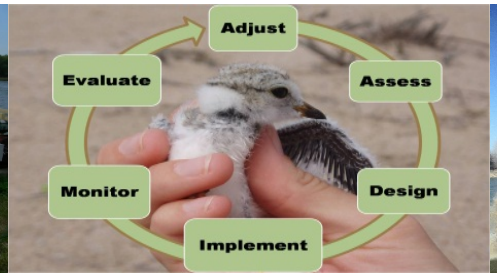
Delivering Science for Decision Making: Platte River Decision Support

Trinity River Restoration Program
Decision Support System Workshop

Weaverville, CA
March 29, 2016

Chad Smith
Director of Natural Resources Decision Support – Headwaters Corporation



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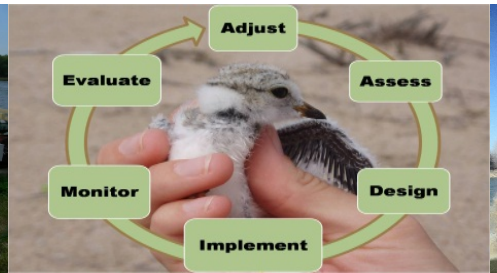
Decision Support in Recovery/Restoration Programs

Lessons learned from the Platte (and other systems) – “must haves”

1) <u>Governance</u>
   - Get the **people** part right
   - Science from AM must feed into decision-making – science **informs**, it does not control

2) <u>Why?</u>
   - Make science **useful** for decision-makers
   - Avoid the “science pile” – **synthesize**



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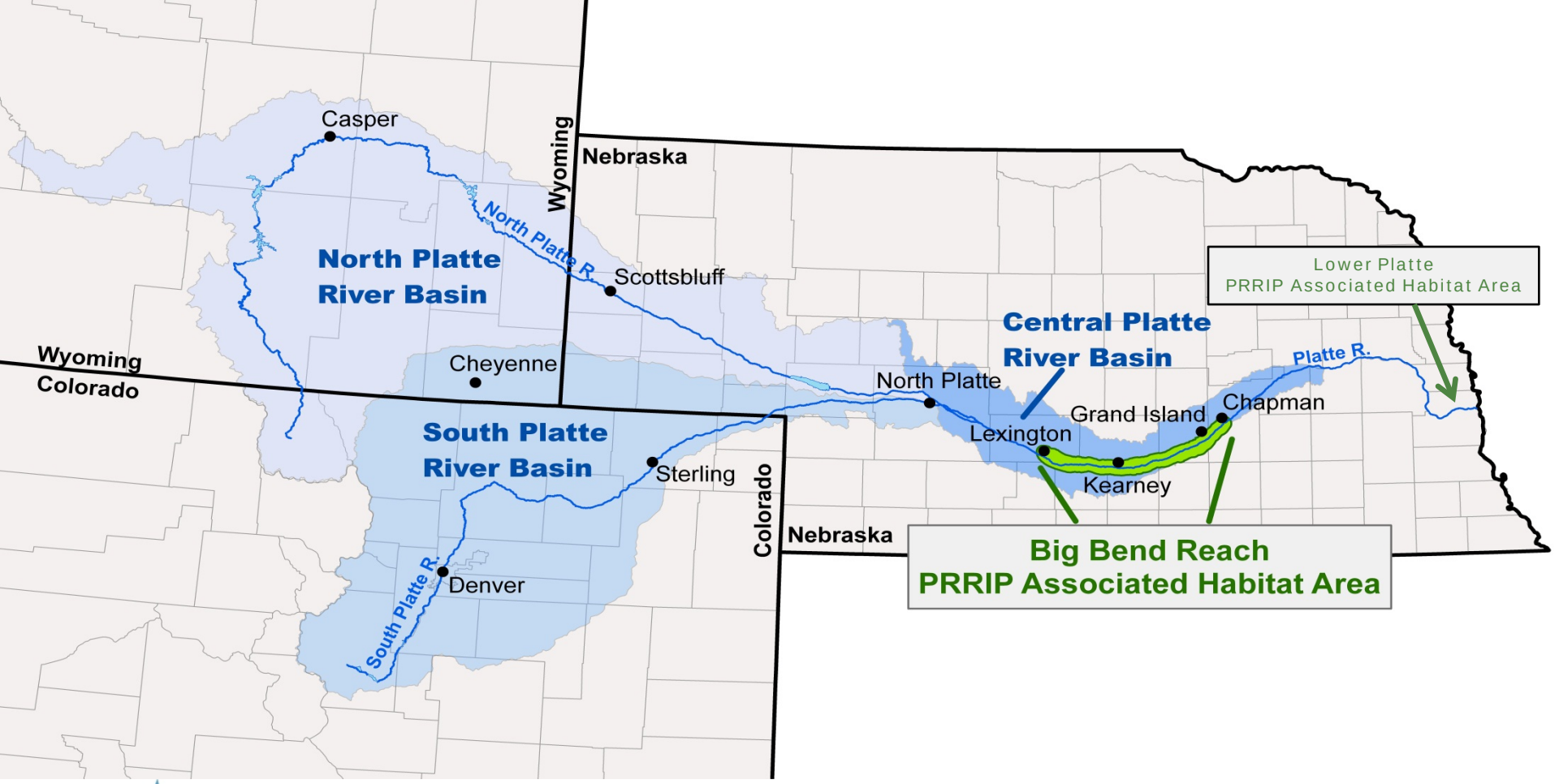


