Middle Rio Grande Endangered Species Collaborative Program

Draft Action Plan

Activities, Schedule, and Budget Projections

DRAFT

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Preface

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program or Program) has decided to advance the Program through the structure of a recovery implementation program (RIP). This Draft Action Plan is under development in anticipation of being part of a 5-year action plan for the RIP. It identifies actions and tasks that have been agreed upon to date by the Program parties to further the interests of efficiency and increased emphasis on species recovery and Endangered Species Act compliance.

It is anticipated that this document will be revised prior to it becoming the conservation measure for the RIP. Future revisions will include commitments in the form of responsibilities and tools from various Program parties. In its current form, it is a draft for review by the U.S. Fish and Wildlife Service and Program members.

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Acronyms

AM	adaptive management
BO	Biological Opinion
Collaborative Program	Middle Rio Grande Endangered Species Collaborative Program
CPUE	catch per unit effort
EC	Middle Rio Grande Endangered Species Collaborative Program Executive Committee
ESA	The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
flycatcher	Southwestern Willow Flycatcher (*Empidonax traillii extimus*)
LTP	Long-Term Plan
MRG	Middle Rio Grande
PVA	Population Viability Analysis
RIP	Recovery Implementation Program
Service	U.S. Fish and Wildlife Service
silvery minnow	Rio Grande silvery minnow (*Hybognathus amarus*)
WMP	Water Management Plan

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1 Introduction

1.1 Background

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program or Program) has decided to advance the Collaborative Program through the structure of a recovery implementation program (RIP). This Action Plan identifies substantive RIP elements, actions, and tasks that are necessary to meet the purpose and goals of the RIP.

The general purpose of the RIP is:

To protect and improve the status of species listed pursuant to the Endangered Species Act (ESA) within the Middle Rio Grande (MRG) by implementing certain recovery activities to benefit those species and their associated habitats, with special emphasis on the Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow) and the Southwestern Willow Flycatcher (*Empidonax traillii extimus*; flycatcher);

and, simultaneously,

To protect existing and future water uses while complying with applicable state and federal laws, rules and regulations, and to serve as the ESA coverage vehicle for water uses and management actions in the Program area.

The following goals were established by the Collaborative Program as a means to fulfill the above purposes. All signatories believe that the RIP is the best mechanism to carry out the following goals in accordance with State and Federal laws and Rio Grande Compact obligations.

1. Alleviate jeopardy to the listed species and adverse modification of their designated critical habitats in the MRG Program area
    - Avoid actions that preclude survival or recovery of the listed species
    - Continually identify the critical scientific questions and uncertainties that will be addressed through adaptive management (AM) in support of a hydrologically and biologically sustainable MRG water operations Biological Opinion[1] (BO)

[1] The U.S. Army Corps of Engineers submitted a Biological Assessment and has requested a separate BO.

2. Conserve and contribute to the recovery of the listed species within the constraints of the RIP
    - Stabilize existing populations through ongoing and future management activities
    - Support the development of self-sustaining populations
3. Protect existing and future water uses
    - Provide a mechanism for ESA compliance for identified federal and non-federal actions that do not create additional net depletions to the MRG
    - Provide a process for streamlined Section 7 consultation for future water uses needing compliance with the ESA

1.2 Need for Action Plan

The Middle Rio Grande Recovery Implementation Program (RIP) is established through the following formal documents: the RIP Document, this RIP Action Plan, and a Cooperative Agreement. The RIP utilizes three main plans to plan and implement activities to benefit the listed endangered species: the Long Term Plan (LTP), the Action Plan, and the Annual Work Plan.

- The LTP is a background guidance document that provides an inventory describing beneficial activities that may be implemented by the RIP to meet its purposes and goals.
- The Action Plan tiers off the LTP and includes the activities that are projected to be implemented during the first 5 years after the RIP is established. Implementation of the Action Plan will proceed when appropriate according to adaptive management principles. The Action Plan has a 5-year window of planning activities and is expected to be updated on an annual or biannual basis.
- The Annual Work Plan is the list of activities, schedule, and budget that will be funded during the upcoming federal fiscal year by the RIP. It will take all the contributions, federal and nonfederal, into consideration.

In addition to the three RIP plans, federal and non-federal water management entity Program members will establish additional plans and strategies, such as a Water Management Plan (WMP) and San Acacia Plan, to be included in the suite of water management tools available to assist the Program in meeting its species goals. These tools and strategies are referenced in the LTP and the Action Plan.

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This Action Plan is needed to identify specific actions and tasks that the RIP plans to implement, according to Annual Work Plans, during the first five years of its existence to advance the purposes and goals stated above. Future 5-year Action Plans will be updated annually or biannually, with revised actions and tasks generally drawn from and tiered from the broader inventories of possible species recovery actions identified and described in the Program's LTP and species Recovery Plans. All updates or revisions to the RIP Action Plan shall be approved by the Collaborative Program Executive Committee (EC). In selecting future Action Plan actions and tasks, the EC's decision-making will be guided by species needs for survival and recovery as determined by the best available scientific information and shall consider new information from the adaptive management process, recommendations in the River Advisory Team's report concerning improvements to or modification of the management activities, input from the Service regarding adjustments to the RIP Action Plan activities or metrics, and other appropriate sources of information.

