The Loup River Hydroelectric Project

Updated Study Results Meeting

September 8, 2011

Agenda

8:30 AM	Welcome and Introductions
8:45 AM	Integrated Licensing Process Overview
9:00 AM	Presentation of Updated Study Results • Study 1.0 – Sedimentation • Study 2.0 – Hydrocycling
Noon	Lunch
1:00 PM	Species Summaries • Interior Least Terns and Piping Plovers
2:00 PM	Next Steps In Process • Updated Study Results Meeting Summary • Agency Comment Opportunities • Draft License Application – November 18, 2011
2:30 PM	Adjourn

Ground Rules

1. When speaking, please speak in a microphone, speak clearly and have your number towards the court reporter for identification.
2. Phone attendees may not put this call on hold – mute is appropriate.
3. An alternate phone number is required for all phone attendees.
4. All attendees should shut off their cell phones.
5. Breaks will be provided as needed. If needed, please step out.
6. If phone attendees have difficulty hearing the audio, please let the moderator know as soon as possible.

Goals of the Updated Study Report Meeting

- To present the updated results of the studies identified in the Revised Study Plan and Study Plan Determinations
- To discuss any proposals to modify the study plan (by the District or other participants) in light of study results and data collected

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Previous Meetings

- May 2008 – Introduction to the Process and the Project
- June 2008 – Issues Discussion
- July 2008/August 2008 – Studies Discussions
- January 2009 – FERC Scoping Meeting
- April 2009 – Study Goals/Objectives Discussion
- May 2009 – Section 106/Recreation Discussions
- May 2009 – Study Methodology Discussion
- January 2010 – Discussions w/ NGPC/USFWS & FERC/NPS on study data needs/methods
- September 2010 – First Initial Study Results Meeting
- February 2011 – Second Initial Study Results Meeting

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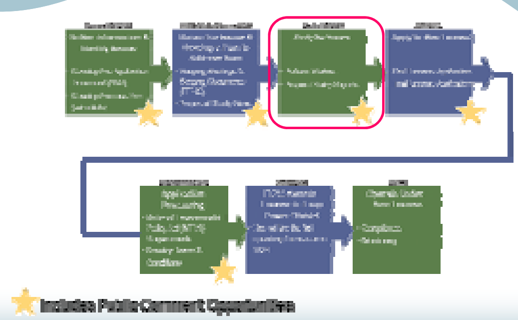
Overview of Integrated Licensing Process



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Study Plan Determination

- FERC issued on August 26, 2009
- Removed three studies:
  - Water Temperature in the Platte River, Fish Sampling, and Creel Survey [combined with Recreation Use]
- Approved three studies without modification:
  - Fish Passage, Land Use Inventory, and Section 106 Compliance
- Approved six studies with modification:
  - Sedimentation, Hydrocycling, Water Temperature in the Loup River Bypass Reach, Flow Depletion and Flow Diversion, Recreation Use, and Ice Jam Flooding on the Loup River

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Studies Completed for the First and Second Initial Study Results Reports

- Study 1.0 Sedimentation
- Study 2.0 Hydrocycling
- Study 4.0 Water Temp in Loup River Bypass Reach
- Study 5.0 Flow Depletion and Flow Diversion
- Study 7.0 Fish Passage
- Study 8.0 Recreation Use
- Study 10.0 Land Use Inventory
- Study 11.0 Section 106 Compliance
- Study 12.0 Ice Jam Flooding on the Loup River
- PCB Fish Tissue Sampling

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Initial Study Results Meetings/ FERC Determinations

Study Revisions

- Study 1.0 – Sedimentation
  - Confidence limits for sediment rating curves
  - Aggradation/degradation analysis for Duncan, North Bend, Ashland, Louisville & Genoa
  - Kendall Tau test to assess aggradation/degradation trends
  - Supplemental spatial analysis of channel geomorphologic characteristics
  - Additional statistical analysis related to tern and plover nesting
  - Provide Chen et all (1999) and MRBC report to FERC

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Initial Study Results Meetings/ FERC Determinations

Study Revisions

- Study 2.0 – Hydrocycling
  - Conduct sediment transport analysis using HEC-RAS
- Species Summary for Interior Least Tern and Piping Plover

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Next Steps

18CFR5.15

- September 23, 2011
  - District submits meeting summary
- October 24, 2011
  - Agencies file meeting summary disagreements and submit requests for study modifications
- November 23, 2011
  - District responds to summary comments and study modification requests
- December 23, 2011
  - FERC resolves comments and study modification requests
- November 18, 2011
  - District files Draft License Application

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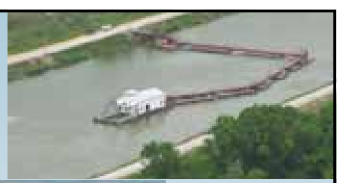
1. Sedimentation



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1. Sedimentation

Goals

- Determine the effect, if any, that Project operations have on stream morphology and sediment transport in the Loup River bypass reach and in the lower Platte River.
- In addition, compare the availability of sandbar nesting habitat for interior least terns and piping plovers to their respective populations and to compare the general habitat characteristics of the pallid sturgeon in multiple locations.

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1. Sedimentation

Objectives

1. To characterize sediment transport in the Loup River bypass reach and in the lower Platte River through effective discharge and other sediment transport calculations.
2. To characterize stream morphology in the Loup River bypass reach and in the lower Platte River by reviewing existing data and literature on channel aggradation/degradation and cross sectional changes over time.

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1. Sedimentation

Objectives (continued)

3. To determine if a relationship can be detected between sediment transport parameters and interior least tern and piping plover nest counts (as provided by the Nebraska Game and Parks Commission [NGPC]) and productivity measures.
4. To determine if sediment transport is a limiting factor for pallid sturgeon habitat in the lower Platte River below the Elkhorn.

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1. Sedimentation

- Initial Study Report
- Second Initial Study Report
- Updated Study Report
  - Combined Report
  - New Analyses
    - Confidence Limits
    - Spatial Analysis
    - Specific Gage Analysis & Kendall Tau
    - Bird Nesting Statistics

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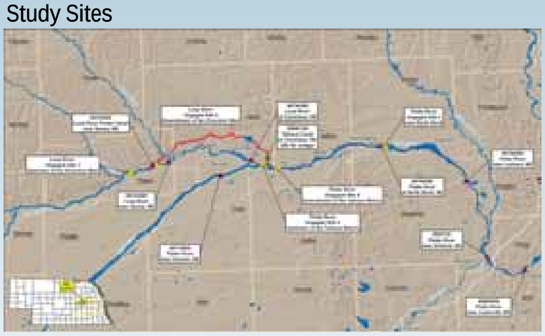
1. Sedimentation

Study Sites



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1. Sedimentation

"Include confidence limits on the sediment rating curves used to develop the sediment budgets and effective discharges that are presented in the Sediment Study Report." - FERC 12/20/2010

- Sediment Discharge Rating Curve and Yang USP equation
- Velocity, Depth, D50 confidence limits
- Sediment discharge rating curve with limits
- Regression on USGS data

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1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

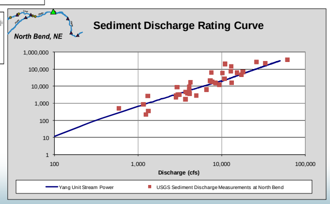
- Sediment Discharge Rating Curve and Yang USP equation

$$\log C_t = 5.435 - 0.286 \log (\omega d/\nu) - 0.457 \log (U_*/\omega) + [1.799 - 0.409 \log (\omega d/\nu) - 0.314 \log (U_*/\omega)] \times \log (VS/\omega - V_{cr}S/\omega)$$

$$V_{cr}/\omega = \frac{2.5}{\log(U_* d/\nu) - 0.06} + 0.66 \,, \quad 0 < (U_* d/\nu) < 70$$

and

$$V_{cr}/\omega = 2.05, \quad 70 \le (U_* d/\nu)$$



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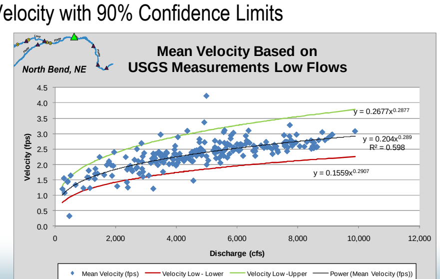
1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

- Velocity with 90% Confidence Limits



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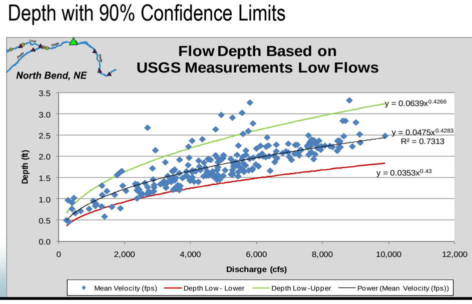
1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

