PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM (PRRIP -or- Program)

Extension Science Plan

June 7, 2022

Supporting Document Bookmarks:

I. PURPOSE

The purpose of the Extension Science Plan is to describe a concise and practical roadmap to 1) implementing Program science activities, 2) analyzing and synthesizing multiple lines of data, and 3) connecting useful scientific information to Governance Committee (GC) decision-making. This Science Plan is organized around a set of priorities focused on GC questions related to the response of two target bird species (*Grus americana*, whooping crane (WC); *Charadrius melodus*, piping plover (PP)) to Program water releases and other management actions. In addition, the Science Plan includes a bounded set of research activities directed at filling information gaps related to the life history, ecology, and habitat use of a Program target fish species (*Scaphirhynchus albus*; pallid sturgeon (PS)).

The Extension Science Plan is an update to the original PRRIP Adaptive Management Plan (AMP) that was incorporated into the Final Program Document and guided implementation of science activities during the First Increment from 2007-2019. While this Science Plan provides focus for Program science activities during the Extension from 2020-2032, the Executive Director's Office (EDO) will continue to collect monitoring data and evaluate new sources of information relative to First Increment Big Questions that have been answered conclusively throughout the remainder of the Extension. **Attachment 1** includes a table detailing Big Questions from the First Increment, their assessment status, and check in activities to obtain information that might indicate the necessity for the Program to re-visit these questions and their underlying hypotheses.

Following initial approval of the Science Plan by the GC, subsequent changes to the Science Plan, particularly the science priorities and Extension Big Questions identified below, will require review and approval by the GC during the course of the Extension. **Attachments 2, 3,** and **4** contain detailed information about Program hypotheses, implementation timelines, monitoring protocols, plans for data analysis/synthesis, and other important scientific and technical pieces of Program science. **Attachments 2-3** containing the Conceptual Ecological Models, Priority Hypotheses and Learning Objectives, and Implementation Activities and Timeline are subject to GC approval. Changes to **Attachment 4** containing monitoring and research protocols and plans for data analysis and synthesis will occur through discussions with the EDO, Technical Advisory Committee (TAC), and Independent Scientific Advisory Committee (ISAC) but will not require GC approval and changes will be dictated by Program learning, methodology updates, and agreement within the technical arm of the Program based on the best available science.

II. OBJECTIVES & KEY QUESTIONS

The Platte River Recovery Implementation Program Extension Act, passed by Congress in 2019, and PRRIP Cooperative Agreement Amendment No. 1, signed by the Secretary of the Interior and the Governors of Colorado, Wyoming, and Nebraska in 2019, extended the Program's First Increment through 2032. Incorporated by reference in the Cooperative Agreement Amendment, the Final Program Document Addendum (approved by the GC in 2017) set the following direction for Program science during this Extension:

A. Program science objectives for the Extension (negotiated by the GC during development of the Addendum):

1) *Scientific investigations* need to be completed to confirm the need for 130,000 acre-feet in annual reductions to target flow shortages.
2) The Program will invest the resources available to achieve at least 120,000 acre-feet in annual reductions to target flow shortages as quickly as possible during the Extension and will also *invest in the science* necessary to determine if the additional 10,000 acre-feet is justified.
3) The Program is committed to finding the additional resources necessary to achieve that additional 10,000 acre-feet *if justified by the science*.
4) Continued implementation of the *management actions* specified in the Adaptive Management Plan (AMP) related to short duration high flows (SDHF), sediment augmentation, and least tern (LT, *Sternula antillarum*)[1], piping plover, and whooping crane habitats.
5) Contribute to reach-scale *Phragmites and invasive species* control efforts.
6) Utilization of Program water assets to *implement and evaluate flow-related management actions* including SDHF and species-related target flows.
7) *Pallid sturgeon activities* in the Extension will be guided by the results of the incremental four-step process adopted by the GC at the September 2016 meeting (as updated by the 2021 PRRIP Pallid Sturgeon Agreement Framing Document).
8) The Program will continue to consider the emerging science related to climate change in management and decision-making.

B. Program management objectives for the Extension (incorporated from the original 2006 PRRIP Adaptive Management Plan (PRRIP Program Document, Attachment 3, pg. 20):

1) Improve production of *piping plovers* from the central Platte River.
2) Contribute to the survival of *whooping cranes* during migration.
3) Avoid adverse impacts from Program actions on *pallid sturgeon* populations.
4) Within overall Management Objectives 1-3, provide benefits to *non-target listed species* and *non-listed species of concern* and reduce the likelihood of future listing.