The LTP is a background guidance document that provides an inventory describing the full range of potential activities that may be implemented by the RIP to meet its purposes and goals. The previous 2006 LTP will be updated and replaced by a revised LTP pursuant to one of the tasks under the first Action Plan for the RIP.

1.3 Formulation of Elements and Activities

The Elements, Actions, and Tasks described in this Action Plan and in the LTP are principally founded on the work and accomplishments of the Collaborative Program from 2000 to 2012 (see http://www.middleriogrande.com/Default.aspx?tabid=174), the 2009 draft long-term plan (Water Consult 2010), the recovery plans for the flycatcher and the silvery minnow (U.S. Fish and Wildlife Service 2009, 2002), biological assessments (U.S. Bureau of Reclamation 2003, 2012), the 2003 Biological Opinion (U.S. Fish and Wildlife Service 2003), and the initial framework for an adaptive management plan (Murray et al. 2011).

This Action Plan includes activities for the endangered Rio Grande silvery minnow (*Hybognathus amarus*) and the southwestern willow flycatcher (*Empidonax traillii extimus*). The threatened Pecos sunflower (*Helianthus paradoxus*), the endangered Interior least tern (*Sternula antillarum athalassos*), and the candidate New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) are not addressed in this Action Plan. The only population of the Pecos sunflower within the MRG water management action area is at the La Jolla Waterfowl Management Area in Socorro County near the confluence of the Rio Puerco. The least tern has been observed as a 'vagrant' or 'highly unusual' species

in the area, and the jumping mouse nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet. It is believed that activities designed to benefit the silvery minnow and the flycatcher will not harm and may benefit these other species.

This Action Plan is organized to focus RIP activities on the species of concern in a manner that promotes and emphasizes the integration of the essential components of species habitat (water, channel morphology, floodplain, food, water quality, etc.) within an adaptive management framework. This framework is an important premise underlying Action Plan implementation, as it directs that the RIP activities pertaining to and affecting species should be designed and coordinated to incorporate, where warranted, appropriate hypotheses, research and monitoring of species needs and responses. This information will allow water managers and regulators to address species needs in a more effective and resource-efficient manner.

This Action Plan builds on and formalizes the existing coordination of water management agencies in the MRG, regulatory authorities, and program participants during the water year to ensure that MRG activities, including those contained in the WMP, are coordinated among the various agencies throughout the year and are well informed by science. The recovery actions and tasks identified in this Action Plan include those considered to be most important, within a 5-year timeframe, to alleviate threats to species and promote recovery. The Action Plan also describes some elements, actions and tasks that have been prescribed (under the 2003 Biological Opinion) and relied on to date in an attempt to securely manage the species while the current RIP formation effort has been in process. In particular, the operation of silvery minnow propagation facilities that was prescribed to ensure survival and promote recovery will continue under a RIP while these resources are needed.

While it is still unknown if two or more additional and distinct, self-sustaining populations can be established for the silvery minnow, the Program believes it is important to assist with efforts on range expansion outside the MRG. The Big Bend 10(j) efforts that have been underway since 2007 may provide one additional area if stocked fish become self-sustaining. The Program proposes relatively short-term and phased-in assistance for additional range expansion efforts outside the MRG. In addition, within the Program Area certain efforts will be taken to expand the silvery minnow's range.

The RIP will support recovery efforts for the flycatcher within the Program Area. The formulation of elements and activities for the flycatcher is presented in a similar manner to that of the silvery minnow. Many of the activities for the silvery minnow should be

beneficial for the flycatcher as well. The efforts for flycatcher that are funded by the RIP are restricted to the Program Area with the exception of supporting monitoring at Elephant Butte, which is just south of the Program boundary.

1.4 Tools and Strategies

A number of tools and strategies will used to accomplish RIP actions within an adaptive management framework. These tools and strategies may identify resources that may be used or provide details needed to fully implement the actions and tasks within the Action Plan.

The RIP will be responsible for developing tools and strategies that would be described in plans addressing their actions, including, but not limited to, a Genetics Management and Propagation Plan, a Refuge Habitat Plan for Rio Grande Silvery Minnow During River Drying Events, a Fish Population and Monitoring Plan, a Plan to Investigate and Identify Additional Introduction Sites for Minnow, a Communication and Outreach Plan, and an Adaptive Management Plan.

Other tools may be utilized by the RIP that are not developed within the RIP. These tools and strategies include, but are not limited to, Bureau of Reclamation's Water Management Plan, Middle Rio Grande Conservancy District's Operations Plan, and the U.S. Fish and Wildlife Service's Recovery Plan. The RIP will not be accountable for tools and strategies developed independently by RIP members.

1.5 Adaptive Management

The Collaborative Program will be initiating adaptive management principles as it seeks to achieve the RIP goals. The highly variable southwestern climate, increasing demands on limited water supplies, and uncertainties regarding the listed species life history indicate a strong basis for incorporating adaptive management for MRG resources. As the RIP progresses, it is important that the uncertainties and related hypotheses about the listed species and their habitats are better understood. The Adaptive Management Plan, Version 1.1 (AM Plan; Murray et al. 2011), which was completed for the Collaborative Program in 2011, provides adaptive management principles and strategies to approaching RIP issues. The Action Plan's integration of water, species, and habitat management will rely heavily on reducing uncertainties through scientific investigation and hypothesis testing. Further refinement of the AM Plan is envisioned as a task for the RIP.

