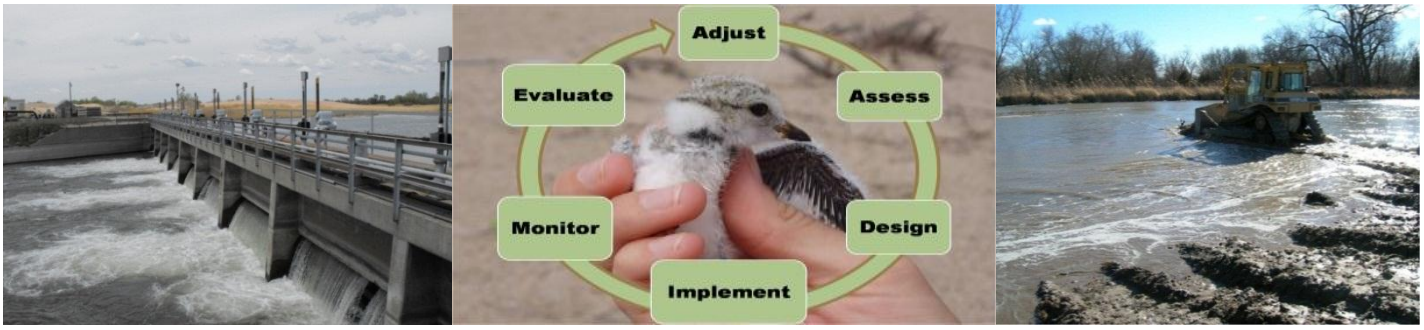
ADAPTIVE MANAGEMENT ON THE PLATTE RIVER



06/04/2012

Platte River Recovery Implementation Program
Adaptive Management Plan (AMP)
2012 "State of the Platte" Report – Executive Summary

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PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

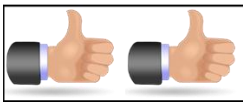
Program activities are being implemented to address major Program scientific and technical uncertainties identified as "broad hypotheses" on Pages 14-17 of the AMP. The following set of ten "Big Questions" represents a condensed version of uncertainties related to Program management actions, habitat, and target species response during the First Increment.

PRRIP Big Questions = What we don't know but want to learn
Implementation – Program Management Actions and Habitat
1. How do Program management actions (flow releases, sediment augmentation, flow consolidation, mechanical actions) contribute to the maintenance of channel width and creation of a braided river channel?
2. What is the relationship between Program management actions (flow releases, sediment augmentation, flow consolidation, mechanical actions) and suitable tern and plover riverine nesting habitat as defined by the Program?
3. What is the relationship between Program management actions (flow releases, sediment augmentation, flow consolidation, mechanical actions) and suitable whooping crane habitat as defined by the Program?
Effectiveness – Habitat and Target Species Response
4. Do terns, plovers, and whooping cranes use Program habitat complexes and/or Program-defined habitat in proportions greater than their availability?
5. What is the relationship between concurrently available riverine and sandpit nesting habitat and tern and plover use and productivity?
6. What is the relationship between the availability of Program-defined nesting habitat and tern and plover use and reproductive success?
7. What is the relationship between the availability of Program-defined whooping crane roosting habitat and whooping crane use?
8. Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?
Larger Scale Issues – Application of Learning
9. How do Program management actions in the central Platte River contribute to least tern, piping plover, whooping crane, and pallid sturgeon recovery?
10. What uncertainties exist at the end of the First Increment, and how might the Program address those uncertainties in the Second Increment?

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

Big Question Assessments

2011 marked the conclusion of the fifth year of the 13-year First Increment, so any conclusions drawn to date are made cautiously. Generally, information does exist to pair the key data and visualizations with a preliminary assessment of what we know about some of the Program's Big Questions. Additionally, these preliminary assessments are made utilizing the following guide:

	• Question/hypothesis **answered conclusively** in the **affirmative** • Consider adjustments in actions or influence on decision-making
	• Affirmative answer or trend, but question/hypothesis **NOT answered conclusively**
	• Evidence thus far is inconclusive; no affirmative or negative answer to question/hypothesis
	• Negative answer or trend, but question/hypothesis **NOT answered conclusively**
	• Question/hypothesis **answered conclusively** in the **negative** • Consider adjustments in actions or influence on decision-making

PRRIP Big Questions = What we don't know but want to learn	2012 Assessment
Implementation – Program Management Actions and Habitat	
1. How do Program management actions (flow releases, sediment augmentation, flow consolidation, mechanical actions) contribute to the maintenance of channel width and creation of a braided river channel?	
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Effectiveness – Habitat and Target Species Response	
4. Do terns, plovers, and whooping cranes use Program habitat complexes and/or Program-defined habitat in proportions greater than their availability?	
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7. What is the relationship between the availability of Program-defined whooping crane roosting habitat and whooping crane use?	
8. Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?	
Larger Scale Issues – Application of Learning	
9. How do Program management actions in the central Platte River contribute to least tern, piping plover, whooping crane, and pallid sturgeon recovery?	
10. What uncertainties exist at the end of the First Increment, and how might the Program address those uncertainties?	