Platte River Recovery Implementation Program Scale

- Cooperative effort between Department of Interior, Colorado, Wyoming, Nebraska, & stakeholders
- Initiated on January 1, 2007
- $325 million First Increment (2007-2019)

PRRIP Goals and Objectives

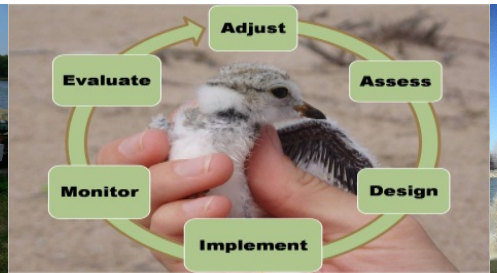
- Securing defined benefits for target species
- ESA compliance for existing and new water uses
- Prevent additional ESA listings
- Mitigate adverse effects of water activities on Service target flows
- Organizational structure for agency and stakeholder involvement

First Increment Objectives

- 130,000-150,000 acre feet/year
- 10,000 acres of land

AMP Management Objectives

- Terns/plovers
- Whooping cranes
- Do no harm to pallid sturgeon



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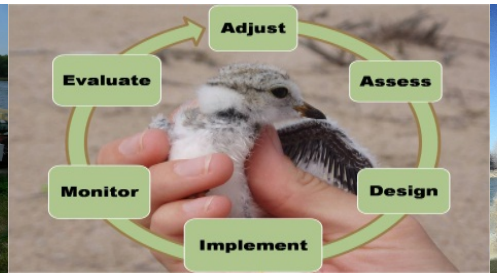
What's different about the Platte?

- Shared decision-making – stakeholders sit on Governance Committee
- 10 years of negotiation – agreed on water, land, and AMP; Final Program Document defines the Program
- Independent Executive Director and staff
- Consensus decision-making
- Commitment
- Meeting structure