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1.6 Sufficient Progress Determination

The Service will make an annual determination of whether the RIP is making sufficient progress toward recovery of listed species. This determination of sufficient progress ensures continued ESA compliance for covered actions. It is conditioned on the Fish and Wildlife Service's assessment in its Biological Opinion that the RIP activities adequately serve to minimize detrimental listed species effects of the proposed water use and management actions and that covered actions in combination with RIP activities are not reasonably expected, directly or indirectly, to diminish listed species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced or to result in the destruction or adverse modification of critical habitat. The sufficient progress determination will also assess whether RIP activities are advancing species recovery by working toward the reduction of threats to listed species and the improvement of the status of listed species and their habitats.

The RIP will adopt specific criteria (Sufficient Progress Metrics) by which the Service will make the sufficient progress determination. The RIP Sufficient Progress Metrics (Metrics) will consist of (1) measures of implementation of RIP activities listed in the current Five-Year Action Plan and (2) measures of species response to RIP activities, including demographic indicators of the species and population viability analysis assessment of the probability of species survival over a given period (e.g., 100 years).

It is recognized that the current monitoring protocols are not sufficiently precise and sensitive to be endorsed by the RIP for purposes of measuring species response to specific management activities and progress toward recovery. During the first two years of RIP operations, the RIP will continue to collect and consider the results of ongoing demographic monitoring data in its implementation of activities under the RIP, but will not use such data in a Sufficient Progress Metric. During this interim period, the EC will work to determine appropriate and scientifically supportable Metric(s) to determine if the species is making progress towards recovery. The Service will assess sufficient progress during this interim period based on (1) measures of implementation of RIP activities, and (2) steps undertaken and progress made by the RIP toward reaching agreement upon use of catch per unit effort (CPUE) and/or other methods to assess species status and/or response.

The establishment of sufficient process metrics is further described in Appendix A.

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2 Elements for Rio Grande Silvery Minnow

Elements and activities anticipated to be pursued during the period of this 5-year Action Plan to fulfill the Collaborative Program's purposes and goals relative to the Rio Grande silvery minnow are outlined in Sections 2.1 through 2.5 and summarized in Appendix B.

2.1 Element 1 - Spawning and Survival of Larvae

Action 2.1.1. Create habitat for spawning and larval rearing.

Task 2.1.1a. Develop and implement a habitat restoration strategy, resulting in a prioritized list of habitat projects.

Task 2.1.1b. Over 5 years, target a total of 300 acres of habitat in the Cochiti, Albuquerque, Isleta, and San Acacia reaches based on past experience and implementability.

Action 2.1.2. Work to provide spring-time hydrologic (flow) conditions and suitable habitat to produce spawning and larval fish survival.

Task 2.1.2a. In advance of spring runoff, the Action Team will evaluate the annual species management objectives, available resources, climatic projections, and other information to develop recommendations for that specific year.

Task 2.1.2b. Manage resources in accordance with Action Team's approved recommendations as needed to provide environmental conditions expected to produce spawning and larval fish survival (e.g., provide wet river for at least 45 days post peak spawn).

2.2 Element 2 - Post-Spawning

Action 2.2.1. Provide viable wetted habitats during main channel drying events.

Task 2.2.1a. Develop a "Refuge Habitat Plan for Rio Grande Silvery Minnow During River Drying Events" to identify desirable areas for refuge sites, strategies for enhancing their benefits, available water sources, and evaluation methods.

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Task 2.2.1b. Construct and maintain "refuge habitats" in the Albuquerque, Isleta, and San Acacia reaches for use during river drying events as prescribed by the Refuge Habitat Plan (Task 2.2.1a).

Action 2.2.2. Work to provide hydrologic (flow) conditions to support survival in all years.

Task 2.2.2a. In advance of spring runoff, the Action Team will evaluate the annual species management objectives, available resources, climatic projections, and other information to develop recommendations for that specific year.

Task 2.2.2b. Manage resources in accordance with Action Team's approved recommendations as needed to provide environmental conditions sufficient to produce silvery minnow post-spawning survival.

Action 2.2.3. Minimize silvery minnow mortality associated with river drying.

Task 2.2.3a. Manage rates of recession to minimize stranding and mortality of silvery minnow.

Task 2.2.3b. Rescue and relocate silvery minnow.

Action 2.2.4. Increase reach boundary connectivity.

Tasks to be determined.

2.3 Element 3 - Propagation and Augmentation

Action 2.3.1. Plan and evaluate silvery minnow propagation and augmentation program.

Task 2.3.1a. Revise and refine "RGSM Genetics Management and Propagation Plan" including captive rearing and propagation to augment the population in the middle Rio Grande and identification of reintroduction sites to start new populations.

Task 2.3.1b. Perform genetic evaluation of captive and wild fish and determine effect of augmentation on genetic viability of wild populations.

