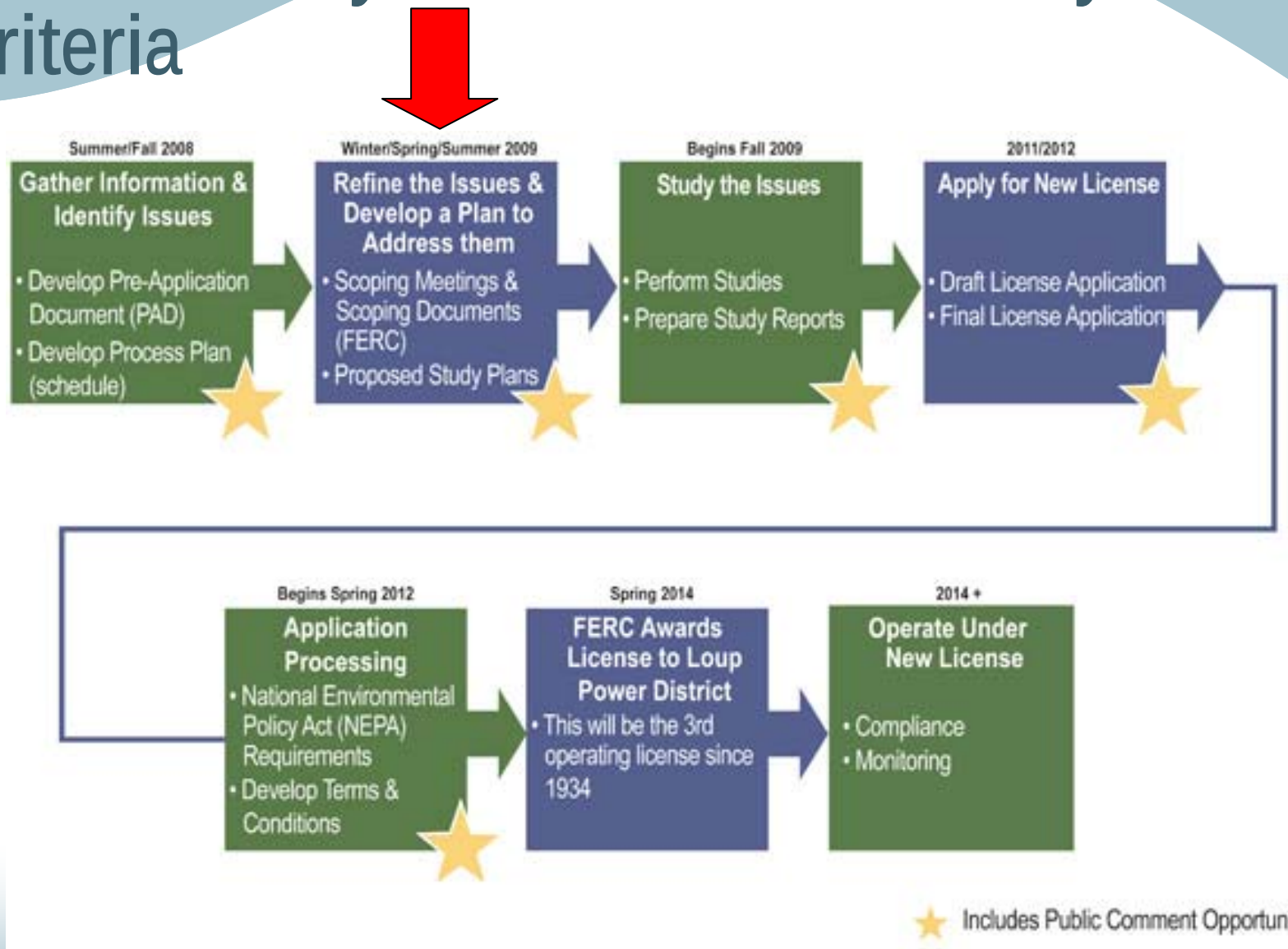
The Loup River Hydroelectric Project

Study Plan Discussion

April 21, 2009

Loup Power District
Hydro Project

Review Study Plan Process & Study Criteria



FERC Study Request Criteria

1. Goals & Objectives of Study
2. Relevant Resource Management Goals, or
3. Relevant Public Interest
4. Background & Existing Information
5. Project Nexus
6. Proposed Methodology
7. Level of Effort and Cost