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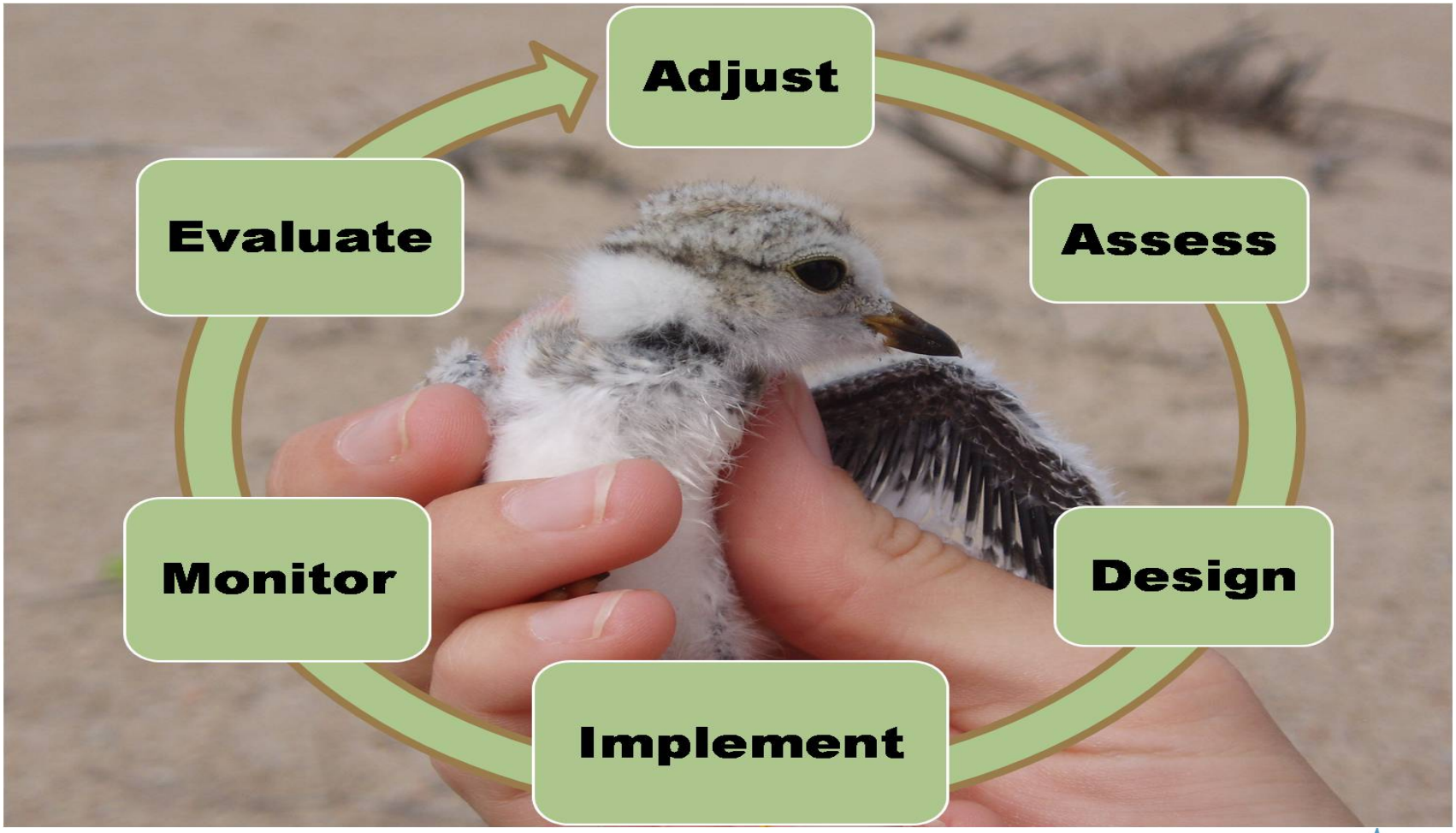
Adaptive Management (AM) – What is it?



Rigorous approach for designing and implementing management actions to maximize learning about critical uncertainties that affect decisions, while simultaneously striving to meet multiple management objectives.

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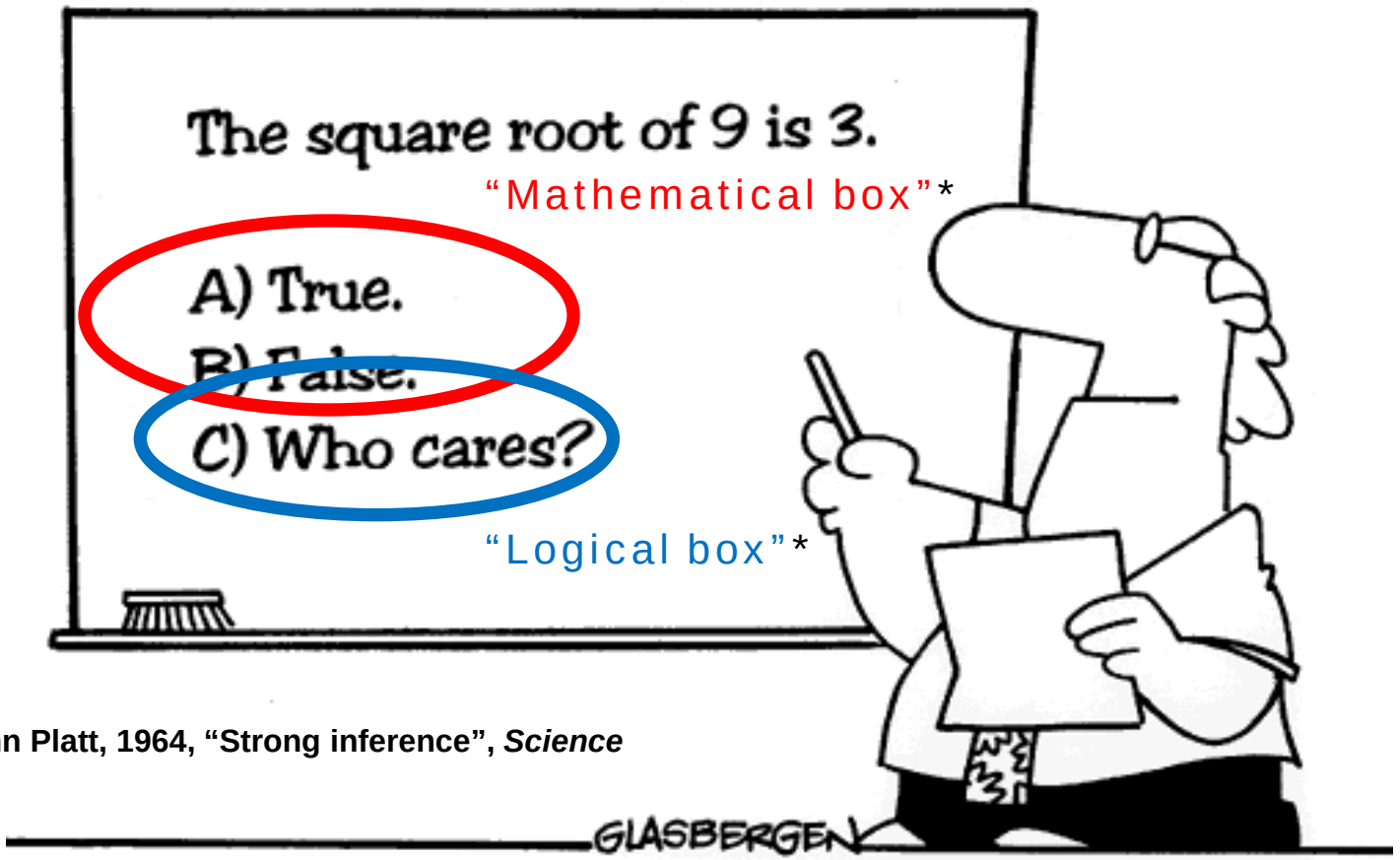
Decisions – Why?