In addition, the GC conducted a "mock negotiation" for the Second Increment in 2020 to look ahead to potential key policy considerations that will need addressed in building goals, objectives, and implementation priorities for the Second Increment. Those discussions resulted in a **set of key science questions** that relate to how science activities will be implemented during the Extension and to how science learning will be analyzed, synthesized, and communicated to the GC:

[1] The interior least tern was delisted in 2021 but is expected to remain a Program target species throughout the Extension. The Program will continue to monitor least terns, but all priority hypotheses are specific to the piping plover.

1) How should we identify and communicate target species outcomes as well as our ability to influence those outcomes?
2) In what specific ways will the continuation of Program management actions in a Second Increment contribute to Management Objective #4 (non-target species)?
3) How does current chokepoint capacity constrain ability to implement flow management actions and what are the incremental and relative benefits of increasing capacity?
4) What are the incremental and relative benefits and costs of using water versus mechanical/chemical means to create and/or maintain suitable in-channel species habitat?
5) What are the incremental and relative benefits to target species (or target species habitat) of other potential flow actions?
6) How much of the 19,000 acres of pre-1997 conservation land remains under conservation ownership and how many acres have been acquired (non-PRRIP) since 1997?
7) What proportion of existing non-PRRIP conservation lands benefit target species or species of concern as defined by the Program?
8) Are existing PRRIP and non-PRRIP conservation lands sufficient to meet the target species management objectives as detailed in the Extension Science Plan?

In short, these **objectives and questions** form the boundaries of Program science during the Extension and science learning will be directed at addressing these issues in a manner that informs GC decision-making throughout the Extension and during Second Increment negotiations that will occur near the end of the Extension.

III. EXTENSION SCIENCE PRIORITIES

During the Extension, Program science activities will center around two broad categories of learning as an organizing concept for relating scientific data and conclusions to the key objectives and questions noted above:

1) Active Learning – management action experiments

This Program science priority will focus on the design and implementation of specific Program management actions to learn how river form/function and the target bird species (primarily whooping cranes) respond. Science activities in this category of learning during the Extension will be supported (to the greatest extent possible) by the application of rigorous adaptive management (AM) and clear efforts to test hypotheses related to predictions of river and target species responses to Program management actions. For the Extension, this science priority includes evaluation of:

- The effectiveness of Program water management in creating and/or maintaining suitable whooping crane habitat through suppression of channel vegetation germination (river channels with ≥650-ft widths unobstructed by dense vegetation are highly suitable for WC roosting).
- The effectiveness of Program management actions (flow and mechanical tools) in controlling the spread of channel vegetation, particularly *Phragmites* (*Phragmites australis*), as means of creating and/or maintaining suitable WC habitat.
- The role of Program sediment augmentation in the south channel of the Platte River along Jeffrey Island in creating and/or maintaining suitable WC habitat.
- The relationship between WC use and flow and the seasonal effects of flow on WC use.
- The effect of Program flow management actions to benefit WC, PP, and LT in the central Platte River on pallid sturgeon use of the lower Platte River.

2) Maintenance Learning – improving and sustaining ongoing Program management actions

This Program science priority will focus on applying Program science to provide incremental refinements to ongoing Program management actions (primarily for piping plovers). Science activities in this category of learning during the Extension will be supported by the application of more traditional status/trends monitoring and the design of management treatments to identify variables that can be controlled or minimized through improvements in long-term management implementation. For the Extension, this science priority includes:

- Investigating the effects of predation (mammals, reptiles, birds) on piping plover productivity (fledging) at Program-managed nesting sites.
- Complete research to provide a deeper understanding of the physical processes through which hydrological and meteorological variables affect groundwater levels to impact wet meadows.

IV. EXTENSION "BIG QUESTIONS"

The following set of "Big Questions", organized by science priority categories, are intended to serve as common organizing questions for addressing key areas of uncertainty for the Program and also to serve as a device for communicating with the GC on how science learning connects to decision-making as a helpful input. **Table 1** presents the Big Questions and the underlying hypotheses that will be tested and explored as means to answer each Big Question. New Big Questions or additional specific hypotheses may be added over time once questions are conclusively answered or if science learning points the Program in a different direction.

Table 1. PRRIP Extension Big Questions and priority hypotheses.

