PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Strategic Science Plan for Adaptive Management Plan Implementation, 2009-2013

Adaptive Management Working Group Discussion Draft

Prepared by: Executive Director's Office, Platte River Recovery Implementation Program
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Introduction and Background

This Strategic Science Plan is intended to serve as a key descriptive tool in the planning process for implementation of the Platte River Recovery Implementation Program's (Program) Adaptive Management Plan (AMP). This document will be utilized by the Program Executive Director's (ED) Office, Independent Scientific Advisory Committee (ISAC), Adaptive Management Working Group (AMWG), Technical Advisory Committee (TAC), Water Advisory Committee (WAC), and Land Advisory Committee (LAC) to establish priorities and strategies for providing objective scientific information on the results of AMP implementation to the Governance Committee (GC) of the Program. The priorities and strategies presented in the Science Plan will guide development and implementation of Program monitoring and research activities over the FY2009-FY2013 time period.

The Program initiated on January 1, 2007 and is the result of a Cooperative Agreement negotiating process that started in 1997 between the states of Colorado, Wyoming, and Nebraska; the Department of Interior; waters users; and conservation groups. The Program is intended to address issues related to the Endangered Species Act (ESA) and loss of habitat in the river in central Nebraska by managing certain land and water resources following the principles of adaptive management to provide benefits for four "target species": the endangered whooping crane (*Grus americana*), interior least tern (*Sterna antillarum*), and pallid sturgeon (*Scaphirhynchus albus)*; and the threatened piping plover (*Charadrius melodus*). The Program is led by a Governance Committee that is assisted by several standing Advisory Committees as well as an ED and staff. The Program's 13-year First Increment began in 2007. The Program is estimated, in 2005 dollars, to cost roughly $320 million, with the monetary portion of that being $187 million; the total cost of the Program in terms of cash, water, and land will be shared equally between the federal government and the states.

The Program has three main elements:

- Increasing streamflows in the central Platte River during relevant time periods through re-timing and water conservation/supply projects. The First Increment objective is to re-time and improve flows in the central Platte River to reduce shortages to target flows by an average of 130,000 to 150,000 acre-feet per year at Grand Island.
- Enhancing, restoring, and protecting habitat lands for the target bird species. The First Increment objective is to protect, restore, and maintain 10,000 acres of habitat.
- Accommodating certain new water-related activities.

Central to the Program is its Adaptive Management Plan, which provides a systematic process to test priority hypotheses and apply the information learned to improve management on the ground. The AMP was developed collaboratively by Program partners and cooperators under the guidance of experts from around the country. The AMP is centered on priority hypotheses developed jointly by numerous Program partners that reflect different interpretations of how river processes work and the best approach to meeting Program goals. The cooperative nature of the hypotheses reveals a shared attempt on the part of Program cooperators and partners to use the best available science in an agreed-upon manner to implement experiments, learn, and revise management actions accordingly. The AMP's Integrated Monitoring and Research Plan (IMRP) will guide implementation of monitoring and research protocols during the First Increment.

The Program will establish an Independent Scientific Advisory Committee (ISAC) to provide external review of implementation of the AMP, the IMRP, protocols, and other scientific issues critical to the Program. External peer review will be conducted to ensure the scientific rigor of all monitoring and research activities. The process of assessing and identifying implementation priorities, developing experimental design recommendations, implementing actions, and monitoring and evaluating those actions is outlined in the AMP (Figure 1). That process will be a collaborative effort between the ED Office, Program advisory committees (including the ISAC), contractors, and other cooperators with direct links to GC oversight and direction.