*John Platt, 1964, "Strong inference", *Science*

Many students actually look forward to Mr. Atwadder's math tests.

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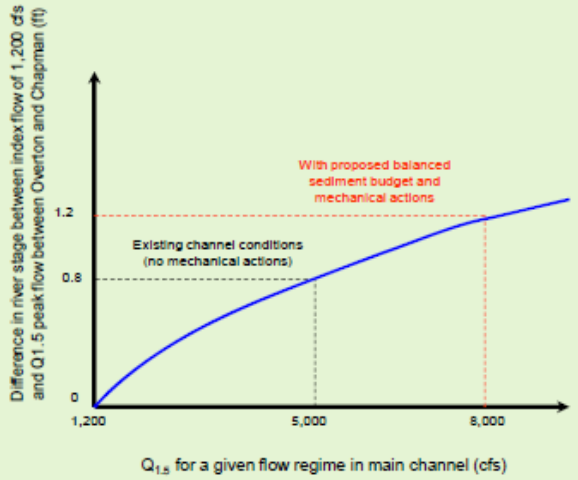
Critical Uncertainties

PRRIP Big Question	2014 Assessment	Basis for assessment
Implementation – Program Management Actions and Habitat		
1. Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?		Peer-reviewed Program synthesis concludes that SDHF will not produce suitable nesting sandbars.
2. Will implementation of SDHF produce and/or maintain suitable whooping crane riverine roosting habitat on an annual or near-annual basis?		Trending negative; Program synthesis chapters now in development will be discussed with the TAC and ISAC and peer reviewed in 2015; those synthesis chapters and published manuscripts related to the Program's vegetation and lateral erosion research will likely support a "two thumbs down" assessment in the 2015 State of the Platte Report.
3. Is sediment augmentation necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?		Trending positive; certainty about the sediment deficit; uncertainty about the role of that deficit in habitat creation and maintenance.
4. Are mechanical channel alterations (channel widening and flow consolidation) necessary for the creation and/or maintenance of suitable riverine tern, plover, and whooping crane habitat?		Trending positive; planform management manuscript now in development will be published and will likely support a "two thumbs up" assessment in the 2015 State of the Platte Report.
Effectiveness – Habitat and Target Species Response		
5. Do whooping cranes select suitable riverine roosting habitat in proportions equal to its availability?		A definitive assessment is expected by 2017 once peer review of data analyses (monitoring, telemetry, stopover study data, habitat availability assessments, IGERT research) is complete.
6. Does availability of suitable nesting habitat limit tern and plover use and reproductive success on the central Platte River?		Trending positive; three documents now in development will be peer reviewed and/or published and will likely support a "two thumbs up" assessment in the 2015 State of the Platte Report.
7. Are both suitable in-channel and off-channel nesting habitats required to maintain central Platte River tern and plover populations?		Trending negative; three documents now in development will be peer reviewed and/or published and will likely support a "two thumbs down" assessment in the 2015 State of the Platte Report.
8. Does forage availability limit tern and plover productivity on the central Platte River?		Trending negative; synthesis document related to tern forage (fish) will be peer reviewed that, in combination with the results of the Foraging Habits Study, will likely support a "two thumbs down" assessment in the 2015 State of the Platte Report.
9. Do Program flow management actions in the central Platte River avoid adverse impacts to pallid sturgeon in the lower Platte River?		Peer-reviewed Program stage change study concludes Program flow management actions will avoid adverse impacts.
Larger Scale Issues – Application of Learning		
10. Do Program management actions in the central Platte River contribute to least tern, piping plover, and whooping crane recovery?		By definition, implementation of the Program contributes to recovery of the target species. A definitive answer for this question can only be obtained by a broader analysis of the contribution of the central Platte to range-wide recovery.
11. What uncertainties exist at the end of the First Increment, and how might the Program address those uncertainties?		This question is a "parking lot" for uncertainties that could be addressed through adaptive management in an extended First Increment or new Second Increment.