Task 2.3.1c. Determine best propagation strategy for genetic viability of silvery minnow as part of Task 2.3.1a, Revise and refine "RGSM Genetics Management and Propagation Plan."

Task 2.3.1d. Determine genetic effective population size of the silvery minnow.

Action 2.3.2. Develop, support, and maintain propagation and rearing facilities for silvery minnow.

Task 2.3.2a. Continue to fund, maintain, and operate the Albuquerque BioPark Facility.

Task 2.3.2b. Continue to fund, maintain, and operate the Los Lunas Silvery Minnow Refugium.

Task 2.3.2c. Continue to fund and support technical assistance from the Dexter National Fish Hatchery and Technology Center (DNFH), including maintaining fish on-site.

Task 2.3.2d. Assist with efforts at Rio Grande Silvery Minnow Sanctuary.

Action 2.3.3. Rear and maintain silvery minnow in captivity.

Task 2.3.3a. Annually gather silvery minnow eggs in drift from wild populations and rear the young in captivity, with a goal of collecting approximately 500,000 eggs to meet annual stocking commitments.

Task 2.3.3b. Maintain at least 100,000 silvery minnow of wild genetic origin in captivity on an annual basis for restoration in case of a catastrophe.

Task 2.3.3c. Quantify and evaluate genetic diversity of wild and captive fish to ensure genetic diversity as part of Task 2.3.1b, Perform genetic evaluation.

Task 2.3.3d. Maintain sufficient numbers of silvery minnow to augment existing populations, as necessary.

Action 2.3.4. Augment MRG wild populations as necessary.

Task 2.3.4a. Evaluate the need for and make recommendations for augmentation as necessary.

Task 2.3.4b. Accomplish augmentation as needed.

2.4 Element 4 - Research, Monitoring, and Adaptive Management

Action 2.4.1. Develop and implement fish population monitoring programs with sufficient reliability, precision, and accuracy for RIP needs.

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Task 2.4.1a. Synthesize monitoring data sets (see Task 2.4.3a).

Task 2.4.1b. Convene a series of workshops to evaluate and redefine a Rio Grande Silvery Minnow population monitoring program based on RIP needs.

Task 2.4.1c. Write and scientifically review a refined "Fish Population Monitoring Plan" with the appropriate design and data analysis.

Task 2.4.1d. Implement, evaluate, and refine the monitoring program, as necessary.

Action 2.4.2. Conduct, evaluate, and refine ongoing monitoring activities. The list of tasks is not exhaustive and includes examples taken from long-term plan.

Task 2.4.2a. Monitor spawning and egg production.

Task 2.4.2b. Monitor habitat conditions, usage, and effectiveness of completed habitat restoration projects.

Task 2.4.2c. Monitor and assess wild and captive-propagated silvery minnow genetics.

Task 2.4.2d. Monitor water movement through the Middle Rio Grande Valley.

Task 2.4.2e. Additional monitoring as needed.

Action 2.4.3. Use adaptive management to identify and prioritize specific research and monitoring activities.

Task 2.4.3a. Synthesize science data sets starting from program consensus data set and DBMS to achieve (1) consensus conclusion, (2) alternative hypotheses, and (3) data gap. This will serve as a body of knowledge to guide development of science/monitoring plans.

Task 2.4.3b. Evaluate previous projects and develop a prioritized list of ongoing and future activities and related research.

Task 2.4.3c. Convene a series of workshops to address specific questions or uncertainties related to silvery minnow and its habitat.

Action 2.4.4. Conduct silvery minnow research for the RIP. The list of tasks is not exhaustive and includes examples taken from long-term plan.

Task 2.4.4a. Determine factors that affect age structure, age-specific survival rates, and recruitment.

Task 2.4.4b. Determine factors that affect growth rates of silvery minnow.

Task 2.4.4c. Determine fecundity (average number of eggs per female) and maternity (proportion of young produced per female that reach maturity).

Task 2.4.4d. Determine effective female:male gender ratio for spawning.

Task 2.4.4e. Determine food habits of the silvery minnow.

Task 2.4.4f. Determine species habitat needs by life stage and river reach.

Action 2.4.5. Determine the viability of silvery minnow populations. The list of tasks is not exhaustive and includes examples taken from PVA work group.

Task 2.4.5a. Maintain and use population viability analysis (PVA) models in an adaptive management framework.

Additional tasks to be added as developed by PVA workgroup.

Action 2.4.6. Update and refine the adaptive management plan.

Tasks to be determined.

2.5 Element 5 - Additional Wild Self-Sustaining Populations

Action 2.5.1. Support the development of additional wild self-sustaining populations of silvery minnow.

Task 2.5.1a. Contribute to Big Bend monitoring, augmentation, and research.

Task 2.5.1b. Complete evaluation of alternative reintroduction sites.

Task 2.5.1c. Implement reintroduction activities as approved based on results of evaluation.

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3 Elements for Southwestern Willow Flycatcher

Elements and activities anticipated to be pursued during the period of this 5-year Action Plan to fulfill the Collaborative Program's purposes and goals relative to the Southwestern Willow Flycatcher are outlined in Sections 3.1 through 3.3 and summarized in Appendix B.

3.1 Element 1 - Territory Establishment and Nesting Success

Action 3.1.1. Create habitat conducive to territory establishment and nesting success.