2. What is the relationship between Program management actions (flow releases, sediment augmentation, flow consolidation, mechanical actions) and suitable tern and plover riverine nesting habitat as defined by the Program?

Based upon the SedVeg model and associated assumptions in the FSM management strategy, it is hypothesized that under a balanced sediment budget, flows of 5,000 to 8,000 cfs magnitude for three days on an annual or near annual basis (SDHF) will build sand bars to an elevation that is suitable for tern and plover nesting.

Analysis Conducted to Date:

The Program developed system and project-scale hydraulic and sediment transport models and collected detailed system and project-scale topographic data following three natural flow events that exceeded SDHF magnitude and duration. The EDO and contractors used this data to analyze sand bar height in relation to peak flow stage and minimum habitat suitability criteria in the portions of the reach that are in sediment deficit (upstream of Kearney) and sediment balance (downstream of Kearney).

Thus far, analyses focused on relationships related to SDHF because that flow management action is prioritized in the AMP. Additional monitoring and analysis may be utilized to evaluate alternative flow management actions (i.e. USFWS target flows – pulse flows and species flows) if the GC elects to implement such alternatives.

What Does the Science Say?

Program modeling and monitoring indicate that SDHF will likely not produce habitat meeting the Program's suitability criteria for tern and plover nesting habitat with or without sediment balance.

The Program's minimum suitable sand bar height criterion for tern and plover nesting is 1.5' above a stage of 1,200 cfs, which correlates to tern and plover nests having a 50% probability of being flooded during the nesting season (May-July). During a peak flow event, sand bars grow to some height below the flow stage. The increase in flow stage during an event in combination with sand bar height below peak stage, dictate whether or not sand bar heights exceed 1.5 feet above 1,200 cfs. Program modeling, research, and monitoring indicate that:

1. Stage increase during peak flow events of SDHF magnitude (5,000-8,000 cfs) is sufficient to produce sand bars meeting the height criterion <u>if</u> sand bars build to very near or at the peak flow stage, which is what was assumed in the SedVeg model used in the FEIS analysis.

2. Sand bars formed during peak flow events in 2010 and 2011 had maximum heights of approximately 1.0-1.5 feet below peak flow stage and mean heights of 2.0-2.5 feet below peak stage. This was not high enough to produce appreciable area meeting the minimum height criterion. This despite the fact that these peak flow events had higher peak discharges and longer durations than a SDHF release.

3. Sand bar heights do not differ significantly in the sediment deficient reach upstream of Kearney versus the reach in sediment balance downstream of Kearney.

4. The area of in-channel sand bar habitat meeting minimum suitable habitat criteria has declined steadily since 2008 as constructed nesting islands have been eroded by peak flow events.

The finding that SDHF-magnitude flows do not produce suitable nesting habitat is qualitatively supported by a simple analysis of annual peak flow events and nesting records for the period of 1942-2011 (Figure 1). During that period, annual peak flow event magnitude and volume exceeded SDHF minimums in 41 out of 70 years. In addition, there were seven periods when minimums were exceeded in 2 out of 3 years, including recent periods from 1984-1991, 1993-1999, and 2010-2011. *If the FSM management strategy is capable of creating and/or maintaining tern and plover nesting habitat, regular nesting on natural sand bars should have occurred downstream of Kearney (area of sediment balance) from 1984-1999.*