18CFR §5.9

Key Dates Per Scoping Document 2

- April to July – Refine studies & seek consensus
- June 25 – Comments due on Proposed Study Plan
- July 27 – District's Revised Study Plan due
- August 26 – FERC Study Plan Determination
- September 15 - Dispute Filing Deadline (18CFR §5.14)

Study Plan Collaboration

- Goals of Today's Meeting:
  - Provide an overview of the entire Proposed Study Plan
  - Seek consensus on the goals and objectives of proposed studies related to aquatic resources

Planned Activities

- May 5: Cultural Resources; Study 11
- May 11: Recreational Resources; Studies 8, 9, 10
- May 27-28: Continued Discussion as needed; Studies 1-12
- July 1: Additional discussion as needed
- Others as necessary

Study Plan Overview

- Purpose of the Study Plan:
  - Identify studies needed to provide information for evaluation of a new project license relative to NEPA and ESA evaluations

Study Plans

1. Sedimentation
2. Hydrocycling
3. Water Temperature in the Platte River
4. Water Temperature in the Loup River Bypass Reach
5. Flow Depletion and Flow Diversion
6. Fish Sampling
7. Fish Passage
8. Recreation User Survey
9. Creel Survey
10. Land Use Inventory
11. Section 106 Compliance
12. Ice Jam Flooding on the Loup River

1. Sedimentation

Goal

- Determine effect, if any, Project operations have on stream morphology and sediment transport as it relates to listed T&E species in the bypass reach and in the lower Platte River.

1. Sedimentation

Objectives

- Characterize stream morphology and determine sediment transport parameters in the bypass reach and the lower Platte River.
- Determine if a relationship can be detected between sediment transport parameters and tern and plover census data.
- Evaluate whether availability of sandbar is limiting tern and plover populations in the lower Platte River.
- Determine if sediment transport is a limiting factor for pallid sturgeon habitat in the lower Platte River below the Elkhorn River.
- Determine if Project operations affect sediment transport, and if so does that influence ice jam flooding in the bypass reach.

1. Sedimentation

Objective

- Characterize stream morphology and determine sediment transport parameters in the bypass reach and the lower Platte River.

Associated Activities

- Update sediment budget utilizing existing data sources.
- Generate collective sediment discharge curves at gage stations.
- Review and utilize USGS stream morphology literature.

1. Sedimentation

Objective

- Determine if a relationship can be detected between sediment transport parameters and tern and plover census data.

Associated Activities

- Plot and evaluate tern and plover census data against sediment transport parameters.

1. Sedimentation

Objective

- Evaluate whether availability of sandbar is limiting tern and plover populations in the lower Platte River.

Associated Activities

- Compare tern and plover census data and available habitat in lower Platte River to the same parameters in the Missouri River downstream of Gavins Point Dam.

1. Sedimentation

Objective

- Determine if sediment transport is a limiting factor for pallid sturgeon habitat in the lower Platte River below the Elkhorn River.

Associated Activities

- Compare pallid sturgeon habitat characteristics of the Upper Missouri and Yellowstone Rivers to those of the lower Platte River below the confluence with the Elkhorn River.

1. Sedimentation

Objective

- Determine if Project operations affect sediment transport, and if so does that influence ice jam flooding in the bypass reach.

Associated Activities

- Research a potential link between sediment and frazil ice transport.

2. Hydrocycling

Goal

- Determine effect, if any, Project hydrocycling operations have on habitat used by listed T&E species in the lower Platte River.

2. Hydrocycling

Objectives

- Characterize the relative degrees of variance (flow and stage) between hydrocycling and alternative conditions.
- Determine effect, if any, Project hydrocycling operations have on the potential for nest inundation.
- Determine effect, if any, Project hydrocycling operations have on sediment transport parameters.
- Determine effect, if any, Project hydrocycling operations have on pallid sturgeon and associated habitat.