Tasks to be determined.

Action 3.1.2. Create hydrologic conditions conducive to territory establishment and nesting success.

Tasks to be determined.

3.2 Element 2 - Flycatcher Research, Monitoring, and Adaptive Management

Action 3.2.1. Assess, identify and prioritize specific science activities that address overall Program goals.

Tasks to be determined.

Action 3.2.2. Conduct flycatcher research critical to RIP.

Tasks to be determined.

Action 3.2.3. Determine the viability of flycatcher populations.

Tasks to be determined.

Action 3.2.4. Develop and implement monitoring programs with sufficient reliability, precision, and accuracy for RIP needs.

Tasks to be determined.

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3.3 Element 3 - Populations Outside the Program boundaries (within New Mexico)

Action 3.3.1. Support the development of other populations of flycatcher.

Tasks to be determined.

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4 RIP Management Elements

Elements and activities anticipated to be pursued during the period of this 5-year Action Plan to fulfill the Collaborative Program's purposes and goals relative to RIP management are outlined in Section 4.1 and summarized in Appendix B.

4.1 Element 1 – RIP Management

Action 4.1.1. Administer the RIP.

Task 4.1.1a. Schedule and coordinate Program activities, including meetings of executive and technical committees.

Task 4.1.1b. Establish and coordinate independent science panel.

Task 4.1.1c. Develop and administer required internal processes such as peer review process, information dissemination, etc.

Task 4.1.1d. Fiscal management (i.e., budgeting, funding and contracting).

Task 4.1.1e. Reporting and accountability under program documents.

Action 4.1.2. Implement and coordinate RIP activities.

Task 4.1.2a. Develop and implement long-term planning.

Task 4.1.2b. Prepare, update, and implement Action Plan and annual work plans.

Task 4.1.2c. Communication and outreach including ongoing public relations for the program and new communication planning.

Task 4.1.2d. Implement priority Program projects.

Task 4.1.2e. Integrate tools and strategies from plans such as the Water Management Plan and San Acacia Plan as approved.

Task 4.1.2f. Establish an Action Team to provide recommendations regarding the annual needs of listed species in the MRG to the Water Managers who will utilize the tools and strategies described in the WMP to meet those needs.

Action 4.1.3. Establish and maintain a Database Management System for RIP needs.

Task 4.1.3a: Procure original datasets from investigators in a flat-file, fixed format.

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Task 4.1.3b: Reconcile all data errors, inconsistencies, and discrepancies with data collectors to ensure a clean and concise database.

Task 4.1.3c: Establish a "Data Assembly, Storage, and Quality Control Protocol" that provides data formats, dates for data submission, and conditions for data releases and accessibility to the data by the general public.

Task 4.1.3d: Assemble available data in a clear and concise manner.

Task 4.1.3e: Coordinate future data assembly and quality control through an established "Data Assembly, Storage, and Quality Control Protocol."

Action 4.1.4. Develop sufficient progress metrics for listed species.

Task 4.1.4a: Develop and apply agreed-upon demographic metric(s) to assess population trends and progress toward recovery under the RIP (see Section 2, Action 4.1 for development of population monitoring program).

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5 Priorities, Responsible Parties, Dates of Performance

Not yet drafted.

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6 Time Schedule

Not yet drafted.

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7 Estimated Costs

Not yet drafted.

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Definitions

Adaptive Management – A structured, iterative and analytical process for designing and implementing management actions to maximize learning about critical uncertainties that affect decisions, while simultaneously striving to meet multiple management objectives. It involves synthesizing existing knowledge and identifying critical uncertainties, developing hypotheses related to those critical uncertainties, exploring alternative management actions to test those hypotheses, making explicit predictions of their outcomes including level of risk involved with implementation, selecting one or more actions to implement, conducting monitoring and research to see if the actual outcomes match those predicted, and then using these results to learn and adjust future management and policy.

Flycatcher – The shortened name given in this document to the southwestern willow flycatcher (*Empidonax traillii extimus*).

Larvae – The newly hatched form of a fish in which the individual lacks a functional mouth and fully developed fins and continues to feed off a yolk-sac. Larval fish are often very small (5-15 mm) and bear little resemblance to adults. Approximately 4 to 7 days depending on temperature.

Minnow – The shortened name given in this document to the Rio Grande silvery minnow (*Hybognathus amarus*).

Population Viability Analysis (PVA) – A risk-assessment methodology applied to calculate species extinction or recovery probability. PVA uses population-specific time-series and life history data to construct a probabilistic population model that includes provisions for uncertainty about environmental drivers, uncertainty about chance demographic processes, and uncertainty about parameters of the model.

Sufficient Progress Metric – In a recovery implementation program, sufficient progress metrics are generally a series of factors or criteria used by the RIP and the U.S. Fish and Wildlife Service to evaluate whether the program is performing satisfactorily to promote progress toward recovery and can continue to allow coverage for related proposed actions under Section 7 (jeopardy) or Sections 9 (take) of the ESA.

Viability (genetic) – To be genetically viable, a population must start out with, and maintain, sufficient genetic diversity to adapt to the anticipated range of environmental conditions that it will encounter. Factors that can work against the maintenance of

genetic diversity include episodes of extremely small numbers of breeding individuals, high frequency of inbreeding, and selection in artificial environments.