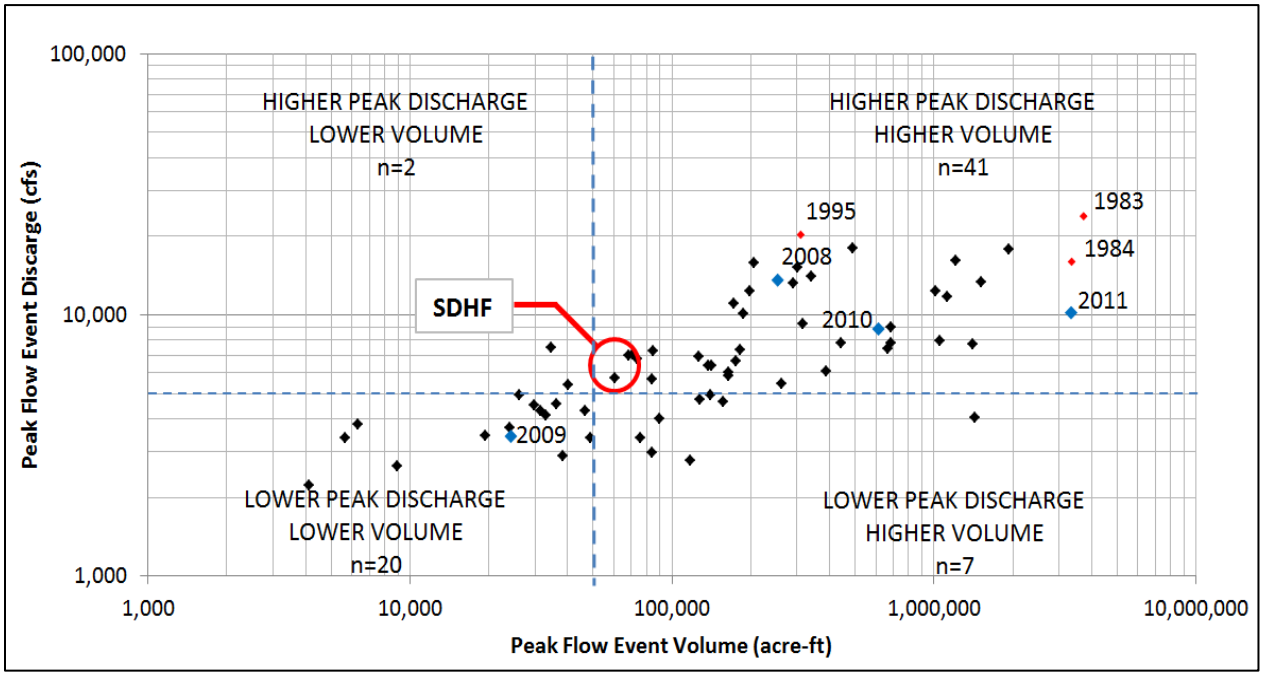

Figure 1. Annual peak flow event discharge and volume for 1942-2011.

A total of 63 nests were observed on natural sand bars at five locations in the years following consecutive high flow events of 23,900 cfs in 1983 and 16,000 cfs in 1984[1]. Four of the five sites and all but two of the nests were in the reach from Overton to Kearney at locations where channel hydraulics are affected by infrastructure (J-2 return, bridges, and the Kearney Canal diversion). The only nest observed on a natural sand bar after 1991 was downstream of the J-2 Return in 1996 following a high flow event of 16,200 cfs in 1995. During the period of 1984-1999, 233 nests were observed on managed islands, 871 nests were observed on managed sandpits, and 144 nests were observed on unmanaged sandpits.

The low number of nest observations on natural sand bars in comparison to other habitat types is a strong indicator that natural variation in peak flows, sediment, and channel characteristics during this period did not produce suitable nesting habitat with the exception of areas with unique hydraulics following very high peak flow events. If the Program is to expect a different result in the future, one (or a combination) of these factors must be manipulated outside of the ranges typically experienced during this period.

[1] Lingle, Gary. 2004. Platte River Recovery Implementation Program DEIS Response. Report Submitted to Central Platte NRD.

Governance Committee Decision-making Q&A:

Do these results mean the Program shouldn't attempt to make SDHF releases?

There are other hypothesized benefits to SDHF releases including maintaining wide, unvegetated channels for whooping cranes. The inability of SDHF to produce sand bars defined as nesting habitat by the Program should not necessarily be a reason to abandon the action as what constitutes suitable nesting habitat could be revised. However, results to date necessitate the GC be aware that current flow management priorities (SDHF) are not likely to produce all the hypothesized results and discussion of alternative flow management actions may be warranted.

Do these results mean the Program shouldn't augment sediment?

No. The effects of sediment deficit on braided stream morphology are well documented. Without augmentation, narrowing and incision in the reach upstream of Kearney will continue. The results only indicate that the sediment deficit upstream of Kearney is probably not the reason sand bar heights are not suitable for tern and plover nesting.

What management actions could conceivably produce islands that meet suitable nesting habitat criteria?