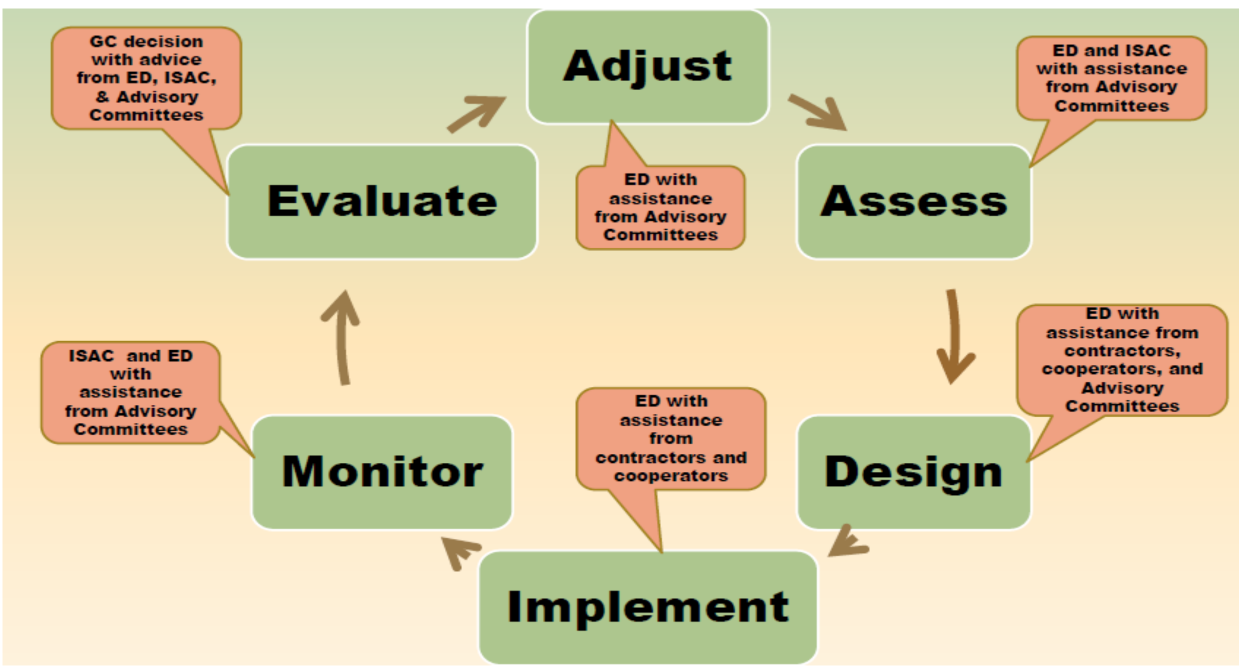

Figure 1. Program adaptive management steps and task assignments (AMP, 2006).

Program Adaptive Management Process and Structure

The AMP is built on the foundational principles of an innovative approach to resources management known as Adaptive Environmental Assessment and Management (AEAM, now commonly referred to as "adaptive management" or "AM") (Holling, 1978; Walters, 1986). In the AMP, adaptive management is defined as:

> "…a systematic process administered by the Governance Committee for continually improving management by: 1) designing certain Program management activities to test alternative hypotheses, and 2) applying information learned from research and monitoring to improve Program management. The process also includes the flexibility to use information and experience from all sources." (AMP, 2006)

This "learning by doing" approach (Walters and Holling, 1990) embodies the classic tenets of active adaptive management – identify key questions in relationship to multiple hypotheses (priority hypotheses and Conceptual Ecological Models in the AMP), develop/utilize predictive tools to evaluate management action choices, design and implement management "experiments", conduct linked monitoring and research, evaluate results, and reassess hypotheses and management actions in the context of management objectives. The structure of the Program's AMP is closely tied to this active adaptive management approach as seen in specific Management Objectives and Management Strategies/Actions (Table 1). Active adaptive management will be paired with monitoring of responses to natural events (such as the precipitation-driven high flows in 2008) and trends over time in species abundance and use and river form. Monitoring and research conducted through the IMRP will be directly linked to information needs related to AMP implementation and addressing priority hypotheses as they relate to specific Program goals and objectives.

Table 1 identifies the four **management objectives** that will serve as a means to evaluate the effectiveness of different Program actions within an adaptive management framework and provide the linkage between the management purposes and broader Program objectives.

Table 1. AMP management objectives and indicators (AMP, 2006).
1) Improve production of interior least tern and piping plover from the central Platte River. • ↑ nesting pairs • ↑ fledge ratios • ↓ adult mortality (by reducing predation)
2) Improve survival of whooping cranes during migration. • ↑ habitat availability on central Platte River (area of suitable roosting habitat and foraging habitat, proportion of population, crane use days)
3) Avoid adverse impacts from Program actions on pallid sturgeon populations. • No indicators identified; further research needed
4) Within overall objectives 1-3, provide benefits to non-target listed species and non-listed species of concern and reduce likelihood of future listing. • ↑ habitat availability on central Platte River (species occurrence, Land Plan Table 1 and 2 characteristics)

These objectives serve as the desired outcomes of implementation of the two **management strategies** (Table 2) indentified in the AMP. Each of the two management strategies incorporates a number of management actions that will result in habitat modifications (treatments) on the ground and the ability to test priority hypotheses during the course of the First Increment.

Table 2. AMP management strategies and actions (AMP, 2006).

Strategy #1 – Flow-Sediment-Mechanical Strategy ("Clear/Level/Pulse" or "FSM")

This strategy attempts to rehabilitate the Platte River toward braided channel morphology as the underpinnings of restoring habitat for key management species.

- Create and maintain where possible a wide braided channel with a high width/depth ratio.
- Offset the existing sediment imbalance by increasing sediment inputs to the habitat area.
- Use the Environmental Account (EA) and other Program water to create annual peaks as large as can be sustained over many years.