- Depth with 90% Confidence Limits



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1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

- Upper and Lower 90% Confidence Limits for D50 at Each Gage

USGS Gage Number	Gage Location	Lower d_{50}	District-selected d_{50}	Upper d_{50}
06793000	Loup River near Genoa, NE	0.17	0.20	0.22
06774000	Platte River near Duncan, NE	0.29	0.38	0.46
06796000	Platte River at North Bend, NE	0.20	0.23	0.26
06805500	Platte River at Louisville, NE	0.20	0.22	0.24

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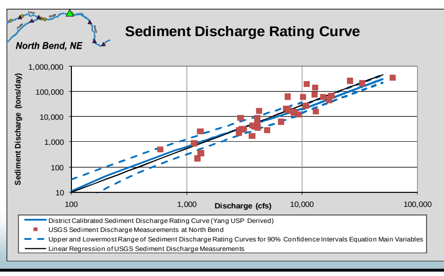
1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

- Sediment discharge rating curve with confidence limits



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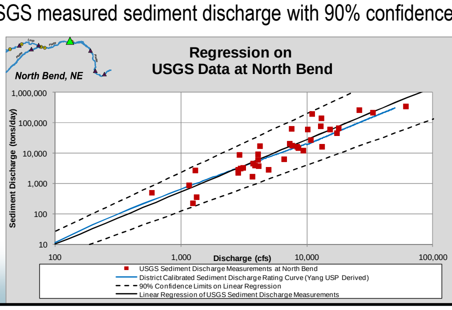
1. Sedimentation

Confidence Limits on Sediment Discharge Rating Curves

- USGS measured sediment discharge with 90% confidence limits



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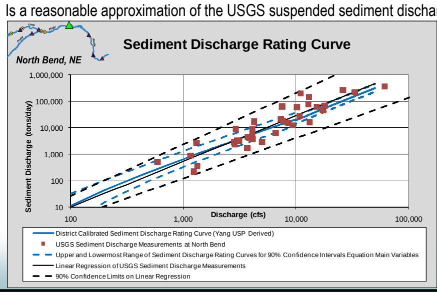
1. Sedimentation

District's calibrated sediment discharge rating curve:

- Falls within the 90% confidence interval of the USGS data
- Is a reasonable approximation of the USGS suspended sediment discharge data



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1. Sedimentation

Spatial Analysis

- Per FERC SPD letter June 10, 2011

Therefore, for each of the seven USGS sites and five ungaged sites, we recommend that Loup Power District relate effective discharge to mean velocity, flow width, flow depth, and flow area.[1] Using each of the four channel geomorphologic characteristics (mean velocity, flow width, flow depth and flow area) developed at each of the seven gaged sites and five ungaged sites, Loup Power District should make longitudinal (spatial) comparisons of all sites on the Loup and Lower Platte rivers starting at the most upstream site on each river, and progressing downstream. The Loup River analysis should include comparisons of ungaged site 1, ungaged site 2, USGS gage no. 06793000 (Genoa gage), and USGS gage no. 06794500 (Columbus gage).[2] Similarly, the Lower Platte river analysis should include comparisons of USGS gage no. 06774000 (Duncan gage), ungaged site 3, ungaged site 4, USGS gage no. 06796000 (North Bend gage), ungaged site 5, USGS gage no. 06796500 (Leshara gage), USGS gage no. 06801000 (Ashland gage) and USGS gage no. 06805500 (Louisville gage) progressing upstream to downstream. To facilitate the spatial analysis, we recommend that Loup Power District present the information graphically similar to figure 5-2 of the Sedimentation Addendum, dated February 11, 2011 (filed on February 14, 2011).

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1. Sedimentation

Spatial Analysis

- Relate effective discharge to mean velocity, flow width, flow depth, and flow area.
- At each of the gaged and ungaged sites make longitudinal (spatial) comparisons of all sites on the Loup and lower Platte Rivers starting at the most upstream site on each river and progressing downstream.
- Sequential comparison - compare ungaged Site 1 to ungaged Site 2, ungaged Site 2 to Loup at Genoa, and so on.

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1. Sedimentation

Spatial Analysis - Methodology

- Channel Geomorphologic Characteristics
  - Mean Velocity
  - Flow Width
  - Flow Depth
  - Flow Area
- Gaged locations – long term measurements
- Ungaged locations – HEC-RAS from 2010 surveys

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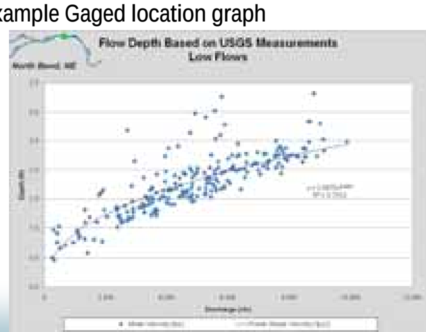
1. Sedimentation

- Example Gaged location graph



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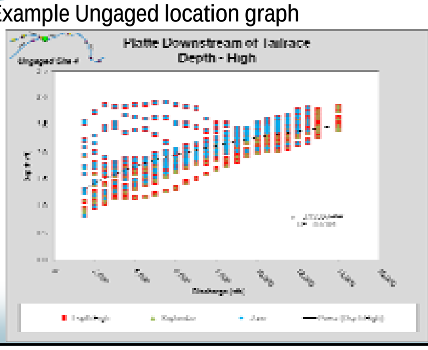
1. Sedimentation

- Example Ungaged location graph



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1. Sedimentation

Spatial Analysis - Methodology

- Developed sediment discharge rating curves
- Determined Qe and Qd
- Computed mean velocity, flow depth, flow width, and flow area at Qe and Qd

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1. Sedimentation

Spatial Analysis

- Study period Selection
  - Gage Locations 1985-2009 & 2003-2009 for comparison with ungaged
  - Ungaged Locations 2009 & 2003-2009
  - Selected 2003 to 2009 for gaged and ungaged

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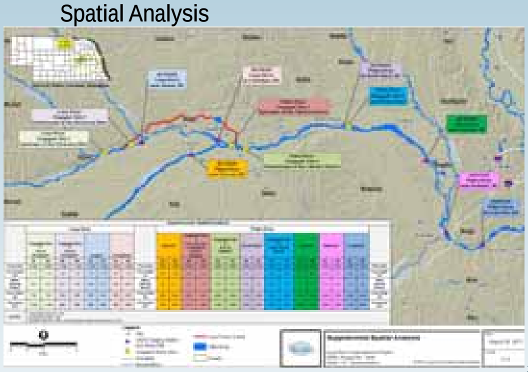
1. Sedimentation

Spatial Analysis



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1. Sedimentation

Loup River Bypass Study Sites

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1. Sedimentation

Spatial Analysis - Loup River

- Data limitations
  - 2 gaged sites
    - Genoa 1950 to 2010
    - Columbus 2008-2010
  - 2 ungaged sites
    - Site 1 (upstream of diversion)
    - Site 2 (downstream of diversion)

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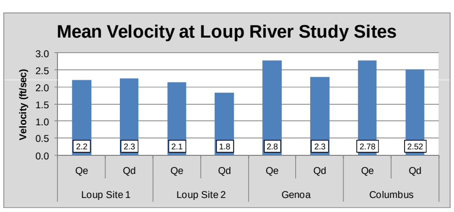
1. Sedimentation

Spatial Analysis – Loup River



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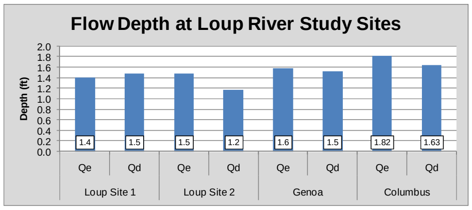
1. Sedimentation

Spatial Analysis – Loup River



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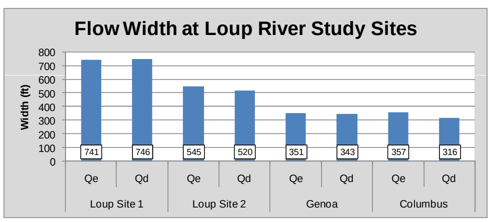
1. Sedimentation

Spatial Analysis – Loup River



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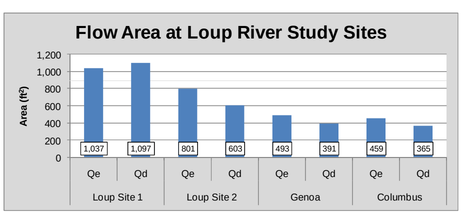
1. Sedimentation