Viability (population) – A species population's ability to persist and to avoid extinction. The viability of a population typically varies with changes in the rates of birth, death, and growth of individuals. In natural populations, these rates themselves fluctuate in response to external forces (floods, droughts, introduced species) and internal forces (competition and genetic composition). Such factors can drive populations to extinction if they are severe or if several detrimental events occur before the population can recover.

Young-of-Year – A fish that is less than one year of age from the approximate date in which it was hatched.

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Appendix A. Sufficient Progress Determination

As described in Section 1.5 of the Recovery Implementation Program (RIP) Action Plan, the RIP Sufficient Progress Metrics (Metrics) are expected to incorporate and reflect both measures of implementation of RIP activities and of species response, as well as standards of avoiding jeopardy (and adverse critical habitat modification) and of advancing species recovery. This framework for developing metrics may be visualized as filling in the following matrix, which is presented purely as an example of the types of metrics that the RIP could utilize and not as a proposal to adopt these particular metrics. As represented here, this framework would allow the RIP to assess with some precision its level of success in implementing activities and promoting species responses that maintain and advance listed species' likelihood of survival and recovery, as well as allowing the RIP to select and develop future activities, adaptive management approaches, and metrics that are informed by such assessments.

Example of types of metrics to be utilized after interim period

Interpretational	Example Operational Measures	
	Implementation of RIP Action Plan	Species Response
Avoids appreciable reduction in likelihood of survival and recovery (and adverse critical habitat modification) so as not to trigger reinitiation.	*x* fish released from hatchery *x* miles of river bank lowered *x* acre-feet of water pumped into river	demographic indicators, CPUE index from monitoring sites PVA assessment of probability of survival at 100 years
Achieves sufficient progress toward recovery	*x* + *y* fish released from hatchery *x* + *y* miles of river bank lowered *x* + *y* acre-feet of water pumped into river	demographic indicators, such as ??? PVA assessment of probability of recovery

PVA = population viability analysis
CPUE = catch per unit effort

Particular values for these types of metrics would be determined as a result of the incorporation of upcoming scientific analysis from various sources (e.g., 2012 Workshop(s), Program science, science compiled for Biological Assessments, Biological Opinion) after assessment and decision by the Middle Rio Grande Endangered Species

Collaborative Program Executive Committee (EC). The Program's population viability analysis (PVA) modeling may be able to assess the contribution of each factor underlying such types of metrics (e.g., flow or habitat) to the likelihood of species' survival and recovery. PVA model outputs can thus validate indicators of progress and, further, can be used to propose other indicators and thereby assume an important role in ongoing development and refinement of the RIP's Sufficient Progress Metrics.

Initially, the RIP Sufficient Progress Metrics will be approved by the EC. Thereafter, updating RIP Sufficient Progress Metrics, as part of annual update and amendments of the Five-Year Action Plan, is expected to be the responsibility of the Science Coordinator (or related position or entity to be defined), in coordination with and with the approval of the EC (including the Service). Because Sufficient Progress Metrics must continually remain relevant to species status and prospects for survival and recovery, using the best available scientific information as this information is developed, key considerations to be utilized by the Science Coordinator and the EC in updating Sufficient Progress Metrics include:

- Relevance to species population viability (i.e., to maintaining the risk of extirpation below an acceptable level and the probability of recovery above an acceptable level);
- Relevance to RIP recovery actions identified in the Action Plan and Annual Work Plan (since the metrics serve to evaluate these);
- Measurability of demographic and other factors important as indicators of viability (e.g., survival, reproduction, recruitment, distribution, genetic diversity), appropriate correlate measures, and the degree of confidence in such correlations;
- Feasibility and achievability of measured activities and/or population viability factors within resource (funding, water) and RIP organizational and institutional constraints.

During the initial and subsequent formulation of Sufficient Progress Metrics, the Science Coordinator and EC will consider the following sources of information to ensure that proposed Metrics maintain relevance to species population viability, utilizing the RIP protocols and procedures for internal science review and external peer review as needed:

- Long-Term Plan: Activities deemed by RIP to be relevant to recovery goals;

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- Recovery Plan: Criteria for recovery and preventing extinction, prescribed activities;
- Program science: Science Workgroup and Population Viability Analysis Workgroup, PVA response to questions posed by EC, Service and others, Adaptive Management, internal peer review;
- Scientific information considered by the Fish and Wildlife Service in its Five-Year Review and Biological Opinion, scientific information presented to the Service before and during analysis for Biological Opinion;
- External peer review;
- Science Workshop(s) initiated fall of 2012.