Actions

- **Flow Management Action –** Using EA water and the ability of the Program to deliver 5,000 cfs of Program water at Overton, generate short-duration near bankfull flows in the habitat reach in the spring or at other times outside of the main irrigation season; includes pulse flows of EA water and flexibility in canal and reservoir system operations.
- **Sediment Augmentation Management Action –** Sediment is mechanically placed into the river at a rate that will eliminate the sediment deficiency and restore a balance sediment budget; includes pushing sand into the river from banks, islands, and out-of-bank areas.
- **Mechanical Management Action –** To increase the acreage of channel area greater than 750 feet wide by 30% over the 1998 baseline conditions for the study area, and restore channel habitat toward Land Plan Table 1 characteristics; includes consolidating flow and river channels, cutting banks and lowering islands, and clearing vegetation off islands and banks.

Strategy #2 – Mechanical Creation and Maintenance Approach ("Clear/Level/Plow")

This strategy attempts to achieve similar management objectives by mechanical creation and maintenance of habitat for target species, which may or may not depend on the Platte River.

- Improve least tern and piping plover production by management of sandpits and riverine islands developed and maintained by mechanical and other means (e.g., herbicides, grazing, burning) without the need for pulse flows.
- Improve survival of whooping cranes by providing non-riverine wetlands, upland habitats, and open channel habitats maintained with mechanical and other means without the need for pulse flows.

Actions

- **Sandpit Management Action –** To increase the amount of nesting habitat available to least terns and piping plovers the Program will acquire 200 acres of sandpits that will include at least 40 acres of bare sand; includes application of predator management techniques.
- **Restore, Create, and Maintain Bare Sand Riverine Island and Channel Width Management Action –** Islands will be created using the same methods as in FSM except for EA augmented pulses, and channels of 750 feet wide will be created and maintained using mechanical means similar to methods in FSM except for released pulses; includes mechanical maintenance and predator management.
- **Create and Maintain Inundated Wetlands and Upland Areas Action –** Each 0.5 miles of linear wetlands (sloughs, backwater) constructed on Program lands will include at least one area that has a shallow water area with a minimum water surface area of 500 feet by 500 feet; Program acquired agricultural fields not previously wetlands should be planted to corn; the Program will utilize the remaining 400 acres of non-complex land to create 300 acres of palustrine wetlands.

Science Strategy, Planning Process, and Reporting

AMP implementation will be built on a foundation of interdisciplinary science through an Applied Science Strategy (Figure 2) that cycles information related to Conceptual Ecological Models (CEMs), priority hypotheses, the two management strategies, and IMRP activities through a feedback loop that ties outcomes and learning (performance measures) to management objectives. This framework, adapted from a similar approach developed for dealing with science questions and challenges in the Everglades (Busch and Trexler, 2003), provides guidance for core monitoring, research, and experimental activities as well as direction for quantitative modeling and other predictive efforts. This approach lends itself to an integration of understanding about species response and river form and function based on priority science questions and information needs.