Spatial Analysis – Loup River



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1. Sedimentation

Spatial Analysis - Loup River Results

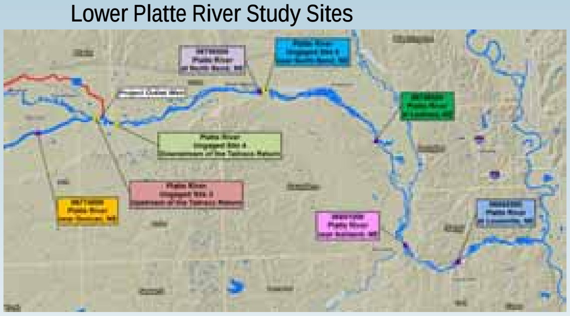
- Flow depth and mean velocity uniform or consistent
- For all four characteristics Genoa to Columbus is stable
- Site 2 is an intermediate but stable geometry between Site 1 and Genoa
- % reduction between Qe for Sites 1 and 2 very closely matches the width and area reduction

1. Sedimentation

- Consistent with the results presented in ISR and SISR
  - Percent changes in both flow width and flow area between Sites 1 and 2 closely matched the percent change in Qe between those sites
  - The data at Genoa and Columbus reveal a state of dynamic equilibrium

1. Sedimentation

Lower Platte River Study Sites



1. Sedimentation

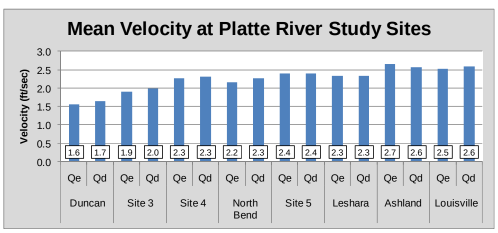
Spatial Analysis – Platte River

Data limitations

- Gaged locations
- Ungaged locations

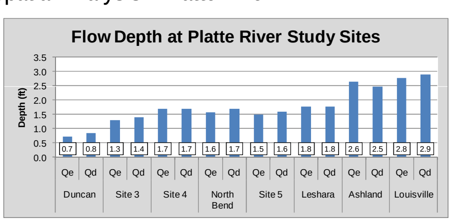
1. Sedimentation

Spatial Analysis – Platte River



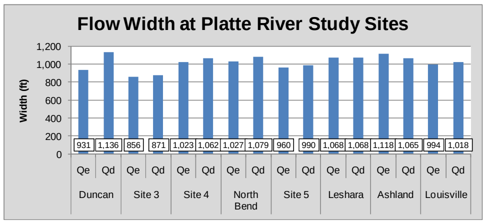
1. Sedimentation

Spatial Analysis – Platte River



1. Sedimentation

Spatial Analysis – Platte River



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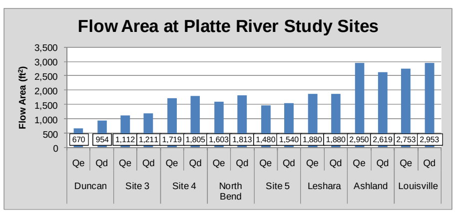
1. Sedimentation

Spatial Analysis – Platte River



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1. Sedimentation

Spatial Analysis - Platte River Results

- Flow depth, mean velocity, and flow area:
  - Duncan to Site 4 gradual increase
  - Site 4 to Leshara essentially no change
  - Leshara to Ashland step up
  - Ashland to Louisville no change
- Changes consistent with changes in Qe and Qd

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1. Sedimentation

Spatial Analysis - Platte River Results

- Flow width:
  - Duncan to Louisville gradual increase with the exception of Site 3
  - Confirms Kircher (USGS) assertion of relationship between width and effective discharge for a laterally unconstrained river

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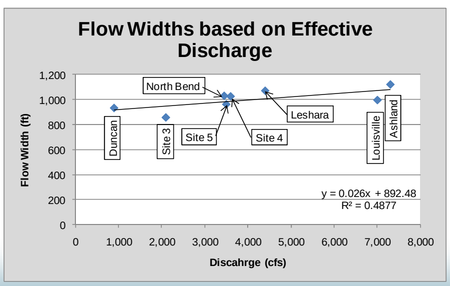
1. Sedimentation

Spatial Analysis



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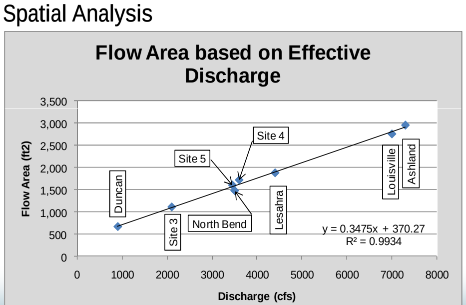
1. Sedimentation

Spatial Analysis



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1. Sedimentation

Spatial Analysis – Platte River Results

- Strong relationship between Qe and width
- Similarly strong relationship with Qe and area
- Area in a braided river is predominantly governed by width
- Indicates that a % change in Qe corresponds to a proportionate change in width and area
- One exception is Site 3

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1. Sedimentation

Spatial Analysis

- Consistent with results of the spatial analysis in the ISR and SISR, there is a strong relationship with channel geomorphologic characteristics and Qe (and Qd)
- Indicates that a % change in Qe corresponds to a proportionate change in width and area
- Consistent with Kircher findings that relate Qe and width

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1. Sedimentation

Specific Gage Analysis

- Analysis originally presented in the PAD
- "include aggradation/degradation analyses developed for the Duncan, North Bend, Ashland and Louisville gages that were presented in the Pre-Application Document into the Updated Study Report for the Sedimentation Study."
  - Added 2 more years of data
- conduct an aggradation/degradation analysis using Genoa gage data
- "use the Kendall tau test to assess trends in the aggradation/degradation data"

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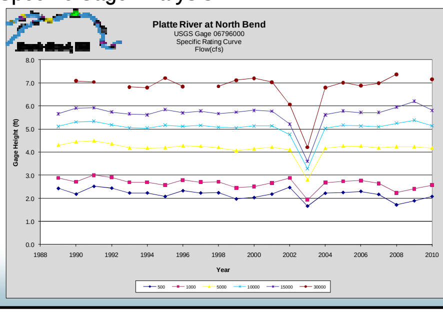
1. Sedimentation

Specific Gage Analysis



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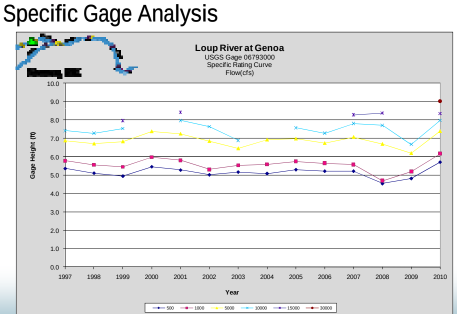
1. Sedimentation

Specific Gage Analysis



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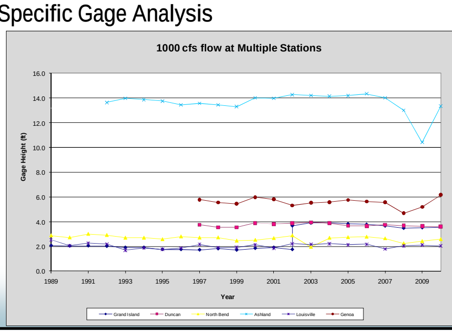
1. Sedimentation

Specific Gage Analysis



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1. Sedimentation

Summary of Kendall Tau results

- No trend at Genoa, Duncan, Ashland
- Trend for a low flow rate at North Bend
- Trend for the highest flow rate at Louisville
- Overall, no aggradational or degradational trends

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1. Sedimentation

Objective

3. To determine if a relationship can be detected between sediment transport parameters and interior least tern and piping plover nest counts (as provided by the Nebraska Game and Parks Commission [NGPC]) and productivity measures.

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1. Sedimentation

Initial Study Results

- Nest Count Data
  - Best available data (1983 - 2009)
  - Scarcity of fledge ratio data
  - Accuracy of adult counts for riverine habitat nesting and breeding

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1. Sedimentation

Initial Study Results (Cont.)