Table 2. 2014 Big Questions table.

Critical Uncertainties

PRRIP "Big Questions"	Priority Hypotheses	Alternative Hypotheses	X-Y Graphs
<u>Implementation</u> – Program Management Actions and Habitat			
1. Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?	**Flow #1:** ↑ the variation between river stage at peak (indexed by Q1.5 flow @ Overton) and average flows (1,200 cfs index flow), by ↑ the stage of the peak (1.5-yr) flow through Program flows, will ↑ the height of sandbars between Overton and Chapman by 30% to 50% from existing conditions.	Flow magnitudes and channel compilations are insufficient to generate bars high enough to provide habitat for ILT and PP. Bars may become quickly vegetated, making them poor habitat for target species. Bars can be created or maintained by mechanical or other means.	Flow 1: Increasing river stage variation will increase sand bar height  Increasing the variation between river stage at peak flow (indexed by $Q_{1.5}$ flow at Overton) and average flows (1,200 cfs index flow), by increasing the stage of the peak (1.5-yr) flow through Program flows, will increase the height of sand bars between Overton and Chapman by 30% to 50% from existing conditions, assuming balanced sediment budget.

Management Actions

Flow-Sediment-Mechanical (FSM)
"Clear/Level/Pulse"

Mechanical Creation & Maintenance (MCM)
"Clear/Level/Plow"

- Short-duration high flows (SDHF)
- Sediment augmentation
- Mechanical island building, channel widening, vegetation clearing
- Off-channel habitat

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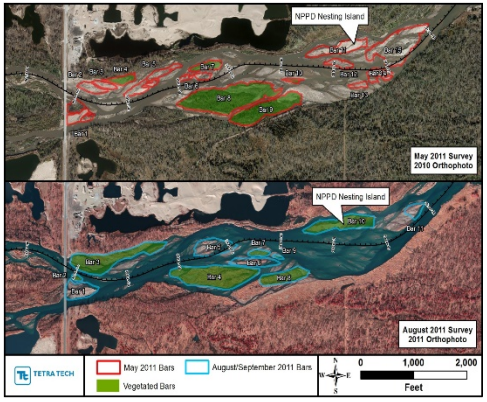
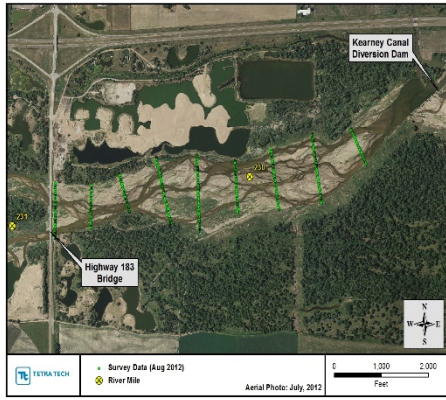
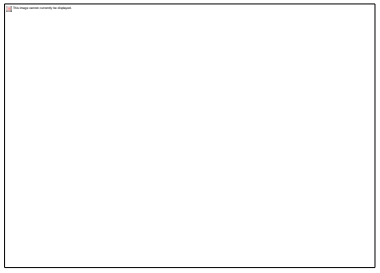
Monitoring Data