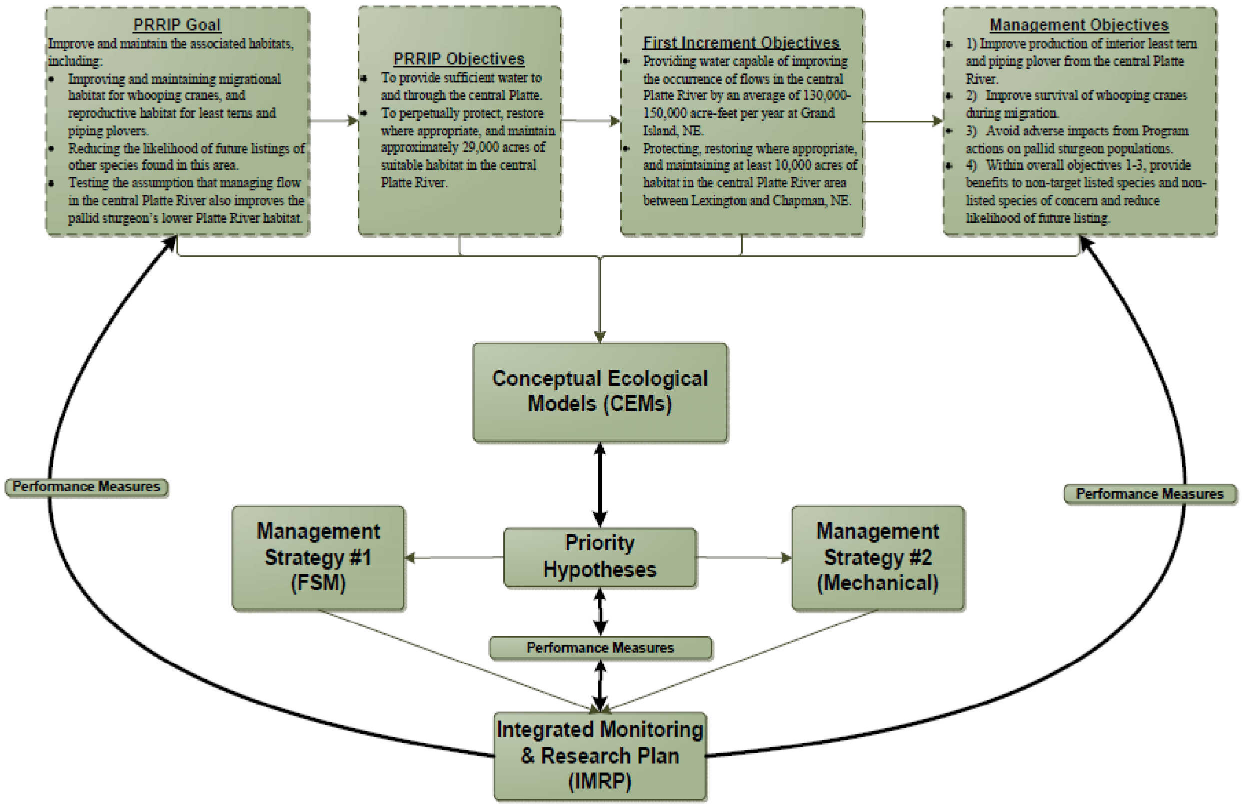

Figure 2. Program Applied Science Strategy.

The purpose of this Strategic Science Plan is to provide a five-year work plan for AMP implementation. The idea of a science plan as a support tool for implementation of adaptive management is modeled after a similar document developed for the Glen Canyon Adaptive Management Program (U.S. Geological Survey, 2008). The Platte River Program's AMP provides direction on implementation of the two management strategies and related management actions as they relate to the Program's management objectives. Application of those management actions will essentially constitute the Program's "management experiments" consistent with the active adaptive management paradigm (Walters, 2007). The science plan provides the "means objectives" and action details for those experiments, and also identifies information needs, data gaps, necessary monitoring and research activities, and a framework for using conceptual and predictive models as decision-support tools.

The science plan will be refined and continually updated through a collaborative effort of the ED Office, AMWG, TAC, LAC, and WAC with the GC retaining oversight and approval authority. In addition, application of the Applied Science Strategy and overall implementation of the AMP will be conducted in close coordination with the Program's Independent Scientific Advisory Committee (ISAC). This will provide the Program with important external scientific review and advice on strategies to implement the AMP with a robust science program. The ISAC will provide independent opinions to the GC and the ED Office on a scientific approach to adaptive management, monitoring, and research for the Program that will include an assessment of ecological indicators and other measures of scientific progress.

A series of reporting and planning activities (Table 3) will keep the GC and Program advisory committees informed on progress toward management objectives, knowledge gained from AMP implementation, and direction of Program science efforts. This flow of information includes specific requirements as detailed in the AMP plus additional activities recommended to help tie together AMP implementation and gained knowledge for the purposes of informing future management activities and other Program actions.

Table 3. AMP reporting/planning activities for FY2009-FY2013.
→ **Annual AMP Progress Report** (2009-2013) – ED Office compiles; summarizes previous field season of monitoring, research, and management and provides data analysis related to key science questions; reviewed by ISAC, AMWG, TAC, LAC, and WAC
→ **Annual AMP workshop** (2009-2013) – ED Office coordinates; typically held in conjunction with February GC and ISAC meetings; highlights of AMP implementation activities, lessons learned, recommendations for changes in direction or changes to overall AMP
→ **Strategic Science Plan** (2009) – ED Office drafts with input from ISAC and other Program advisory committees; serves as five-year work plan (through FY2013) for AMP implementation; revised annually as necessary based on information gained from Annual AMP Progress Report and other input
→ **Annual Work Plan/Budget** (2009-2013) – ED Office drafts with input from Program advisory committees; details annual work that stems from five-year Strategic Science Plan; includes specific tasks, estimated budgets, task leads, project scope, timeline, and expected deliverables
→ **Five-Year Review** (2013-2014) – ED Office drafts with input from ISAC and other Program advisory committees; consolidates new scientific knowledge, progress toward addressing priority science questions and hypotheses, suggested revisions to AMP and science efforts, and recommendations for future direction

AMP Decision Making

While the management objectives in the AMP provide broad guidance as to implementation priorities and the approach to evaluating the effectiveness of the two management strategies, it is necessary to identify "means objectives" or more specific experimental objectives for individual adaptive management experiments on the central Platte River and how information obtained from those experiments relates to priority hypotheses and management objectives. The process of identifying these more specific experimental objectives will also afford the ED Office, Program advisory committees, and other Program cooperators the opportunity to identify important data gaps, prioritize monitoring and research needs, design management actions ("experiments"), and plan for addressing key science questions related to species response and changes in river form and function.