- Coarse Geographic Scale
  - Analysis by hydrologic river segment (gage Locations)
    - Tailrace Return to North Bend
    - North Bend to Leshara
    - Leshara to Ashland
    - Ashland to Louisville
    - Louisville to confluence with Missouri River
- Linear Regression on 14 Hydrologic Variables
- No evidence from this analysis that suggested a potential relationship between nest counts and sediment transport parameters

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1. Sedimentation

Supplemental Analysis

Hydrologic Data Correlation Analysis

- Collinearity analysis
- Normality assessment
- Factor analysis
- Remaining variables for analysis:
  - River Mile
  - Year
  - Adult tern counts
  - Peak Mean Daily Flow (PMDF)
  - Wetted Width
  - Annual Percent Diverted Flow (APDF)

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1. Sedimentation

Agency Coordination

- Bird Nesting Data
  - Collection methods
  - Analysis of interior least tern nest data
  - Nesting populations
  - Colonial nesting
  - Use of NGPC data

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1. Sedimentation

Agency Coordination

- Refined spatial scale
  - By river mile
  - Limited to area immediately downstream of Tailrace
- Analyses
  - Presence/absence
  - Log transformed nest counts for normalization
  - Logistic regression
  - ANOVA

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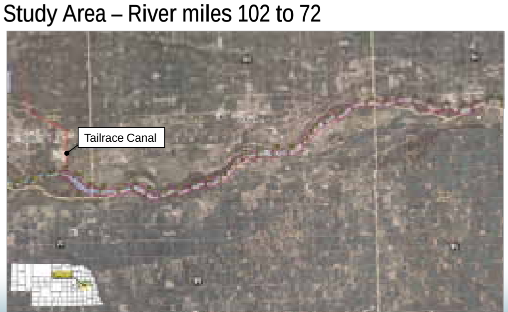
1. Sedimentation

Study Area – River miles 102 to 72



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1. Sedimentation

Analysis of Nest Counts in Relation to Data Collection Visits

- All River Miles (106 to 0)
- On-river data only
- Slight correlation (r^2=4%) between number of visits and number of nests counted.
- Correlation is reduced to r^2=2% when adult counts are included in the analysis
- Number of nests counted is strongly correlated with adult counts
- Number of data collection visits does not significantly affect nest counts

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1. Sedimentation

Analysis of Nest Counts in Relation to Distance from the Tailrace Return

- Analysis of 1987 through 2010
- Analysis of RMs 102 to 72
- Identified post-1995 nest counts as significantly lower than pre-1995 counts
  - t-Test (parametric)
  - Kendall's Tau (non-parametric)

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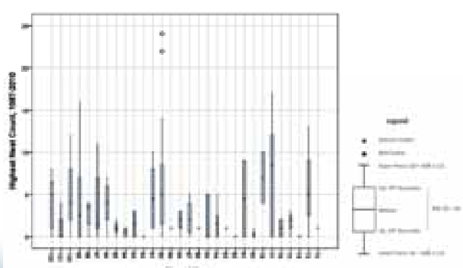
1. Sedimentation

Highest Nest Count by River Mile – RMs 102 to 72



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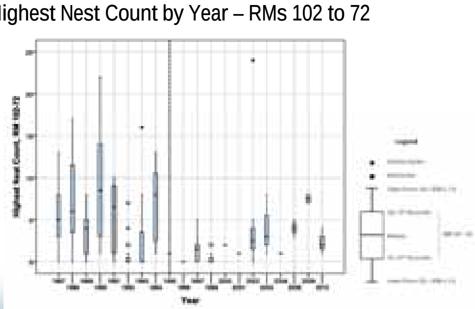
1. Sedimentation

Highest Nest Count by Year – RMs 102 to 72



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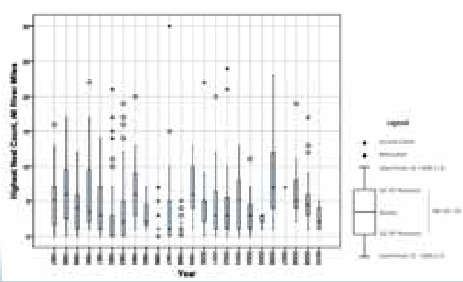
1. Sedimentation

Analysis of Nest Counts in Relation to Distance from the Tailrace Return

- Analysis of 1987 through 2010
- Additional analysis of RMs 106 to 0 and 71 to 0
- On- and off-river data

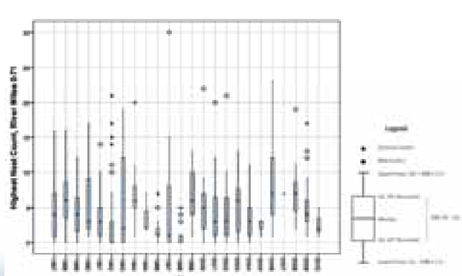
1. Sedimentation

Highest Nest Count by Year – RMs 106 to 0



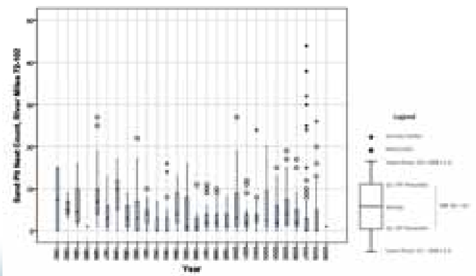
1. Sedimentation

Highest Nest Count by Year – RMs 71 to 0



1. Sedimentation

Highest Nest Count by Year – Sand pits RMs 102 to 72



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1. Sedimentation

Analysis of Nest Counts in Relation to Distance from the Tailrace Return

- Additional analysis of RMs 102 to 72, 106 to 0, 71 to 0
- On- and off-river data
- Post-1995 nest counts as significantly lower than pre-1995 counts
  - RM 102 to 72 only
- Project operations unchanged from 1987 to 2010

74

1. Sedimentation

Analysis of Nest Counts in Relation to Distance from the Tailrace Return

- Binary Logistic Regression
  - Reduced nest count data to presence/absence variable
  - Simplified large amount of data; eliminated magnitude associated with nest counts
  - No relationship detected between nest presence and distance from the Tailrace

75

1. Sedimentation

Analysis of Nest Counts in Relation to Distance from the Tailrace Return

- Multiple Regression – log transformed nest counts as dependent variable
  - High association with adult tern counts
  - No association with other variables (PMDF, RM, year)
  - Slight association with annual percent diverted flow
    - Association determined spurious upon further analysis

76

1. Sedimentation

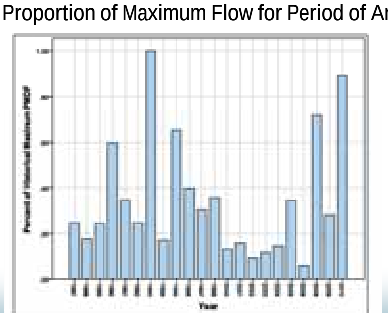
Analysis of Nest Counts in Relation to Annual Change in Peak Mean Daily Flow (PMDF)

- One-way ANOVA
  - River Miles 102 to 72 only
  - Change in flow between years is significant
  - Change in flow between river miles is not significant
  - High flow years followed by low flow years appear to produce more nests
    - Data is inconsistent

77

1. Sedimentation

Yearly Proportion of Maximum Flow for Period of Analysis

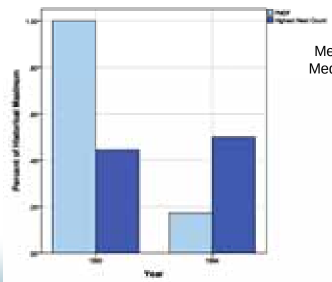


78

1. Sedimentation

Standardized PMDF and Nest Count Sums – 1993 and 1994

1993
Mean = 2.76
Median = 1.0



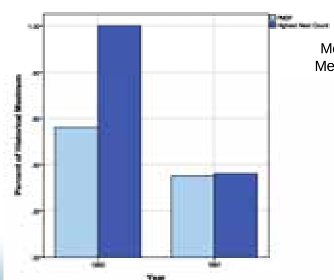
1994
Mean = 7.9
Median = 8.5

79

1. Sedimentation

Standardized PMDF and Nest Count Sums – 1990 and 1991

1990
Mean = 11.4
Median = 5.0



1991
Mean = 6.1
Median = 8.0

80

1. Sedimentation

Conclusions

- Nest counts weakly associated with number of data collection visits per year
- Nest counts strongly associated with number of adult terns
- No measurable relationship between nest counts and distance from tailrace
- No measurable relationship between presence of nest counts and distance from tailrace, year, PMDF, percent diverted
- Potential relationship identified between nest counts and low flow years preceded by high flow years
- No significant changes in flow between river miles in a given year

81

QUESTIONS?

82

2. Hydrocycling

83

2. Hydrocycling

Goal

- Determine if Project hydrocycling operations benefit or adversely affect the habitat used by interior least terns, piping plovers, and pallid sturgeon in the lower Platte River.

84

2. Hydrocycling

Objectives

1. To compare the sub-daily Project hydrocycling operation values (maximum and minimum flow and stage) to daily values (mean flow and stage). In addition to same-day comparisons, periods of weeks, months, and specific seasons of interest to protected species will be evaluated to characterize the relative degrees of variance between hydrocycling (current operations) and run-of-river operations in the study area.
2. To determine the potential for nest inundation due to both hydrocycling (current operations) and run-of-river operations.