Some potential alternative management actions are presented below. Some may not be feasible, acceptable, and/or come with potentially negative impacts but are provided as examples of what it would mean to "go beyond" naturally occurring conditions.

- *Increasing frequency of large peak flow events* - Given that nesting was observed following very large peak flow events, increasing the frequency of flows from 16,000-20,000 cfs magnitude could increase the frequency of suitable habitat creation. However, such flows would require additional sediment augmentation that increases exponentially with flow magnitude.
- *Mechanically over-widen a segment of channel to induce sediment deposition* – This action would induce deposition and potentially encourage development of higher bars.
- *Oversupply the entire reach with medium sand (D_{50} 0.4mm)* – This would produce sediment conditions similar to the lower Platte River. The potential success of this alternative, however, is questionable given the 2011 sand bar height analyses by the USGS in the lower Platte indicated sand bar heights relative to flow event peak stage were very similar to the central Platte.
- *Mechanical approach* – Vegetated sand bars aggrade to heights that are suitable for nesting due to stabilization and sediment trapping by vegetation during natural or augmented annual high flow events. A portion of the sand bars at Program habitat complexes could be selectively allowed to vegetate with non-woody and non-invasive vegetation. Once a sand bar aggrades to a suitable height, it could be mechanically cleared and maintained as nesting habitat until it is eroded by subsequent flow events.

6. What is the relationship between the availability of Program-defined nesting habitat and tern and plover use and reproductive success?

It is hypothesized that when in-channel (sand bars) and off-channel (sandpits) nesting habitat availability increases, tern and plover use and productivity will increase (i.e., habitat is limiting). It is also hypothesized that tern and plover nesting is more successful on in-channel than off-channel habitat.

Analysis Conducted to Date:

The Program monitors tern and plover use of the central Platte River from late April through August each year. This includes both river habitat and off-channel habitat monitoring. EDO staff prepares an annual monitoring report that includes raw monitoring numbers and calculations of important bird-related metrics such as fledge ratios and nest success. Habitat availability during the tern/plover nest initiation period (April-July) is calculated each year based on Program-defined suitability criteria using aerial photography, LiDAR imagery, HEC-RAS models, and GIS computing.

What Does the Science Say?

Program monitoring and data analysis indicate that as habitat increases, tern and plover use and productivity increase. However, due to a lack of in-channel habitat and nesting during 2007-2011, we are not yet able to answer this Big Question.

Program management actions since 2007 have resulted in a steady increase in off-channel habitat despite vegetation encroachment and annual loss of suitable nesting habitat at privately owned sandpit sites (**Table 1**). Prior to the 2012 nesting season, the Program created or enhanced ~75 acres of off-channel nesting habitat which resulted in increased tern and plover nesting at three of these sites. During this same timeframe, availability of in-channel habitat meeting Program suitability criteria decreased steadily due to prolonged natural high-flow events.

Land Ownership	2007 In-Channel Habitat Acres	2011 In-Channel Habitat Acres	% Change		2007 Off-Channel Habitat Acres	2011 Off-Channel Habitat Acres	% Change
Program	5	2	-60%		20	60	200%
Non-Program	20	3	-85%		135	106	-21%
TOTAL	**25**	**5**	**-80%**		**155**	**181**	**16%**

Table 1. Program-defined tern and plover nesting habitat acres in the river as sand bars (in-channel) and at sandpits (off-channel) during 2007 and 2011, and the percent increase or decrease in habitat acres from 2007-2011. Habitat numbers are based on preliminary habitat availability assessment results; final results will likely change slightly during 2012. NOTE: "Habitat acres" are different than "Program acres"; all Program acres do not fit Program-defined habitat suitability criteria (for example, only certain acres of a sandpit count as suitable tern and plover nesting habitat based on criteria like slope, distance to trees, etc.).

Tern and plover productivity numbers have increased steadily since 2007 and are at levels believed to result in population growth. We observed ≥70% more tern and plover nests and fledglings during 2011 than 2007. Much of the productivity observed to date has been at off-channel sites where productivity is hypothesized to be lower than in-channel sites. We have observed a higher tern fledge ratio at off-channel (0.98 fledglings/nest) than in-channel sites (0.37 fledglings/nest) during the first five years of the Program and observed no tern nests on river islands during 2010 or 2011; however, availability of Program-defined suitable in-channel nesting habitat has been low. Similarly, we have observed a higher plover fledge ratio at off-channel (0.93 fledglings/nest) than in-channel sites (0.46 fledglings/nest) during the first five years of the Program and observed no plover nests on river islands during 2011.