In July 2008, a small group of members of the AMWG conducted a four-day Structured Decision Making workshop as a tool to attempt to identify key questions related to AMP implementation and begin to develop specific experimental objectives. That effort was paired with the development of very simple spreadsheet models utilizing a method called “Rapid Prototyping” to serve as predictive tools for the consequences of different management decisions. The final report from that workshop details AMP implementation questions and challenges, specific objectives and actions, and scenario development (Tyre et at., 2008). In addition, the final report includes two simple Excel spreadsheet models developed for tern/plover response and whooping crane response to Program management actions. Figure 3 is a Consequence Table from the final report that reflects various tern, plover, and whooping crane responses to the four modeled scenarios, all of which are built on varying degrees of Program management as represented by habitat availability and other performance measures.

The July 2008 workshop also gave the group a chance to discuss data needs specifically related to terns, plovers, and whooping cranes. Table 4 provides a general overview of the various dimensions of crane, tern, and plover habitat that need to be gathered from ongoing or new monitoring and/or research to feed into the simple models developed during the workshop and other models utilized by the Program. This reflection on important data needs and gaps related to the target species was instructive for AMP implementation purposes in several ways, pointing to the need for constant review of ongoing and planned monitoring and research to ensure collected data are useful for predictive models and other decision-support tools and that monitoring and research activities are directly linked to efforts to address priority hypotheses.

One task for the FY2009-FY2013 time period will be to refine the rapid prototype models and begin using them as a tool for analyzing Program data in relationship to management actions (“experiments”), species response, priority hypotheses, and management objectives. Additional experimental design workshops and development of new models will occur during the next five-year period. As detailed in Figure 3, the scenarios modeled with the rapid prototype models include increasing riverine sandbar habitat at a pace of 20-40 acres a year. **The AMWG generally agrees this is the type of specific habitat-related goal that should be used for experimental design and land management plan purposes in the FY2009-FY2013 time period, thus linking available predictive tools, AMP experiments, and analysis of data to help answer key science questions.**

		Scenario A Do nothing	Scenario B Status quo	Scenario C Gradual	Scenario D Aggressive
Workshop	River habitat	Constant	Add 20-40 ac/yr	Add 20-40 ac/yr to year five; difference to eleven	To 450 ac in year 3
	OCSW habitat	Constant	Decay 5% on 40 ac	Add 40 ac in year 6	Add 40 ac in year 3
	TWW/UW	Constant	1%/ year east of Kearney	750 on program complexes every 2 years; +2%/yr after year five	750/1200 1 per year on PC; +2%/yr after year 5
Excel Parameters	River habitat	Remains at 40 acres throughout the period	Begins at 40 acres and increases by 30 acres each year	Begins at 40 acres and increases by 60 acres each year until year 6, after which it increases by 80 acres per year	Begins at 40 acres and increases by 60 acres each year until year three, when 390 acres are added; after this it increases by 30 acres per year
	OCSW habitat	Begins at 80 acres, 40 acres of which decays by 5% a year	Begins at 80 acres, 40 acres of which decays by 5% a year	Begins at 80 acres, 40 acres of which decays by 5% a year; 40 additional stable acres are added in year 6	Begins at 80 acres, 40 acres of which decays by 5% a year; 40 additional stable acres are added in year 3
	Wetted Width	Randomly distributed throughout the reaches and years	Randomly distributed throughout the reaches and years	750 ft maintained on reach 3 starting in year 1, reach 6 in year 3, reach 9 in year 5, and reach 12 in year 7	750 ft maintained on reach 3 starting in year 1, reach 6 in year 3, reach 9 in year 5, and reach 12 in year 7
	Unobstructed Width	Determined from maximum wetted width	Determined from maximum wetted width; reaches 16-30 increase by 1% each year	Determined from maximum wetted width; reaches 16-30 increase by 1% each year	Determined from maximum wetted width; reaches 16-30 increase by 1% each year; 1200 ft maintained on reach 3 starting in year 1, reach 6 in year 2, reach 9 in year 3, and reach 12 in year 4
Consequences	# of Least Terns	87	245	450	556
	FR Least Terns (River)	0.3	0.7	0.8	0.6
	FR Least Terns (OCSW)	0.3	0.7	0.8	0.6
	# Plovers	68	223	435	516
	FR Plovers (Rivers)	0.63	0.9	1.1	0.8
	FR Plovers (OCSW)	0.63	0.9	1.1	0.8
	Whooping Crane Use of Program Lands	0.06	0.03	0.98	0.99

Figure 3. Consequence Table from July 2008 AMP Structured Decision Making/Rapid Prototyping session outlining the four scenarios evaluated and their effects.

Between River & Elsewhere	Within Central Platte	Within River Reach
Interior Least Terns/Piping Plovers		
• Metapopulation dynamics • Relationship to various basins	• Sandpit vs. river reach • "Availability" • Bare sand with water • Unobstructed width • Previous use • Distance to foraging habitat	• Grain size • Bar elevation, size, % vegetative cover • Length of wetted edge
Whooping Cranes		
• Use the river when it is dry in the Rainwater Basin	• Unobstructed width • Total wetted width • Adjacent landscape	• 1"-8" of water for roosting • Distance to obstruction • % bare ground for landing • "Braiding Index" **(NOTE: can get these parameters from SedVeg model)**

Table 4. Key data needs for Program target species at various scales as identified during July 2008 Structured Decision Making/Rapid Prototyping workshop.