85

2. Hydrocycling

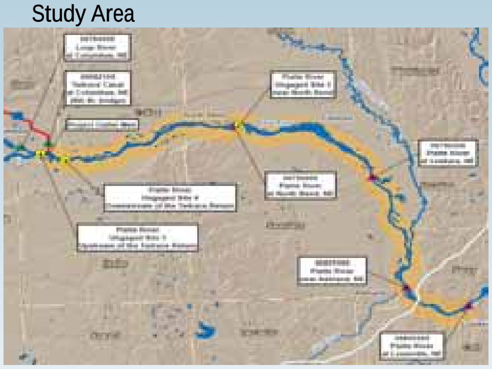
Objectives (continued)

3. To assess effects, if any, of hydrocycling (current operations) on sediment transport parameters
4. To identify material differences in potential effects on habitat of the interior least tern, piping plover, and pallid sturgeon.

86

2. Hydrocycling

Study Area



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2. Hydrocycling

Previous Analyses:

- Sediment Transport Indicators current operations vs. run of river
  - Total sediment transport
  - Effective discharge
  - Dominant discharge

2. Hydrocycling

Previous Analyses:

- Sediment Transport Indicator Results for Hydrocycling Analysis, 2009 (Normal)

Location on the Platte River	Current Operations						Run-of-River Operations (Sub-daily)		
	Daily			Sub-daily					
	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)
Site 3 – Upstream of the Tailrace Return	2,700	2,100	1,100	2,600	2,400	**1,100**	2,600	2,400	**1,100**
Site 4 – Downstream of the Tailrace Return	4,800	4,900	2,970	4,700	5,600	**2,950**	4,600	4,800	**2,840**
USGS gage at North Bend	4,400	3,900	2,050	4,700	4,500	**2,200**	4,700	4,500	**2,210**
Site 5 – Near North Bend	4,000	4,200	2,140	4,200	4,500	**2,300**	4,200	4,400	**2,310**

2. Hydrocycling

Previous Analyses:

- Sediment Transport Indicator Results for Hydrocycling Analysis, 2008 (Wet)

Location on the Platte River	Current Operations						Run-of-River Operations (Sub-daily)		
	Daily			Sub-daily					
	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)
Site 3 – Upstream of the Tailrace Return	4,000	2,100	2,260	4,100	3,000	**2,270**	4,100	3,000	**2,270**
Site 4 – Downstream of the Tailrace Return	5,600	4,100	4,100	5,900	4,400	**4,310**	5,700	4,700	**4,120**
USGS gage at North Bend	5,900	3,900	3,430	6,000	4,400	**3,610**	6,000	3,300	**3,570**
Site 5 – Near North Bend	5,300	3,900	3,540	5,400	4,400	**3,490**	5,400	3,300	**3,500**

2. Hydrocycling

Previous Analyses:

- Sediment Transport Indicator Results for Hydrocycling Analysis, 2006 (Dry)

Location on the Platte River	Current Operations						Run-of-River Operations (Sub-daily)		
	Daily			Sub-daily					
	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)	Q_d (cfs)	Q_e (cfs)	Sediment Capacity (1,000 tons)
Site 3 – Upstream of the Tailrace Return	1,300	1,500	430	1,30	1,400	**445**	1,300	1,400	**445**
Site 4 – Downstream of the Tailrace Return	2,700	3,100	1,490	2,800	4,100	**1,570**	2,700	3,000	**1,500**
USGS gage at North Bend	2,700	3,000	1,020	2,900	3,600	**1,110**	2,900	2,900	**1,100**
Site 5 – Near North Bend	2,500	2,900	1,240	2,600	3,600	**1,300**	2,700	2,900	**1,320**

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2. Hydrocycling

FERC's request

- HEC-RAS predicts whether there would be aggradation or degredation for various project operations.
- Evaluate relative effects of project operations on:
  - Sediment transport
  - Channel geometry
  - Water surface
- Use HEC-RAS for sediment transport analysis

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2. Hydrocycling

Sediment Transport with HEC-RAS

- HEC-RAS Hydraulic Reference Manual
  - "The data utilized to predict bed change is fundamentally uncertain and the theory employed is empirical and highly sensitive to a wide array of physical variables. However, with good data, a skilled modeler can utilize a calibrated sediment model to predict regional, long term trends that can inform planning decisions and can be used to evaluate project alternatives."

93

2. Hydrocycling

Model Development

- Model sources
  - Loup River - USACE Ice Study
  - Platte River – USACE FIS
  - Platte River – Sites for Relicensing Project.

94

2. Hydrocycling

Model Development

- Model considerations\constraints
  - Cross section spacing
  - Simulation
    - Warm up time – computational stability
    - Long term simulation – calibrate long term trends
- Two models were developed
  - Sites 3 and 4
  - Site 5

95

2. Hydrocycling

Model Development

- Model considerations\constraints
  - Hydrology
    - Three year warm up period using Qe
    - Long term trend 1990 to 2005
    - Current operations or Run of River
      - Dry (2006)
      - Wet (2008)
      - Normal (2009)
  - Boundary conditions
  - Calibration

96

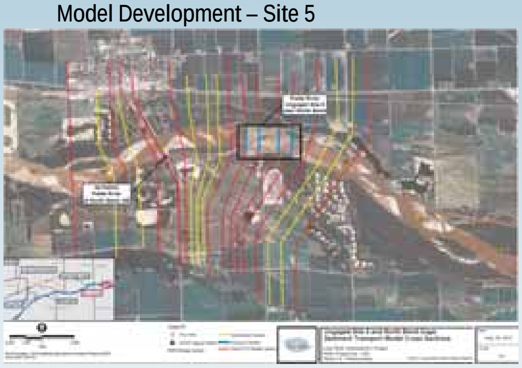
2. Hydrocycling

Model Development – Sites 3 and 4

97

2. Hydrocycling

Model Development – Site 5



98

2. Hydrocycling

Model Development

- Sediment transport
  - Bed gradation
  - Transport Method – Yang's Unit Stream Power
  - Computed Hydraulics

99

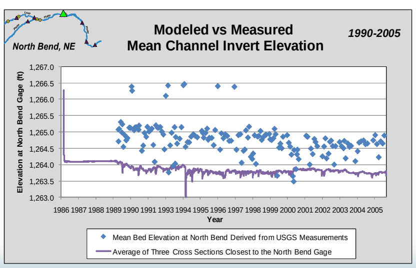
2. Hydrocycling

Model Development

- Calibration
  - Site 5 model included North Bend gage
  - Modeled long term gage trend vs. mean channel invert elevation trend.
  - Measured sediment gradation vs. modeled and 2010 measured gradation
  - Modeled transport rate vs. measured suspended sediment

2. Hydrocycling

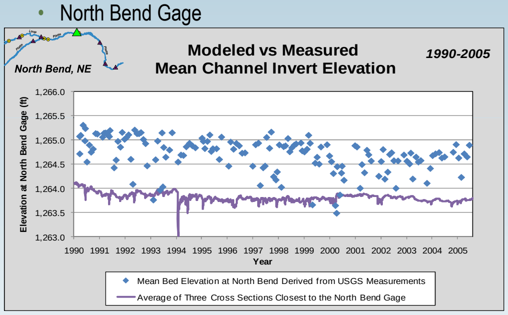
Model Development



2. Hydrocycling

Model Results

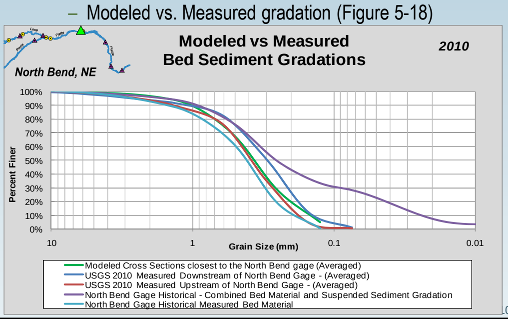
- North Bend Gage



2. Hydrocycling

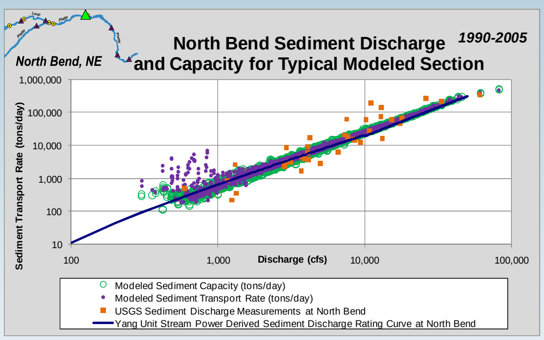
Model Results

- North Bend Gage
  - Modeled vs. Measured gradation (Figure 5-18)