PRRIP Extension Big Questions (EBQ) & Priority Hypotheses (H)
Extension Science Priority – Active Learning
EBQ #1 – How effective is it to use Program water to maintain suitable* whooping crane roosting habitat? *Channels with ≥ 650 ft maximum width unobstructed by dense vegetation (MUCW) are highly suitable for whooping crane roosting.
Management H: Releases to achieve a 30-day minimum flow target of 1,500 cfs between June 1 – July 15 will suppress germination, slow vegetation expansion into the channel, and increase the percent of AHR channel that remains highly suitable for whooping crane roosting (germination suppression release). **Physical Process H:** Vegetation germination and establishment is a function of percent of time bare sand substrate is inundated during a 30-day period between June 1 – July 15. **Alternative H:** 30-day inundation (1,500 cfs target) between June 1 – July 15 is insufficient.
EBQ #2 – How effective is Program management of Phragmites for maintaining suitable whooping crane roosting habitat? Sub-questions: • How effective have previous Program control efforts (flow, spraying, etc.) been? • How much do growing season flows influence *Phragmites* expansion/control?
Management H: Releases to achieve a 30-day minimum flow target of 1,500 cfs between June 1 – July 15 in combination with continued herbicide spraying will slow *Phragmites* rhizome/stolon expansion into the channel and increase the percent of AHR channel that remains highly suitable for whooping crane roosting. **Physical Process H:** *Phragmites* expansion rates into the active river channel are a function of percent of time bare sand substrate is inundated during a 30-day period between June 1 – July 15. **Alternative H:** 30-day inundation (1,500 cfs target) between June 1 – July 15 is insufficient.
EBQ #3 – Is sediment augmentation necessary to create and/or maintain suitable whooping crane habitat?
Management H: Full scale sediment augmentation (60,000 – 80,000 tons annually in south channel below J-2 Return) is necessary to offset the sediment deficit and halt narrowing and incision. **Alternative H:** More or less sediment must be augmented to offset the south channel deficit.
EBQ #4 – What factors influence WC decision to stop or fly over the AHR?
Management H: Probability of a whooping crane stopping and roosting within the AHR (vs. flying over) is a function of discharge. **Physical Process H:** The probability of a WC stopover is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (< 1 ft deep). **Alternative H:** Time of day is the primary driver of WC stopovers with probability of use increasing with decreasing time until dark.

PRRIP Extension Big Questions (EBQ) & Priority Hypotheses (H)
EBQ #5 – What factors influence WC stopover length within the AHR?
Management H: Length of WC stopover within the AHR is a function of discharge. **Physical Process H:** WC stopover length is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (< 1 ft deep). **Alternative H:** Length of stay within the AHR has an inverse relationship with length of stay at the previous stopover and a direct relationship with distance traveled since last stopover.
EBQ #6 – Why is spring WC use of the AHR greater than fall WC use?
Management H: WC use of the AHR in the Spring is greater than during the Fall due to higher flows during the Spring. **Physical Process H:** WC use of the AHR is a function of the relationship between wetted width and the percent of the channel that is of suitable depth for roosting (<1 ft deep). **Alternative H:** WC use of the AHR in the Spring is greater because WC do not stage in other areas prior to reaching the Platte, WC are further along in migration when they arrive, distance traveled since last stopover is longer, and stay length at previous stopovers is shorter when compared to Fall migration.
EBQ #7 – What effect do Program flow management actions to benefit WC, PP, and LT in the central Platte River have on pallid sturgeon use of the lower Platte River?*
Pallid sturgeon genetics research **Learning Objective$_1$:** Establish new genetic baselines for species identification and addressing hybridization. **Learning Objective$_2$:** Identify spawning pallid sturgeon adults and age-0 pallid sturgeon collected on the lower Platte River and its confluence with the Missouri River to evaluate whether or not successful spawning and annual recruitment into the Missouri River has occurred. **Learning Objective$_3$:** Reassess pallid sturgeon population dynamics and estimate effective population size within the Great Plains Management Unit (upper Missouri River) and Central Lowlands Management Unit (lower Missouri River). **Pallid sturgeon habitat and spawning research** **Learning Objective$_1$:** Assess pallid sturgeon use of the lower Platte River and its tributaries. **Learning Objective$_2$:** Relate pallid sturgeon seasonal movements and spawning behavior to environmental patterns on the lower Platte River and its tributaries. **Learning Objective$_3$:** Identify and describe pallid sturgeon spawning habitat on the lower Platte River and its tributaries. **Learning Objective$_4$:** Verify successful pallid sturgeon spawning on the lower Platte River and its tributaries and annual recruitment from the lower Platte River to the Missouri River.