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.1: Spawning and Survival of Larvae			
2.1.1. Create habitat for spawning and larval rearing.			
	2.1.1a . Develop and implement a habitat restoration strategy, resulting in a prioritized list of habitat projects.		
	2.1.1b. Over 5 years, target a total of 300 acres of habitat in the Cochiti, Albuquerque, Isleta, and San Acacia reaches based on past experience and implementability.		
2.1.2. Work to provide spring-time hydrologic (flow) conditions and suitable habitat to produce spawning and larval fish survival.			
	2.1.2a. In advance of spring runoff, the Action Team will evaluate the annual species management objectives, available resources, climatic projections, and other information to develop recommendations for that specific year.		
	2.1.2b. Manage resources in accordance with Action Team's approved recommendations as needed to provide environmental conditions expected to produce spawning and larval fish survival (e.g., provide wet river for at least 45 days post peak spawn).		
Element 2.2: Post-Spawning			
2.2.1. Provide viable wetted habitats during main channel drying events.			
	2.2.1a. Develop a "Refuge Habitat Plan for Rio Grande Silvery Minnow During River Drying Events" to identify desirable areas for refuge sites, strategies for enhancing their benefits, available water sources, and evaluation methods.		
	2.2.1b. Construct and maintain "refuge habitats" in the Albuquerque, Isleta, and San Acacia reaches for use during river drying events as prescribed by the Refuge Habitat Plan (Task 2.2.1a).		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.2: Post-Spawning (continued)			
2.2.2. Work to provide hydrologic (flow) conditions to support survival in all years.			
	2.2.2a. In advance of spring runoff, the Action Team will evaluate the annual species management objectives, available resources, climatic projections, and other information to develop recommendations for that specific year.		
	2.2.2b. Manage resources in accordance with Action Team's approved recommendations as needed to provide environmental conditions sufficient to produce silvery minnow post-spawning survival.		
2.2.3. Minimize silvery minnow mortality associated with river drying.			
	2.2.3a. Manage rates of recession to minimize stranding and mortality of silvery minnow.		
	2.2.3b. Rescue and relocate silvery minnow.		
2.2.4. Increase reach boundary connectivity.			
	Tasks to be determined		
Element 2.3: Propagation and Augmentation			
2.3.1. Plan and evaluate silvery minnow propagation and augmentation program.			
	2.3.1a. Revise and refine "RGSM Genetics Management and Propagation Plan" including captive rearing and propagation to augment the population in the middle Rio Grande and identification of reintroduction sites to start new populations.		
	2.3.1b. Perform genetic evaluation of captive and wild fish and determine effect of augmentation on genetic viability of wild populations.		
	2.3.1c. Determine best propagation strategy for genetic viability of silvery minnow as part of Task 2.3.1a, Revise and refine "RGSM Genetics Management and Propagation Plan."		
	2.3.1d. Determine genetic effective population size of the silvery minnow.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.3: Propagation and Augmentation (continued)			
2.3.2. Develop, support, and maintain propagation and rearing facilities for silvery minnow.			
	2.3.2a. Continue to fund, maintain, and operate the Albuquerque BioPark Facility.		
	2.3.2b. Continue to fund, maintain, and operate the Los Lunas Silvery Minnow Refugium.		
	2.3.2c. Continue to fund and support technical assistance from the Dexter National Fish Hatchery and Technology Center (DNFH), including maintaining fish on-site.		
	2.3.2d. Assist with efforts at Rio Grande Silvery Minnow Sanctuary.		
2.3.3. Rear and maintain silvery minnow in captivity.			
	2.3.3a. Annually gather silvery minnow eggs in drift from wild populations and rear the young in captivity, with a goal of collecting approximately 500,000 eggs to meet annual stocking commitments.		
	2.3.3b. Maintain at least 100,000 silvery minnow of wild genetic origin in captivity on an annual basis for restoration in case of a catastrophe.		
	2.3.3c. Quantify and evaluate genetic diversity of wild and captive fish to ensure genetic diversity as part of Task 2.3.1b, Perform genetic evaluation.		
	2.3.3d. Maintain sufficient numbers of silvery minnow to augment existing populations, as necessary.		
2.3.4. Augment MRG wild populations as necessary.			
	2.3.4a. Evaluate the need for and make recommendations for augmentation as necessary.		
	2.3.4b. Accomplish augmentation as needed.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.4: Research, Monitoring, and Adaptive Management			
2.4.1. Develop and implement fish population monitoring programs with sufficient reliability, precision, and accuracy for RIP needs.			
	2.4.1a. Synthesize monitoring data sets (see Task 2.4.3a).		
	2.4.1b. Convene a series of workshops to evaluate and redefine a Rio Grande Silvery Minnow population monitoring program based on RIP needs.		
	2.4.1c. Write and scientifically review a refined "Fish Population Monitoring Plan" with the appropriate design and data analysis.		
	2.4.1d. Implement, evaluate, and refine the monitoring program, as necessary.		
2.4.2. Conduct, evaluate, and refine ongoing monitoring activities. The list of tasks is not exhaustive and includes examples taken from long-term plan.			
	2.4.2a. Monitor spawning and egg production.		
	2.4.2b. Monitor habitat conditions, usage, and effectiveness of completed habitat restoration projects.		
	2.4.2c. Monitor and assess wild and captive-propagated silvery minnow genetics.		
	2.4.2d. Monitor water movement through the Middle Rio Grande Valley.		
	2.4.2e. Additional monitoring as needed.		
2.4.3. Use adaptive management to identify and prioritize specific research and monitoring activities.			
	2.4.3a. Synthesize science data sets starting from program consensus data set and DBMS to achieve (1) consensus conclusion, (2) alternative hypotheses, and (3) data gap. This will serve as a body of knowledge to guide development of science/monitoring plans.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.4: Research, Monitoring, and Adaptive Management (continued)			
Action 2.4.3 (continued)	2.4.3b. Evaluate previous projects and develop a prioritized list of ongoing and future activities and related research.		
	2.4.3c. Convene a series of workshops to address specific questions or uncertainties related to silvery minnow and its habitat.		
2.4.4. Conduct silvery minnow research for the RIP. The list of tasks is not exhaustive and includes examples taken from long-term plan.			
	2.4.4a. Determine factors that affect age structure, age-specific survival rates, and recruitment.		
	2.4.4b. Determine factors that affect growth rates of silvery minnow.		
	2.4.4c. Determine fecundity (average number of eggs per female) and maternity (proportion of young produced per female that reach maturity).		
	2.4.4d. Determine effective female:male gender ratio for spawning.		
	2.4.4e. Determine food habits of the silvery minnow.		
	2.4.4f. Determine species habitat needs by life stage and river reach.		
2.4.5. Determine the viability of silvery minnow populations. The list of tasks is not exhaustive and includes examples taken from PVA work group.			
	2.4.5a. Maintain and use population viability analysis (PVA) models in an adaptive management framework.		
	Additional tasks to be added as developed by PVA workgroup.		
2.4.6. Update and refine the adaptive management plan.			
	Tasks to be determined.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Rio Grande Silvery Minnow