103

2. Hydrocycling



104

2. Hydrocycling

Model Development – Validation

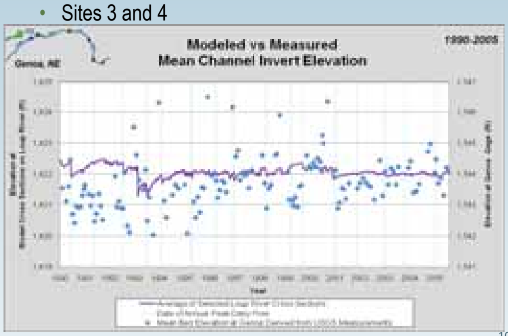
- Qualitative analysis for model performance at Sites 3, 4, and 5
  - Loup at Genoa and Platte at Duncan stage trend
  - Loup and Platte River Modeled vs. Measured gradation upstream of confluence
  - Loup and Platte River Modeled Transport vs. Measured
  - Long Term Trend and Channel response to high flows
  - Compare modeled versus surveyed trend
  - Modeled vs. 2010 measured gradation

105

2. Hydrocycling

Model Results

- Sites 3 and 4



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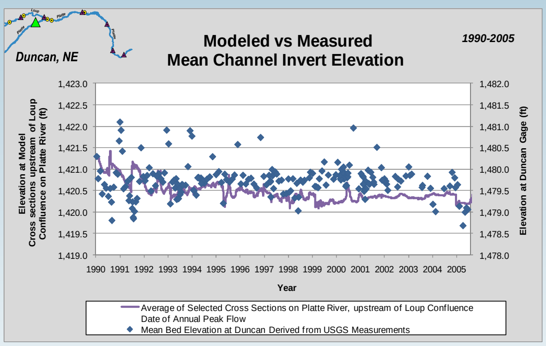
2. Hydrocycling



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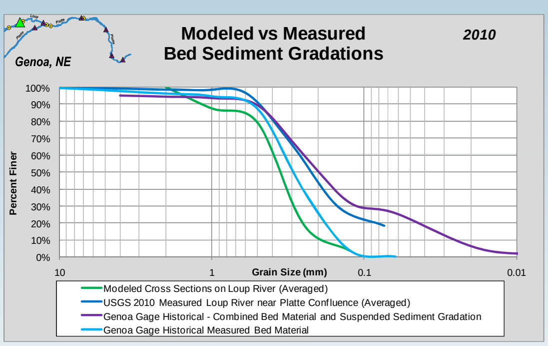
2. Hydrocycling



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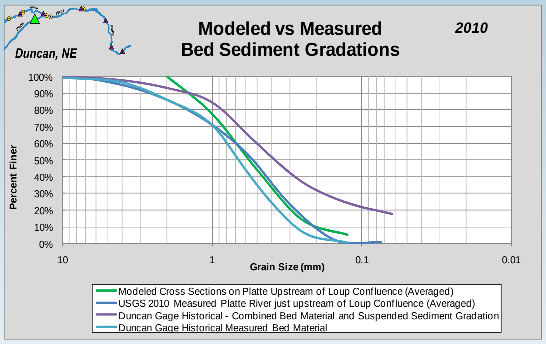

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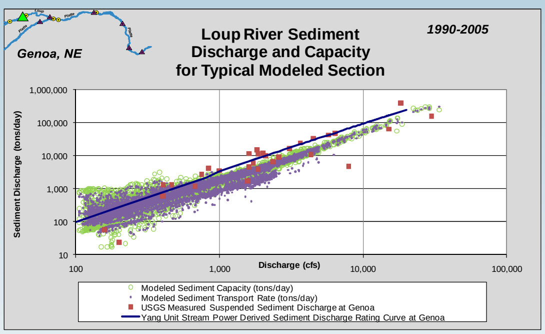
2. Hydrocycling



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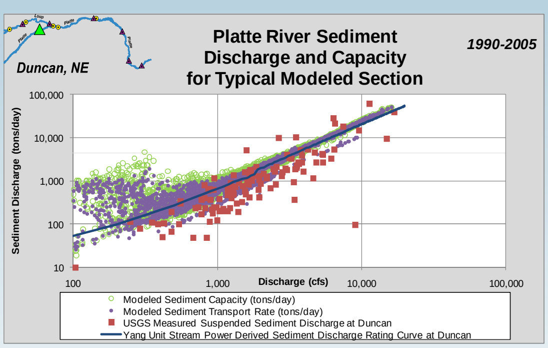
2. Hydrocycling



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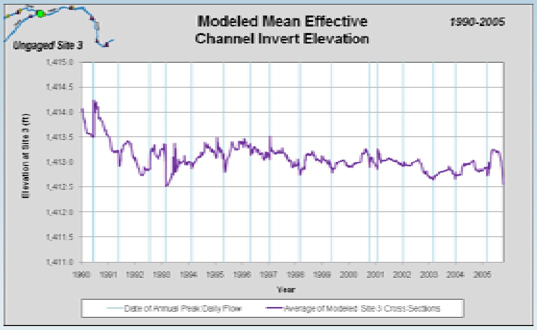
2. Hydrocycling



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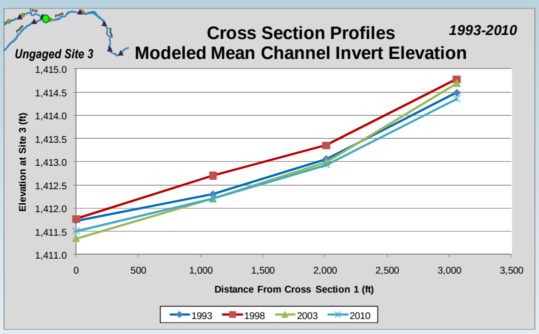
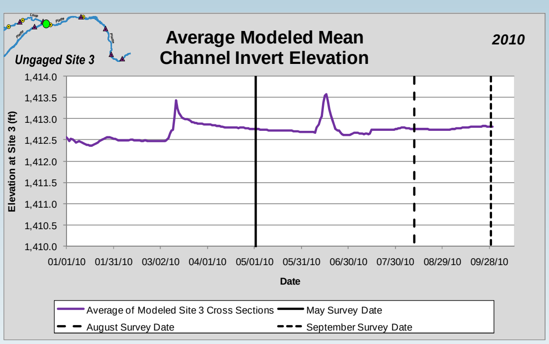
2. Hydrocycling



113

2. Hydrocycling



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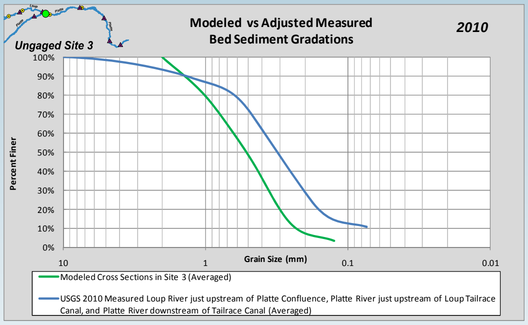
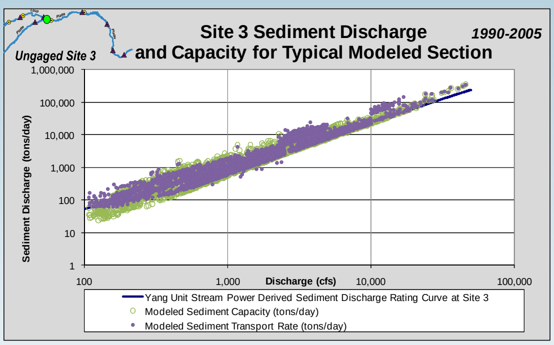
2. Hydrocycling



115

2. Hydrocycling



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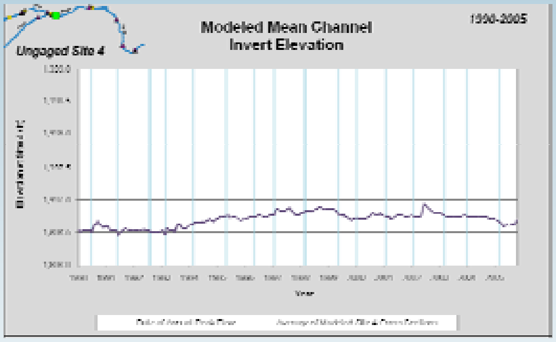
2. Hydrocycling

Sites 3 – Summary

- Long term trend and channel response to high flows
- Modeled versus surveyed trend
- Modeled vs. 2010 measured gradation
- Modeled vs. Computed Sediment Transport Capacity

117

2. Hydrocycling



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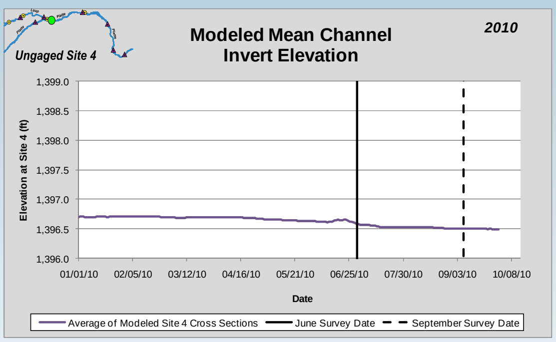
2. Hydrocycling