* A 3-step plan for addressing this Big Question is outlined in the PRRIP Pallid Sturgeon Agreement Framing Document approved by the GC in June, 2021. Summarized for EBQ#7 are the learning objectives for Step 1 of this plan. As research is further developed and information is obtained to generate more plausible hypotheses and predicted outcomes related to the agreed upon learning objectives, formal hypotheses for testing will be added to the Extension Science Plan. Results of formal tests of hypotheses will later feed into Steps 2-3 Program Water Management Study and guidance for Program water operations through the remainder of the Extension and into the Second Increment.

Extension Science Priority – Maintenance Learning*
***EBQ #8* – How much of an effect does predation have on PP productivity (fledging)?**
Learning Objective$_1$: Quantify the impact of predation on PP productivity. **Learning Objective$_2$:** Identify predator species responsible for losses. **Learning Objective$_3$:** Determine when losses are incurred, at the nest or during brood rearing. **Learning Objective$_4$:** Utilize population viability models to predict what effect decreases in fledge ratios due to predation may mean in terms of future PP breeding pairs on the central Platte River.
***EBQ #9* – How effective is Program management at mitigating losses of PP productivity due to predation?**
Learning Objective$_1$: Evaluate effectiveness of trapping, fencing, and/or predator deterrent lighting at reducing nest/brood failure due to predation. **Learning Objective$_2$:** Develop predator management alternatives based upon learning through remote camera/video monitoring. **Learning Objective$_3$**: Evaluate the necessity for additional predator management based upon PP response to predation over time.
***EBQ #10* – Wet meadows research** *(NOTE: this is a carryover task from the First Increment to specifically address the physical processes involved in wet meadow hydrology)*
Learning Objective$_1$: Understand relationships between hydrological and meteorological variables and groundwater levels at natural wet meadow sites. **Learning Objective$_2$:** Understand what constitutes a functional hydrological regime for wet meadows along the central Platte River valley which can be used as a reference and applied to manage other sites. **Learning Objective$_3$:** Develop a modeling tool that can be used by land managers in the central Platte River valley to inform management decisions.

*Summarized for EBQ #8 - 10 are learning objectives for data collection and analyses necessary to answer these questions. They are written as learning objectives rather than priority hypotheses to reflect their lower tier of importance for science learning when compared to EQB #1-7. More detailed information specifying data to be collected, methods for collection, formal analyses planned, and means of communication of results related to these learning objectives can be found in **Attachment 3** Implementation Activities & Timeline and **Attachment 4** Data Collection, Analysis, Synthesis, & Decision-Making Reference Materials.

Attachment 2 provides more detail on each of the priority hypotheses, including X-Y graphs, predicted findings to match against collected data over time, and connections to critical relationships as identified in updated Conceptual Ecological Models (CEMs) for the target species and for key river processes linked to Program management actions. **Attachment 3** details an approach to implementing management actions related to the science priorities and Big Questions, a timeline plotting out science priorities over the length of the Extension, and a more detailed flow chart of management actions and science activities conducted through the Extension with decision points through time. **Attachment 4** includes links to monitoring and research protocols updated and revised as they stand in early 2022 together with anticipated approaches to data analysis, graphs, figures, and other data communication tools. **Attachment 4** also contains an explanation of how information to address the Big Questions, priority hypotheses, and learning objectives be summarized, subjected to independent science review, and communicated to the GC; and describes the anticipated use of decision-making tools like Structured Decision-Making (SDM) to help the GC operationalize scientific and technical information as a useful input to decision-making. The EDO anticipates developing Biennial State of the Platte Reports and conducting an annual Science Plan Reporting Session as means to present the latest status/trends and conclusions related to collected data; to expose this information to the TAC and ISAC to ensure scientific rigor; and to communicate the latest findings to the GC.

V. EXTENSION SCIENCE UNCERTAINTY "PARKING LOT"

Table 2 describes a set of science uncertainties that could be addressed during the Extension if the Big Questions and hypotheses identified above are resolved, if they warrant focused investigation because their potential impacts on GC decision-making and Program management actions are apparent, and if there are available resources (staff time, funding, etc.) to conduct research, monitoring, or other necessary activities.