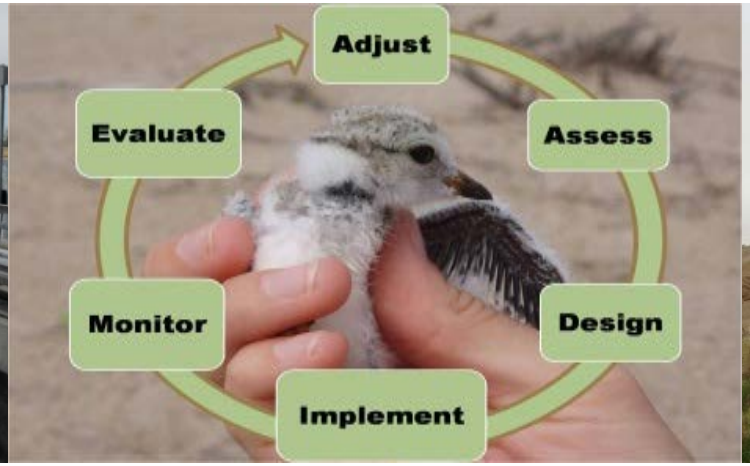
Effort	Frequency	Description
Least Tern and Piping Plover Use and Productivity Monitoring	Annual	Document species use, habitat variables and productivity in the AHR.
Least Tern and Piping Plover Habitat Availability Analysis	Annual	Document occurrence and amount of habitat in AHR meeting minimum species habitat suitability criteria.
Discharge Measurements	Real-time	Real-time Platte River discharge monitoring at six locations in the AHR. Stream gaging conducted in cooperation with the USGS and Nebraska Department of Natural Resources
June Color-Infrared Imagery	Annual	Document in-channel and off-channel habitat conditions during least tern and piping plover nest initiation period.
November Color-Infrared Imagery and Light Detection and Ranging	Annual	Document channel morphology and topography under leaf-off and low discharge conditions.
System-Scale Geomorphology and Vegetation Monitoring	Annual	Monitor sediment transport, channel morphology and in-channel vegetation throughout the AHR. Data include bed and suspended sediment load measurements, repeat channel transect surveys, bed and bank material sampling, and vegetation monitoring.
HEC-GeoRAS Hydraulic Model of AHR	As Necessary	Segment-scale hydraulic model for evaluation of channel hydraulics and development of water surface profiles across a range of discharges.







Adaptive Management on the Platte River

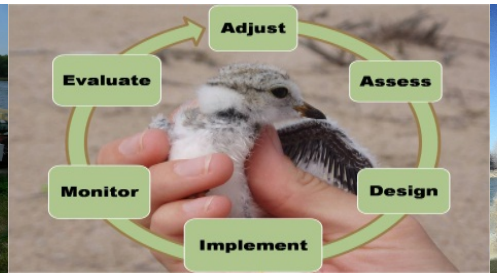


09/01/2015

Platte River Recovery Implementation Program
Adaptive Management Plan (AMP)
2014 State of the Platte Report
(updated primarily with 2013-2014 data)

Synthesis – Big Question #1

- Pulled together multiple lines of evidence regarding terns/plover productivity and relationship to flow
- Six “chapters” compiled into a single document
- Extensive review by Technical Advisory Committee and Independent Scientific Advisory Committee
- Utilized internal Program peer review process
- Data utilized to make definitive assessment of Big Question #1



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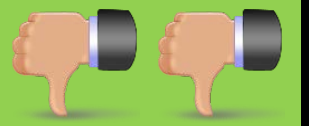
Big Question #1 Assessment

1. Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?

How does this Big Question relate to Program priority hypotheses?

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 (SDHF) will build sandbars to an elevation that is suitable for tern and plover nesting. The Program's minimum height suitability criterion is 1.5 ft above the 1,200 cfs stage and represents the minimum height thought necessary for nest initiation.[1]

2014 Assessment for BQ #1:



- Observational studies of natural high flow events since 2007 have provided sufficient data to test the hypothesis that SDHF releases will create suitably-high sandbars.
- Full SDHF magnitude of 8,000 cfs is not sufficient to create sandbars that exceed the PRRIP's minimum height suitability criterion.
- Sandbars created by SDHF releases will be inundated during the nesting season in most years.
- Regardless of peak flow magnitude or duration, AHR sandbars will generally be much smaller than those used by the species in other regional river segments. This due to significant differences in bed material grain size and the mode of sediment transport. These differences are likely intractable.

[1] This is a restatement of the first bullet under broad hypothesis PP-1. See p. 16 of the Adaptive Management Plan.