2. Hydrocycling

Objective

- Characterize the relative degrees of variance (flow and stage) between hydrocycling and alternative conditions.

Associated Activities

- Collect flow and stage data and determine the timing, frequency, rate of change, travel time, and magnitude of sub-daily flow and stage changes.
- Develop and plot hydrographs for the project and alternative conditions.

2. Hydrocycling

Objective

- Determine effect, if any, Project hydrocycling operations have on the potential for nest inundation.

Associated Activities

- Identify benchmark events for least tern and piping plover nesting season (highest river stage from May 1 to May 21).
- Tabulate and characterize flow events occurring from May 22 to August 1 that are greater than benchmark events.

2. Hydrocycling

Objective

- Determine effect, if any, Project hydrocycling operations have on sediment transport parameters.

Associated Activities

- Determine sediment transport parameters for project and alternative condition sub-daily hydrographs.

2. Hydrocycling

Objective

- Determine effect, if any, Project hydrocycling operations have on pallid sturgeon and associated habitat.

Associated Activities

- Compare Project river stage variations with flow and stage variations of the every-third-day cycling on the Missouri River below Gavins Point Dam to analyze potential effects of hydrocycling on tern and plover nests and pallid sturgeon habitat.

3. Water Temperature in the Platte River

Goal

- Determine if Project operations materially affect water temperature in the pallid sturgeon associated habitat reach of the lower Platte River.

3. Water Temperature in the Platte River

Objective

- Determine if water temperatures at the Louisville gage are consistent with water temperatures at the Elkhorn River and Salt Creek gages.

Associated Activities

- Collect existing USGS temperature and flow data.
- Plot data series (March-June) against time to discern differences in time series trends.
  - Ambient air temperature at Mead, NE weather station
  - Salt Creek water temperature at USGS gage near Ashland, NE
  - Elkhorn River water temperature at USGS gage at Waterloo, NE
  - Platte River water temperature at USGS gage at Louisville, NE

4. Water Temperature in the Loup River Bypass Reach

Goal

- Determine effect, if any, Project operations have on water temperature in the Loup River bypass reach.

4. Water Temperature in the Loup River Bypass Reach

Objectives

- Determine water temperature at the Diversion Weir and in the bypass reach upstream of Beaver Creek.
- Establish a relationship between water temperature, flow, and air temperature in the bypass reach upstream of Beaver Creek.

4. Water Temperature in the Loup River Bypass Reach

Objective

- Determine water temperature at the Diversion Weir and in the bypass reach upstream of Beaver Creek.

Associated Activities

- Coordinate with USGS to install temperature sensors.

4. Water Temperature in the Loup River Bypass Reach

Objective

- Establish a relationship between water temperature, flow, and air temperature in the bypass reach upstream of Beaver Creek.

Associated Activities

- Collect flow and temperature data (water and air).
- Estimate the following relationships at the Diversion Weir and at Genoa:
  - Water temperature
  - Water temperature and flow
  - Water temperature and air temperature
  - Water temperature, flow, and air temperature

5. Flow Depletion and Flow Diversion

Goal

- Determine if Project operations result in a flow depletion on the lower Platte River and to what extent, if any, Project operations affect the flow characteristics in the bypass reach as it relates to listed T&E species.

5. Flow Depletion and Flow Diversion

Objectives

- Determine the net consumptive losses for Project operations and alternative conditions.
- Quantify change in stage in the Loup River bypass reach for Project operations and compare against alternative hydrographs.
- Evaluate Project influence on historic flow trends on the Loup and Platte Rivers.
- Determine the Project's influence on tern and plover nesting on the Loup River above and below the Diversion Weir.
- Determine the relative significance of the Loup River bypass reach to the overall fishery habitat of the Loup River.

5. Flow Depletion and Flow Diversion

Objective

- Determine the net consumptive losses for Project operations and alternative conditions.