FY2009-FY2013 AMP Implementation Objectives and Activities

Adaptive management activities in FY2009-FY2013 will be directed at implementation of the two management strategies identified in the AMP through management actions ("experiments"). A series of AMWG workshops in 2008 and 2009 will provide design details, direction for monitoring and research activities, and guidance on how to link results from management actions to addressing key science questions and priority hypotheses – ultimately, an assessment of progress toward meeting the management objectives identified in the AMP.

Flow-Sediment-Mechanical (FSM) Actions

A. FSM Management Action #1: Sediment Augmentation

During development of the Final Environmental Impact Statement (FEIS) for the Program, the Bureau of Reclamation conducted 1-D sediment transport modeling with the SedVeg model that suggested a sediment imbalance in the Platte River system, primarily from the J-2 Return on the south channel of the river adjacent to Jeffrey Island to a point between Elm Creek and Kearney. Modeling analysis in the FEIS included the annual addition of 185,000 (129,500 yds^3) to 225,000 (157,500 yds^3) tons of sediment with a d50 of < 1.00 mm below the J-2 Return and above the Overton bridge to bring the river back into sediment balance as a part of implementation of the FSM management strategy.

In December 2008, the AMWG convened a workshop to develop details for a sediment augmentation adaptive management experiment in the 2009-2013 timeframe as the initial implementation action for sediment augmentation. Over the next five years, actions related to sediment augmentation will focus on assessing Priority Hypothesis Sediment #1, which states: "Average sediment augmentation near Overton of 185,000 tons/year under the existing flow regime and 225,000 tons/year under the Governance Committee proposed flow regime achieves a sediment balance to Kearney". That hypothesis is represented below by Figure 4:

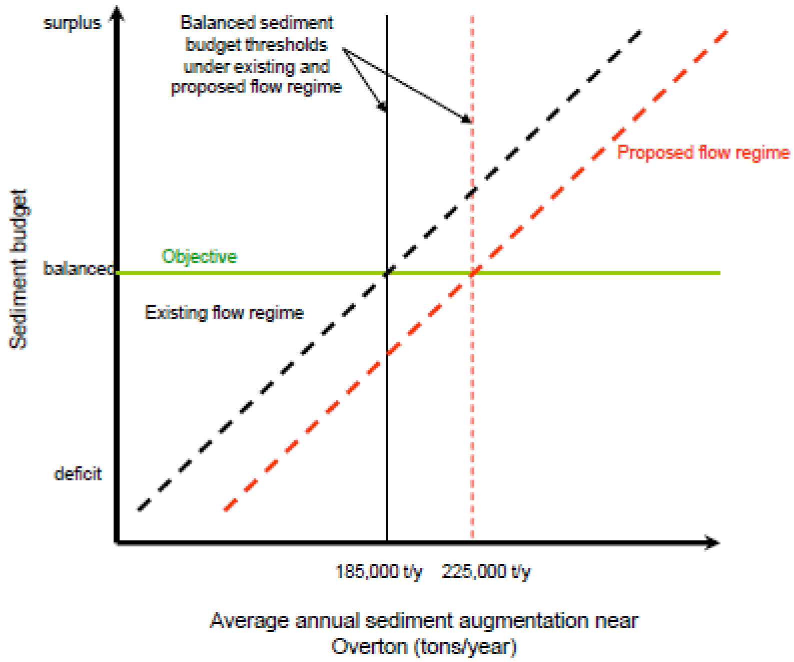

Figure 4. X-Y graph of Sediment #1 Priority Hypothesis.

➢ Experiment "Means" Objective

To test the ability of sediment augmentation to help achieve this balance, provide a measurable objective, and ultimately relate the results of the experiment to habitat changes and species response, the focus of sediment augmentation activities over the next five years will be on the sediment balance in the river just upstream of Cottonwood Ranch. **The specific objective of Sediment Augmentation actions in 2009-2013 will be to achieve a sediment balance just upstream of Cottonwood Ranch.**

➢ Experiment Actions

FEIS modeling assumed sediment augmentation would occur upstream of the Overton bridge, likely in the south channel of the Platte along Jeffrey Island. The Program has acquired property along the south channel in this area for sediment augmentation purposes, but is also investigating other sediment options such as the use of spoil material from existing sand and gravel mining operations just downstream of the Overton bridge. Possible augmentation actions include:

- Augment downstream of Overton bridge with sandpit spoil
- Augment at the Cook property with channel and/or upland sediment
- Investigate augmentation possibilities below J-2 Return
- Mechanical augmentation in channel between the Cook property and Cottonwood Ranch (island leveling, channel widening)

➢ Measurements

Progress toward the experiment "means" objective will be assessed utilizing the following sources of data:

- Total landform volume (areal extent from the North Channel/South Channel confluence upstream of the Overton bridge to Cottonwood Ranch); looking for no net change
- Spatial changes – acquired through topographic surveys
- Width to depth ratio – calculated from geomorphology monitoring data
- Tern/plover nesting habitat – areal extent of bars from aerial photos (assess from sediment augmentation site to Kearney; focus on Cottonwood Ranch); includes evaluation of habitat parameters for terns and plovers as identified by the Technical Advisory Committee in December 2008
- Tern/plover productivity at Cottonwood Ranch (calculated from tern/plover monitoring data)
- Measure channel width at Cottonwood Ranch (whooping crane use); includes evaluation of habitat parameters for whooping cranes as identified by the Technical Advisory Committee in December 2008
- Focused transect surveys at Cottonwood Ranch for baseline data and trends
- Braiding index from augmentation site to Kearney; need aerial photos at index flow of 1,200 cfs (or as close as possible)

➢ **2009 Work Items**

- Develop Request for Qualifications (RFQ) to secure expert assistance for sediment augmentation feasibility analysis that would evaluate costs of various augmentation options, sediment availability at augmentation locations, methods for introducing sediment, timing, and other factors **– ED Office**
- Use results of feasibility analysis to develop sediment augmentation scenarios for use in modeling efforts (additional rapid prototypes, other models) **– ED Office & AMWG**
- Power analysis of sediment augmentation experiment options to reveal statistical power of experiment and help guide data analysis efforts **– ED Office**
- Develop data collection and analysis plan that identifies how measuring objectives will be met, how priority hypothesis will be evaluated, how data from other experiments will be integrated, and how information will be related to species response **– ED Office & AMWG**
- Assess need to conduct specific geomorphology research/investigations to provide data useful for evaluating sediment augmentation experiment **– ED Office & AMWG**

B. *FSM Management Action #2:* Flows

- Pulse flow target of up to 5,000 cfs for three days at Overton
- Address during May 2009 AMWG workshop

C. FSM Management Action #3: Mechanical

As detailed in the AMP, the purpose of riverine mechanical actions in both the FSM and Mechanical Creation and Maintenance (MCM) strategy is to increase the acreage of channel area greater than 750 feet wide to increase whooping crane roosting habitat and to increase the acreage of tern and plover nesting sandbars and islands. Cutting banks, lowering and/or building nesting islands, and clearing vegetation are all actions common to the riverine mechanical actions in both strategies. Flow consolidation is an additional action included in the FSM strategy. In March 2009, the AMWG convened a workshop to develop details for riverine mechanical actions adaptive management experiment in the 2009-2013 timeframe as the initial implementation action for riverine mechanical actions.

➢ Experiment "Means" Objective

The specific objective for Mechanical Actions in 2009-2013 will be to, assuming a sediment balance and Program flows, mechanically create and create and maintain with flows and sediment Program-defined habitat for ILT/PP/WC.

In general, certain items will guide actions aimed at achieving this objective:

- Program habitat criteria are minimum design criteria.
- Two sites have consolidated flow (Elm Creek and Dippel); two sites do not have consolidated flow (Cottonwood Ranch and Wyoming).
- Need to build both FSM islands and MCM islands; FSM islands would be built to be overtopped and maintained by flow; MCM islands would be built to avoid being overtopped by any flow and would be maintained by mechanical means (similar to NPPD island at Overton; spray for vegetation, predator fencing)

➢ Experiment Actions

Riverine mechanical actions will occur at four habitat "complexes" that currently in partial or total Program ownership or are partially or wholly owned by Program partners – Cottonwood Ranch (CR – owned by NPPD, joint management with Program); Elm Creek (EC – mixture of Program, Trust, and TNC ownership); Wyoming (WY – Program-owned); and Dippel (owned by the Trust, with private landowners on the south). Possible riverine mechanical actions include:

- Build islands at CR, EC, WY, and Dippel; FSM islands need to meet minimum design criteria but be able to be overtopped by 1.5 year flow; MCM islands need to be built large enough and high enough to avoid flow overtopping (not sure this is possible)
- CR – channel widening (push in part of existing nesting island); disk as needed; cattle grazing to keep vegetation down
- EC – channel widening through cut/level and vegetation management (in channel and related to unobstructed width to restore to what was there less than a decade ago)
- WY – begin analysis of channel width changes; widen north channel; vegetation management (in channel and related to unobstructed width)
- Dippel – vegetation management (in channel and related to unobstructed width); begin analysis of channel width changes (possibly with 2-D model); some maintenance of existing channel width

➢ Measurements (builds on Sediment Augmentation Experiment measurements)

Progress toward the experiment "means" objective will be assessed utilizing the following sources of data:

- ILT/PP habitat measurements; includes vegetative measurements (percent cover)
- Channel width, plus additional unobstructed width (aerials?)
- Landform volume; looking for no net change
- Spatial changes – acquired through topographic surveys