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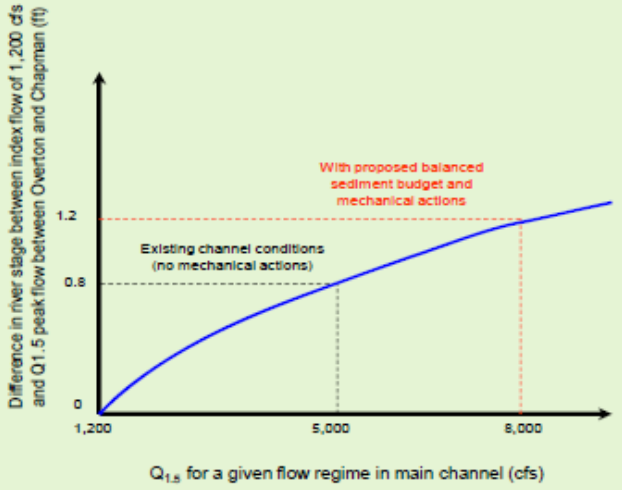
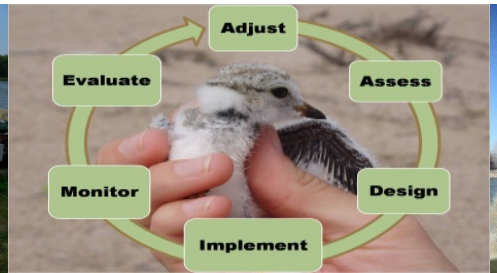
PRRIP "Big Questions"	Priority Hypotheses	Alternative Hypotheses	X-Y Graphs
<u>Implementation</u> – Program Management Actions and Habitat			
NO 1. **Will implementation of SDHF produce suitable tern and plover riverine nesting habitat on an annual or near-annual basis?**	**Rejected** **Flow #1:** ↑ the variation between river stage at peak (indexed by Q1.5 flow @ Overton) and average flows (1,200 cfs index flow), by ↑ the stage of the peak (1.5-yr) flow through Program flows, will ↑ the height of sandbars between Overton and Chapman by 30% to 50% from existing conditions.	**Affirmed (2 out of 3)** Flow magnitudes and channel compilations are insufficient to generate bars high enough to provide habitat for ILT and PP. Bars may become quickly vegetated, making them poor habitat for target species. Bars can be created or maintained by mechanical or other means.	Flow 1: Increasing river stage variation will increase sand bar height  Increasing the variation between river stage at peak flow (indexed by $Q_{1.5}$ flow at Overton) and average flows (1,200 cfs index flow), by increasing the stage of the peak (1.5-yr) flow through Program flows, will increase the height of sand bars between Overton and Chapman by 30% to 50% from existing conditions, assuming balanced sediment budget.

“Getting to Adjust” on the Platte River

- Use Big Questions, State of the Platte Report, and data synthesis to tell the story

- Structured Decision Making (SDM)