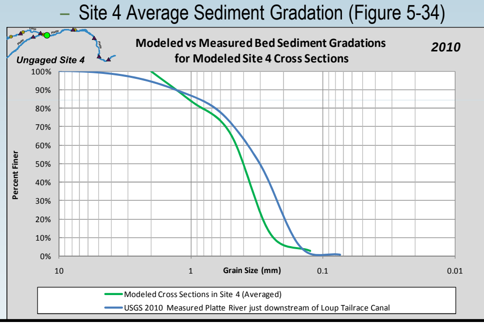


119

2. Hydrocycling

Model Results

- Sites 3 and 4
  - Site 4 Average Sediment Gradation (Figure 5-34)



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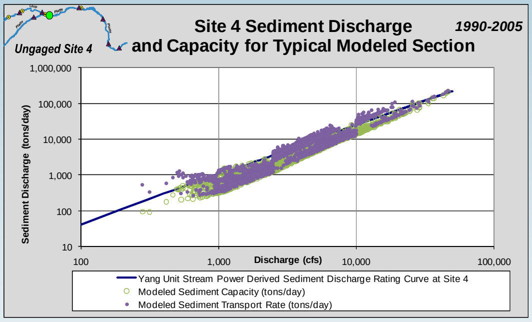
2. Hydrocycling



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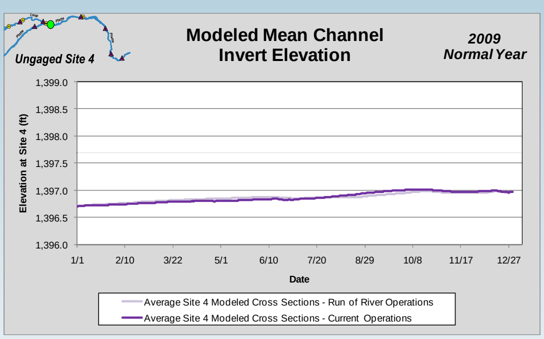
2. Hydrocycling

Sites 4 – Summary

- Long term trend and channel response to high flows
- Modeled versus surveyed trend
- Modeled vs. 2010 measured gradation
- Modeled vs. Computed Sediment Transport Capacity

122

2. Hydrocycling



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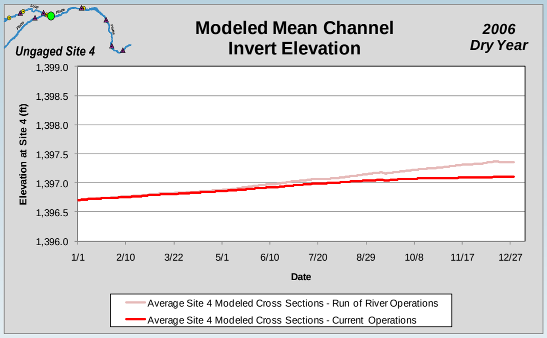
2. Hydrocycling



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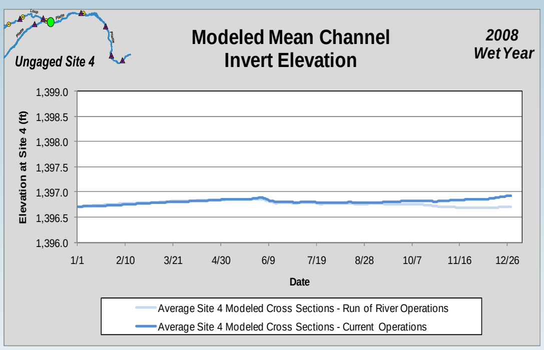
2. Hydrocycling



125

2. Hydrocycling

Site 4 – Current Operations vs. Run of River Trend

- Transport rate at capacity in all cases
- Normal Year – no change in sediment transport
- Dry Year – decrease in transport for the run of river condition as compared to current operations
- Wet Year - increase in transport for the run of river condition as compared to current operations
- Prior analysis showed a decrease in transport rate for run of river vs. current operations in all three cases.

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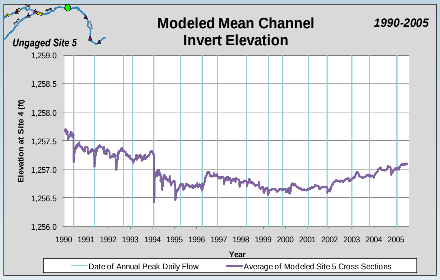
2. Hydrocycling

Model Results

- Site 5



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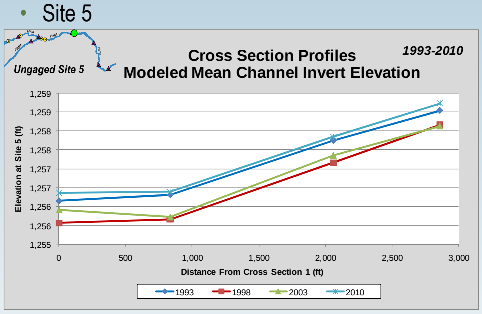
2. Hydrocycling

Model Results

- Site 5



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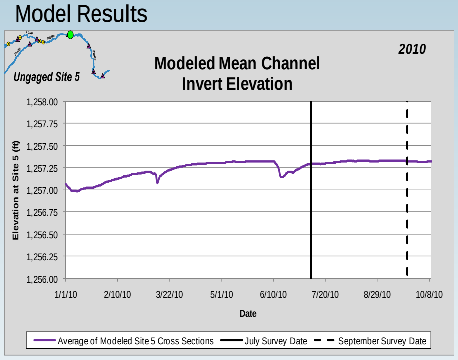
2. Hydrocycling

Model Results



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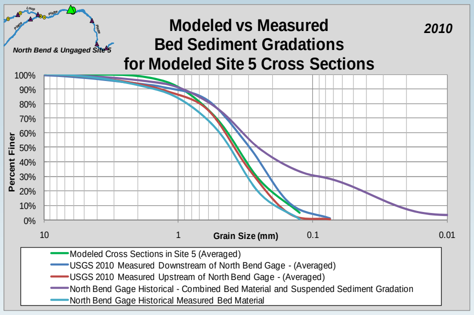
2. Hydrocycling

Model Results



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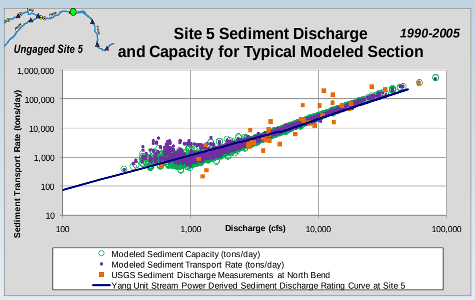
2. Hydrocycling

Model Results



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2. Hydrocycling

Sites 5 – Summary

- Long term trend and channel response to high flows
- Modeled versus surveyed trend
- Modeled vs. 2010 measured gradation
- Modeled vs. Computed Sediment Transport Capacity

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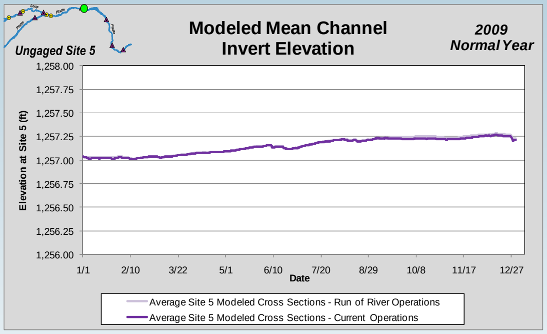
2. Hydrocycling



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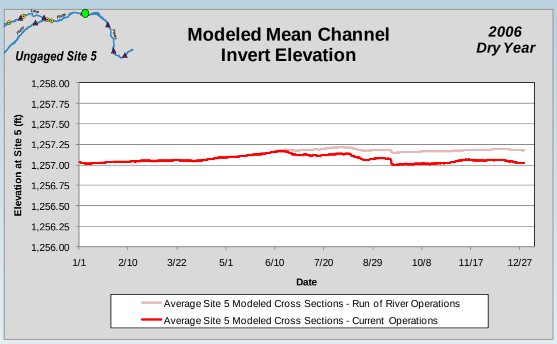
2. Hydrocycling



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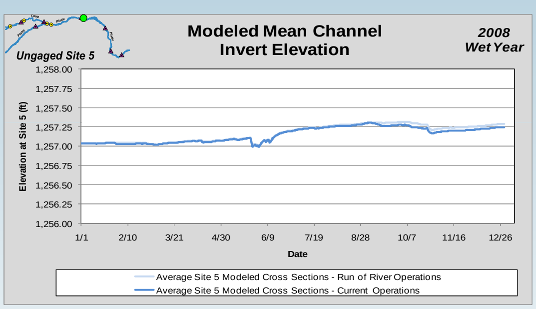
2. Hydrocycling

Model Results



135

2. Hydrocycling

Site 5 – Current Operations vs. Run of River Trend

- Transport rate at capacity in all cases
- Normal, Dry, and Wet Year - decrease in transport for the run of river condition as compared to current operations
- Prior analysis showed a decrease in transport rate for run of river vs. current operations in all three cases.