- Geomorphology monitoring survey data; suspended sediment and estimates of total sediment transport load; gets to sediment balance
- Grain size from sandbars at experiment sites
- Width to depth ratio – calculated from monitoring data; calculated at 2,000 cfs; need 1-D hydraulics model
- ILT/PP nesting habitat; areal extent of bars from aerial photos
- ILT/PP productivity (from monitoring)
- Whooping crane use
- Channel width (for whooping crane use)
- Aerial photos
- Focused transect surveys at CR for baseline data and trends (sed. aug. experiment)
- Braiding index from augmentation location to GI; need aerial photos at index flow of 1,200 cfs (or as close as possible)
- Flow measurements – timing, duration, frequency
- Channel slope – would help to know where river is at pre-experiment and post-experiment on Mechanical #2 X-Y graph

➢ **2009 Work Items**

- Develop tools/begin modeling and analysis of CR to aid interpretation and prediction and to test sustainability of widening actions
- Build islands at CR; continue channel widening and vegetation management
- Begin plans for constructing ILT/PP islands, channel widening, and vegetation management at Elm Creek, Wyoming Property, and Dippel (tern and plover islands already exist; some can be overtopped, some not)
- Sediment augmentation feasibility analysis
- Flow workshop
- Assess need for additional site-specific data collection and determine how to get data
- Landowner contacts and permitting related to each site and related to large actions like sediment augmentation and channel widening
- What is sediment budget today with phragmites? Need 1-D model
- Use LiDAR data; 2-D model at all four experimental sites; this is a high priority at the Wyoming property to keep track of flow split
- Assess our ability to get to and maintain minimums at Wyoming property
- South channel gage at CR
- Begin planning for keeping cattle out of some part of channel at CR
- Begin process of developing flow consolidation design for CR for future years; linked to 2-D model; important to start now because of potential permitting issues
- Consider potential research projects, including:
  1) Vegetation scour, shear stress related to flows in consolidated versus non-consolidated areas and under different flow scenarios (could be field or physical model or flume study).
  2) Morphology of vegetation at time of pulse flows, or how different stages of growth affected by scour.

3) Plan form/braiding index investigation – mining data in available aerials to determine historical trends and aid predictions based on management actions (also incorporate history of land management in study of aerial photos).
4) Historic look at flow conditions at Elm Creek site.
5) Flow split and consolidation studies to estimate flows at splits from aerial mapping; and improve estimate of flow consolidation needed for fully braided river and desirable habitat (analysis of 1998 aerial photos indicate 85 to 90% of the EIS pulse flow);
6) Tributary sediment source studies to support advanced modeling for sediment augmentation Program and research investigations;
7) Headcut sediment source study to determine if upstream will soon become a declining source; and to determine to what extent upstream phragmites are reducing the sediment supply to study area.
8) Geomorphology plan form study to determine impact of phragmites and potentially loss of habitat if phragmites is not controlled.
9) Bar height studies- double-check water surface differential between high and low flow for bar height studies, analyze 2005 bar survey data, 2008 bar survey data and look at other available survey data and tie to hydrologic regime preceding survey.

Mechanical Creation and Maintenance Experiment (MCM) Actions

A. *Mechanical Management Action #1:* <u>Sandpit Management</u>

- Acquire 200 acres of sandpits including at least 40 acres of bare sand; water to bare sand ratio of 1:1 to 3:1; additional 200 acres of abandoned sandpits or similar habitat created by the Program; includes predator management

B. *Mechanical Management Action #2:* <u>Restore, Create, and Maintain Bare Sand Riverine Islands and Channel Width</u>

- Same actions as FSM strategy except for flows; see FSM Management Action #3 above.

C. *Mechanical Management Action #3:* <u>Create and Maintain Inundated Wetlands and Upland Areas</u>

- Each 0.5 miles of linear wetlands (sloughs, backwater) constructed on Program lands will include at least one area with shallow water are with minimum water surface area of 500 feet by 500 feet
- Create 300 acres of palustrine wetlands

<u>Additional AMP Implementation Activities (plug these tasks into experimental actions)</u>

- Overall experimental design – paired five-site approach; discuss in detail with ISAC
- Refine existing rapid prototype models/develop additional simple models
- Contribute to revisions to SedVeg
- Additional modeling – bar evolution model, MIKE 21C, others?
- Identify additional research priorities/projects
- Whooping Crane Conservation Action Plan – link Program to range-wide migratory corridor
- Set Program anchor points for monitoring/research

- USACE permits
- Invasives strategy (particularly phragmites)
- Tern/plover monitoring
- Forage fish monitoring
- Whooping crane monitoring
- Geomorphology/in-channel vegetation monitoring
- Water quality monitoring
- Tern/plover foraging habits study
- Lower Platte River stage change study
- Wet meadows information review/refinement of CEM
- Aerial photography
- Use of LiDAR data

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