Action	Task	Tools	Responsibilities
Element 2.5: Additional wild self-sustaining populations			
2.5.1. Support the development of additional wild self-sustaining populations of silvery minnow.			
	2.5.1a. Contribute to Big Bend monitoring, augmentation, and research (under 5.1).		
	2.5.1b. Complete evaluation of alternative reintroduction sites.		
	2.5.1c. Implement reintroduction activities as approved based on results of evaluation.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for the Southwestern Willow Flycatcher

Action	Task	Tools	Responsibilities
Element 3.1: Territory Establishment and Nesting Success			
3.1.1. Create habitat conducive to territory establishment and nesting success.			
	Tasks to be determined.		
3.1.2. Create hydrologic conditions conducive to territory establishment and nesting success.			
	Tasks to be determined.		
Element 3.2: Flycatcher Research, Monitoring, and Adaptive Management			
3.2.1. Assess, identify and prioritize specific science activities that address overall Program goals.			
	Tasks to be determined.		
3.2.2. Conduct flycatcher research critical to RIP.			
	Tasks to be determined.		
3.2.3. Determine the viability of flycatcher populations.			
	Tasks to be determined.		
3.2.4. Develop and implement monitoring programs with sufficient reliability, precision, and accuracy for RIP needs.			
	Tasks to be determined.		
Element 3.3: Populations outside the Program boundaries (within New Mexico)			
3.3.1. Support the development of other populations of flycatcher.			
	Tasks to be determined.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for RIP Management

Action	Task	Tools	Responsibilities
Element 4.1 RIP Management			
4.1.1. Administer the RIP.			
	4.1.1a. Schedule and coordinate Program activities, including meetings of executive and technical committees.		
	4.1.1b. Establish and coordinate independent science panel.		
	4.1.1c. Develop and administer required internal processes such as peer review process, information dissemination, etc.		
	4.1.1d. Fiscal management (i.e., budgeting, funding and contracting).		
	4.1.1e. Reporting and accountability under program documents.		
4.1.2. Implement and coordinate RIP activities.			
	4.1.2a. Develop and implement long-term planning.		
	4.1.2b. Prepare, update, and implement Action Plan and annual work plans.		
	4.1.2c. Communication and outreach including ongoing public relations for the program and new communication planning.		
	4.1.2d. Implement priority Program projects.		
	4.1.2e. Integrate tools and strategies from plans such as the Water Management Plan and San Acacia Plan as approved.		
	4.1.2f. Establish an Action Team to provide recommendations regarding the annual needs of listed species in the MRG to the Water Managers who will utilize the tools and strategies described in the WMP to meet those needs.		
4.1.3. Establish and maintain a Database Management System for RIP needs.			
	4.1.3a: Procure original datasets from investigators in a flat-file, fixed format.		

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Middle Rio Grande Endangered Species Collaborative Program Action Plan
Outline of Elements, Actions, and Tasks for RIP Management

Action	Task	Tools	Responsibilities
Element 4.1 RIP Management (continued)			
Action 4.1.3 (continued)	4.1.3b: Reconcile all data errors, inconsistencies, and discrepancies with data collectors to ensure a clean and concise database.		
	4.1.3c: Establish a "Data Assembly, Storage, and Quality Control Protocol" that provides data formats, dates for data submission, and conditions for data releases and accessibility to the data by the general public.		
	4.1.3d: Assemble available data in a clear and concise manner.		
	4.1.3e: Coordinate future data assembly and quality control through an established "Data Assembly, Storage, and Quality Control Protocol."		
4.1.4. Develop sufficient progress metrics for listed species.			
	4.1.4a: Develop and apply agreed-upon demographic metric(s) to assess population trends and progress toward recovery under the RIP (see Section 2, Action 4.1 for development of population monitoring program).		

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