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2. Hydrocycling

Model Conclusions

- Reaches are stable – consistent with prior findings – dynamic equilibrium
- Modeled Sediment Transport Rate Matched previous sediment discharge rating curve
- Transport rate at capacity in all cases – not supply limited.

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2. Hydrocycling

Considerations

- Model can be unstable. Great care must be taken when making simulations. Modifying and executing between 32-bit and 64-bit machines can produce different results. In addition, modifying the plan or quasi unsteady flow file on different computers would at times produce differing results. Finally, differing end of simulation dates can produce different results.

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QUESTIONS?

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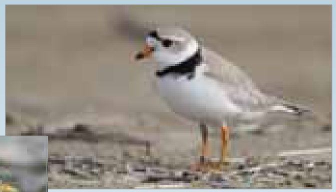
Species Summary: Interior Least Terns & Piping Plovers



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Species Summary: Interior Least Terns & Piping Plovers

- Discussion at Second Initial Study Results Meeting
- Summary that combined studies
- Focus on potential for impact

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Species Summary: Interior Least Terns & Piping Plovers

Interior Least Terns

- Winter in South America
- Arrive in Nebraska in early May to mid-June
- Spend approximately 4 to 5 months at breeding sites
- Breeding range extends from Montana to Texas and from southern Indiana to New Mexico
- Lott Census (November 2006)
  - Lower Mississippi River system – 62.3 percent
  - Arkansas River system – 11.6 percent
  - Red River system – 10.4 percent
  - Missouri River system – 6.9 percent
  - Platte River system – 4.4 percent

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Species Summary: Interior Least Terns & Piping Plovers

Piping Plovers

- Winter in southern Atlantic coast in the U.S., the Gulf of Mexico coast in the U.S. and Mexico, and the Caribbean islands
- Arrive in Nebraska in late April and early May
- Spend approximately 3 to 4 months at breeding sites

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Species Summary: Interior Least Terns & Piping Plovers

Piping Plovers (cont.)

- Breeding range includes the Northern Great Plains from Alberta to Manitoba and south to Nebraska; the Great Lakes beaches; and Atlantic coastal beaches from Newfoundland to North Carolina
- International Piping Plover Breeding Census (2006) indicated that over half of these birds were found in the U.S. and Canada Northern Great Plains and Prairie Canada regions (Elliott-Smith et al., 2009).

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Species Summary: Interior Least Terns & Piping Plovers

Interior Least Tern and Piping Plover Habitat in Nebraska

- Nest on barren sand and gravel shores and islands of rivers and lakes
- Size and height of sandbars
  - Terns
    - 3.58 acres and 2.99 feet above water (Kirsch, 1996)
    - 12.18 acres (average) and 2.29 (Brown and Jorgenson, 2008)
  - Piping Plover
    - 3.89 acres and 0.66 feet above water (Faanes, 1983)
    - 3.58 acres and 1.48 (Ziewtiz, 1992)
- Sandpits also highly used habitat, including the District's North Sand Management Area

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Species Summary: Interior Least Terns & Piping Plovers

Least Tern and Piping Plovers Threats in Nebraska

- Least Tern (USFWS, September 1990)
  - Habitat alteration and destruction – specifically along the Missouri, Arkansas, and Red river systems, due to flow regulation
  - Human disturbance – specifically due to recreational and commercial development activity
- Piping Plover (USFWS, September 2009)
  - Destruction of wintering habitat due to human development
  - Reservoirs, channelization of rivers, and flow modification
  - Predation
  - Human disturbance, specifically due to recreational activity
  - Vegetation encroachment

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Species Summary: Interior Least Terns & Piping Plovers

Review of Agency Concerns:

- Habitat may decrease in suitability due to material changes in the Loup and lower Platter rivers' sediment transport regime.
- Habitat diversity, connectivity, and suitability may be diminished in the lower Platte River due to erosion of sandbars by Project hydrocycling operations.
- Project hydrocycling operations may cause inundation of interior least tern and piping plover nests on the lower Platte River.
- Habitat connectivity and suitability may be diminished in the Loup River bypass reach due to diversion of flows.

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Species Summary: Interior Least Terns & Piping Plovers

Review of Study Results

- Sedimentation
  - Loup River bypass reach and lower Platte River are not supply limited
  - Dynamic Equilibrium – not aggrading or degrading
  - Braided Morphology
  - No statistical relationship between nest count variability and river mile location

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Species Summary: Interior Least Terns & Piping Plovers

Review of Study Results

- Hydrocycling
  - Project hydrocycling operations result in higher flows and stage on a daily basis than a run-of-river scenario; natural seasonal variability is equal to or greater than hydrocycling effects
  - The differences in flow (and stage) between current operations and run-of-river operations diminish with increased flow
  - Exceedances of the benchmark flows are a result of natural high flow events. All benchmark exceedances under current operations were due to high flow events that also caused benchmark exceedances under run-of-river operations
  - Hydrocycling operations results in slightly more sediment transport than run-of-river operations; however, system is transporting at capacity and degradation does not occur

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Species Summary: Interior Least Terns & Piping Plovers

Review of Study Results

- Flow Depletion and Flow Diversion
  - Platte River – No depletions
  - Loup River
    - There is a difference in physical characteristics of the channel above and below the Diversion Weir on the Loup River.
    - Not enough bird use data on the Loup River (above or below the Diversion Weir) to ascertain that these differences in physical characteristics impact use by interior least terns or piping plovers

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Species Summary: Interior Least Terns & Piping Plovers

Collective Analysis

- Sandbar formation
  - System is not-supply limited
  - Sediment removal from canal does not limit sediment supply for potential sandbar creation
  - Sediment removal does not create a sediment deficit that would erode sandbars at a rate faster than normal

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Species Summary: Interior Least Terns & Piping Plovers

Collective Analysis

- Sandbar formation (cont.)
  - System in a state of dynamic equilibrium indicates that channel morphology, that is a braided channel, exists under current operations and has shown to provide tern and plover habitat
  - As a result of a not-supply limited system and a system seated in a braided river system, effects of hydrocycling was not shown to effect sediment supply available for sandbar creation

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Species Summary: Interior Least Terns & Piping Plovers

Collective Analysis

- Suitable Habitat Availability
  - Nest distribution variability not related to proximity to Tailrace Return; appears that Tailrace is not a factor for nest site selection
  - A period of relatively high nest counts from 1987 to 1995 was followed by a period of lower but also static nest counts from 1995 to 2008 between RM 102 and RM 72; Project operations have remained the same during this period.

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Species Summary: Interior Least Terns & Piping Plovers

Collective Analysis

- Suitable Habitat Availability (cont.)
  - Daily fluctuations in stage due to hydrocycling affect the wetted fringe of sandbars that serve as habitat. This effect is greatest when upstream Platte River flows are the lowest. This effect is expected to be the most evident nearest the Tailrace return. However, location to the Tailrace return was not a factor in explaining nest count variability.
  - Many factors in determining suitable habitat on a year-to-year basis (flows, predation, recreational disturbance, nesting success)

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Species Summary: Interior Least Terns & Piping Plovers

Collective Analysis

- Loup River Physical Characteristics
  - Differences in channel widths above and below the Diversion Weir (wider above and narrower below).
  - Project operational changes are limited with respect to altering physical parameters
  - No morphological changes in last 25 years
  - No change in morphology is expected

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QUESTIONS?

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Next Steps

18CFR5.15

- September 23, 2011
  - District submits meeting summary
- October 24, 2011
  - Agencies file meeting summary disagreements and submit requests for study modifications
- November 23, 2011
  - District responds to summary comments and study modification requests
- December 23, 2011
  - FERC resolves comments and study modification requests
- November 18, 2011
  - District files Draft License Application
- April 16, 2012
  - District Files License Application

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Next Steps

Section 7 Consultation

- November 18, 2011
  - District Submits Draft Biological Assessment with Draft License Application
- February 16, 2012
  - Agency Comments on Draft BA / Draft License Application Due
- April 16, 2012
  - District Submits Biological Assessment with License Application

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Next Steps

Section 7 Consultation

- ~July 1, 2012
  - Application Accepted and Ready for Environmental Analysis (REA)
- 60 days after REA
  - Comments, Recommendations and Preliminary Terms and Conditions or Preliminary Fishway Prescriptions Due
- ~May 2013
  - FERC issues Environmental Assessment
- 135 days after EA issued
  - Biological Opinion Due

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Thank You for Your Attendance
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