Program monitoring and data analysis indicate that as sand bar and sandpit habitat increase, tern and plover use of both habitat types increase (**Figure 1**). The presence of little to no sand bar nesting habitat and the increase in off-channel habitat availability on the central Platte since 2007, however, leaves open the questions of whether tern and plover nesting is more successful on sand bar habitat versus sandpit habitat and whether there is a direct relationship between habitat availability and tern and plover use of the central Platte River.

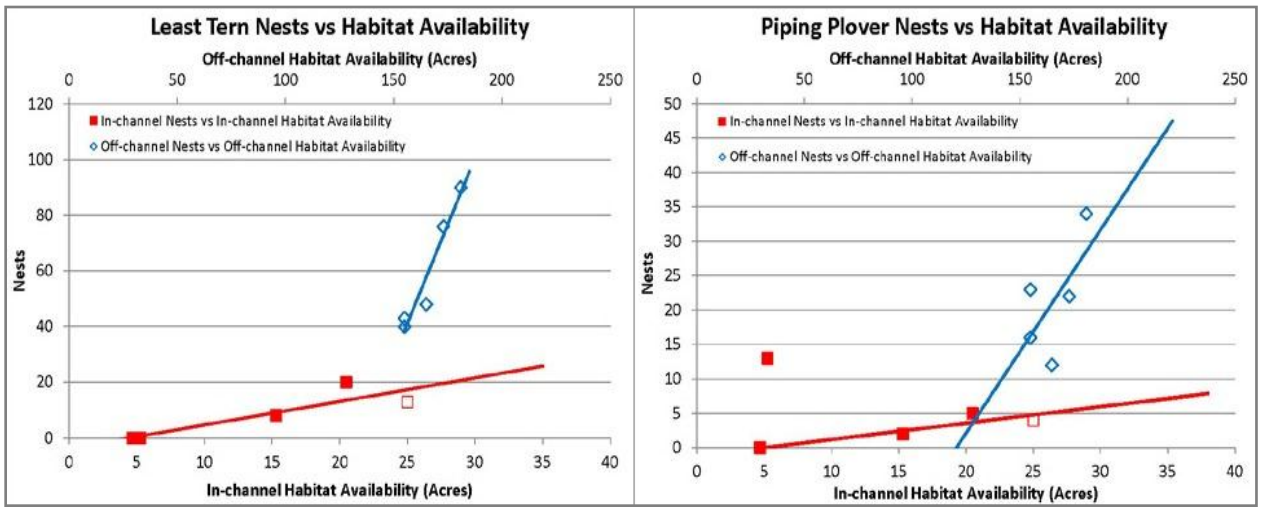

Figure 1. Relationship between availability of Program-defined suitable in- and off-channel nesting habitat and numbers of tern and plover nests observed, 2007–2011. Hollow points indicate habitat numbers were estimated and will be updated following completion of habitat availability assessments in 2012. The in-channel relationship for plovers excludes 2010 data when habitat availability was high during May, but decreased rapidly when a natural high flow event inundated and laterally eroded away most suitable in-channel nesting habitat.

Governance Committee Decision-making Q&A:

Should the Program create and maintain additional off-channel nesting habitat?

Yes. The Program and its partners acquired and maintain approximately 120 acres of suitable tern and plover nesting habitat. Program efforts to create and maintain off-channel tern and plover nesting habitat have been successful and resulted in a net increase in off-channel habitat availability and numbers of tern and plover nests and also distributed nesting across a wider stretch of river. Despite these efforts and successes, the amount off-channel habitat available for nesting only increased by approximately 25 acres due habitat loss to vegetation encroachment at privately owned sandpits. The Program is currently constructing an additional 35 acres and monitors approximately 60 acres of privately-owned, off-channel nesting habitat that is not managed to control vegetation. During the next couple years, the privately-owned habitat will likely become vegetated and unsuitable for terns and plovers which will result in a net loss in off-channel habitat during the Program's First Increment.

Should the Program create and maintain additional in-channel nesting habitat?

Yes. Since 2007, the Program created approximately 13 acres of suitable in-channel nesting habitat that, along with most in-channel habitat created and maintained by Program partners, was inundated and eroded away by natural high-flow events the past two summers. Through 2011, there was a very limited amount of what the Program-defined suitable in-channel habitat available for nesting. A wider range in habitat availability should be created to confirm the relationships between tern and plover use and habitat availability observed to date. Moving forward, the Program should build islands of various sizes and heights to evaluate Program habitat criteria and bird response.