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AM and SDM

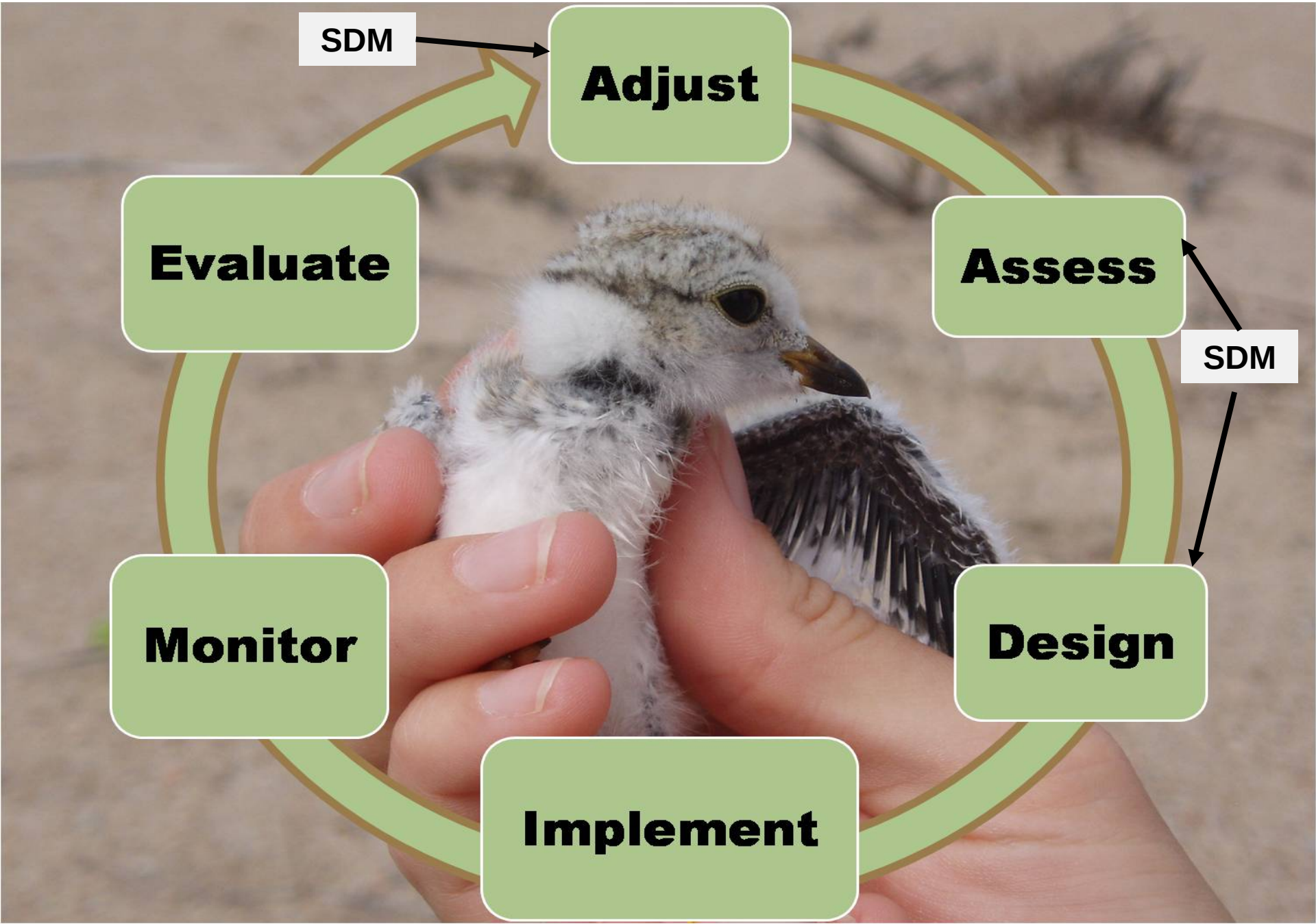


Figure 1: Round 2 Alternatives – Set A

Objective	Performance Measure	Units	Dir	STC	A1	A2	A3	A4
Piping Plovers								
Program Repro Success	Average Breeding Pair (BP)	#/year	H	22	18	34	28	29
	Average Fledge Ratio	#/year	H	1.30	1.40	1.27	1.37	1.34
	Total Fledglings over 50 yr	#	H	1,420	1,271	2,144	1,903	1,929
AHR Repro Success	Average Breeding Pair	#/year	H	30	27	42	36	37
	Average Fledge Ratio	#/year	H	1.33	1.40	1.30	1.37	1.36
Interior Least Terns								
Program Repro Success	Average Breeding Pair (BP)	#/year	H	97	91	141	134	136
	Average Fledge Ratio	#/year	H	1.07	1.10	1.06	1.09	1.08
	Total Fledglings over 50 yr	#	H	5,187	4,992	7,462	7,312	7,339
AHR Repro Success	Average Breeding Pair	#/year	H	140	133	182	176	177
	Average Fledge Ratio	#/year	H	1.08	1.10	1.07	1.09	1.09
Management Cost								
Short-term Management Cost	1st Increment Cost (2017-2019)	1000$	L	$130	$41	$1,220	$1,081	$1,081
Long-term Management Cost	NPV (50 yrs)	1000$	L	$2,931	$464	$6,225	$2,343	$2,343
Land Acquisition Cost	Est. Total Cost	1000$	L	$0	$0	$0	$0	$0
Water Use - Wet Years	Proportion of Program water used	%	L	0%	0%	0%	0%	9%
Water Use - Normal Years	Proportion of Program water used	%	L	0%	0%	0%	0%	63%
Water Use - Dry Years	Proportion of Program water used	%	L	0%	0%	0%	0%	77%
Augmented Volume	Avg. Volume Program water / yr	ac-ft/year	L	0	0	0	0	39090
Whooping Crane								
Habitat Use	Habitat Suitability Scale	-3 to +3	H	0	1	-1	2	2
Pallid Sturgeon								
Pallid Sturgeon Risks	Presense of critical water diversio	Yes/No	L	No	No	No	No	No
Implementation Effort								
Implementation Costs/Risks	Implementation Scale	-4 to 0	H	0	0	-2	-3	-3
Learning								
Learning Potential	Learning Potential Scale	0 to 3	H	1	0	2	1	1

Legend

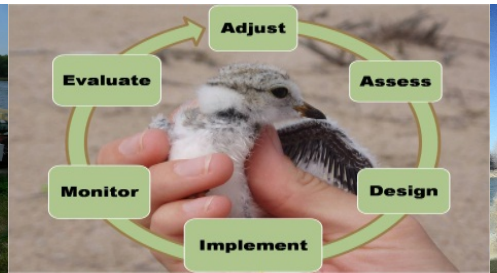
Better than selected

Worse than selected

Selected

“Getting to Adjust” on the Platte River

- If successful, first large-scale program to complete one full loop of AM
- What’s next?



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Questions and Discussion

Contact Info:
Chad Smith
402-432-7950
smithc@headwaterscorp.com

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