish Recovery Program.

Valdez, R.A., and P. Nelson. 2004b. Colorado River Subbasin Floodplain Management Plan. Final Report of R.A. Valdez and Associates, Inc., to Upper Colorado Endangered Fish Recovery Program.

Valdez, R.A., T. Chart, T. Nesler, D. Speas, and M. Trammell. 2008. Yampa River Nonnative Fish Control Strategy. Upper Colorado River Endangered Fish Recovery Program.

Valdez, R.A., A. Widmer, K. Bestgen. 2011. Research Framework for the Upper Colorado River Basin. Final Report of SWCA Environmental Consultants and Larval Fish Laboratory, Colorado State University Resources to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Vaske, J. J. (1995). Knowledge, Beliefs, and Attitudes Toward the Endangered Fish of the Upper Colorado River Basin. Ft. Collins, Colorado State University: 91.

Webber, P.A., and D. Beers. 2014. Detecting razorback suckers using passive integrated transponder tag antennas in the Green River, Utah. Journal of Fish and Wildlife Management 5(1):191–196.

Webber, P.A., K.R. Bestgen, and G.B. Haines. 2013. Tributary Spawning by Endangered Colorado River Basin Fishes in the White River. North American Journal of Fisheries Management 33:1166–1171.

Whitledge, G. W., B. M. Johnson, P. J. Martinez, and A. M. Martinez. 2007. Sources of nonnative centrarchids in the upper Colorado River revealed by stable isotope and microchemical analyses of otoliths. Transactions of the American Fisheries Society 136:1263–1275.

Williams, C.A., Gerner, S.J., and J.G. Elliott. 2009. Summary of fluvial sediment collected at selected sites on the Gunnison River in Colorado and the Green and Duchesne Rivers in Utah, water years 2005–2008: U.S. Geological Survey Data Series 409, 123 p.

Williams, C.A., Schaffrath, K.R., Elliott, J.G., and Richards, R.J., 2013, Application of sediment characteristics and transport conditions to resource management in selected main-stem reaches of the Upper Colorado River, Colorado and Utah, 1965–2007: U.S. Geological Survey Scientific Investigations Report 2012–5195, 82 p.

Williamson, J.H., D.C. Morizot, and G.J. Carmichael. 1999. Biochemical genetics of endangered Colorado pikeminnow from the Green, Yampa, Colorado, and San Juan rivers. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Williamson, J.H., and R.S. Wydoski. 1994. Genetic Management Guidelines. Upper Colorado River Endangered Recovery Program, Denver, Colorado.
Wydoski, R. S. 1994. Coordinated Hatchery Facility Plan: Need for Captive-

Reared Endangered Fish and Propagation Facilities. Denver, CO, US Fish and Wildlife Service.

Wydowski, R.S. 1994. Coordinated Hatchery Facility Plan. Report to the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin.

Wydoski, R.S. 1995. Genetics management plan. Upper Colorado River Endangered Recovery Program, Denver, Colorado.

Zelasko, K.A., K.R. Bestgen and G.C. White. 2009. Survival rate estimation and movement of hatchery-reared razorback suckers Xyrauchen texanus in the Upper Colorado River Basin, Utah and Colorado. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Zelasko, K.A., K.R. Bestgen and G.C. White. 2011. Survival rate estimation of hatchery-reared razorback suckers Xyrauchen texanus stocked in the Upper Colorado River Basin, Utah and Colorado, 2004-2007. Final Report of Colorado State University Larval Fish Laboratory, Department of Fish, Wildlife, and Conservation Biology to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Zelasko, K. A., K. R. Bestgen, J. A. Hawkins, G. C. White. 2015. Abundance and population dynamics of invasive Northern Pike, Yampa River, Colorado, 2004–2010. Final Report to the Upper Colorado River Endangered Fish Recovery Program, Project 161b, Denver. Larval Fish Laboratory Contribution 185.

Zelasko, K.A., K.R. Bestgen, and G.C. White. 2018. Abundance and survival rates of razorback suckers Xyrauchen texanus in the Green River, Utah, 2011-2013. Final Report of Larval Fish Laboratory, Colorado State University to Upper Colorado Endangered Fish Recovery Program, Denver, Colorado.

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.