Associated Activities

- Collect gage and atmospheric data.
- Calculate net consumptive use for the Loup Power Canal system and Loup River bypass reach for current and alternative conditions.

5. Flow Depletion and Flow Diversion

Objective

- Quantify change in stage in the Loup River bypass reach for Project operations and compare against alternative hydrographs.

Associated Activities

- Create flow duration and flood frequency curves based on USGS gages.
- Quantify the stage in the Loup River bypass reach at Genoa and Columbus for current and alternative conditions.

5. Flow Depletion and Flow Diversion

Objective

- Evaluate Project influence on historic flow trends on the Loup and Platte Rivers.

Associated Activities

- Evaluate historic flows in Loup and Platte Rivers.

5. Flow Depletion and Flow Diversion

Objective

- Determine the Project's influence on tern and plover nesting on the Loup River above and below the Diversion Weir.

Associated Activities

- Collect existing information on tern and plover nesting activities upstream and downstream of the Diversion Weir.

5. Flow Depletion and Flow Diversion

Objective

- Determine the relative significance of the Loup River bypass reach to the overall fishery habitat of the Loup River.

Associated Activities

- Compare populations above the Diversion Weir to populations below the Diversion Weir relative to populations on the lower Platte River.
- Analyze existing information on fishery populations above and below the Diversion Weir.

6. Fish Sampling

Goal

- Cooperate with Nebraska Game and Parks Commission fish sampling efforts (independent of Project relicensing).

6. Fish Sampling

Objective

- Facilitate access to Project facilities to conduct fish sampling.

Activities

- Coordinate with NGPC to:
  - Schedule access to Project facilities for purposes of sampling fish.
  - Assist with launching and recovery of NGPC boat used for fish sampling.

7. Fish Passage

Goal

- Determine if a reasonable pathway exists for fish movement upstream and downstream of the Diversion Weir.

7. Fish Passage

Objectives

- Determine the hydraulic conditions that limit movement of fish.
- Develop a hydraulic model to determine the flow split between the Diversion Weir and sluice gates for a range of flows.
- Evaluate the hydraulic flow, velocity, and stage parameters at the Diversion Weir and Sluice Gate Structure.

7. Fish Passage

Objective

- Determine the hydraulic conditions that limit movement of fish.

Associated Activities

- Review stage and discharge data at USGS gage stations.
- Literature review to determine velocity and depth criteria for upstream migration.

7. Fish Passage

Objective

- Develop a hydraulic model to determine the flow split between the Diversion Weir and sluice gates for a range of flows.

Associated Activities

- Survey river cross sections upstream and downstream of the Diversion Weir.
- Collect Diversion Weir headwater and tailwater elevations.

7. Fish Passage

Objective

- Evaluate the hydraulic flow, velocity, and stage parameters at the Diversion Weir and Sluice Gate Structure.

Associated Activities

- Review flow duration curves at Diversion Weir.
- Calculate the percent of time during the spawning season that the Diversion Weir is a barrier to upstream fish movement.

8. Recreation User Survey

Goal

- Determine public awareness, usage, and demand of the Project's existing recreation facilities to determine if potential improvements are needed.

Objectives

- Measure usage.
- Document types of recreation use.
- Determine whether facilities meet current demand.
- Determine public's perception/awareness of facilities.
- Determine if Project operations affect recreation.
- Develop recreation management plan.

8. Recreation User Survey

Activities

- On-site observation & recreation user survey.
- Trail counts.
- Telephone survey.
- NOHVA survey.
- Analyze results.
- Synthesize with results from other studies.

9. Creel Survey

Goal

- Determine the status of Project fisheries and how the fisheries are used by anglers; assess angler perception of fisheries.

Objectives

- Identify species targeted by anglers.
- Determine catch rates.
- Identify angler perception, expectation, and level of satisfaction related to Project fisheries.
- Contribute to the recreation management plan

9. Creel Survey

Activities

- Conduct stratified, random survey using NGPC standard methodologies.
  - May through September; 4 weekend days & 6 weekdays per month
  - 2-hour instantaneous counts
  - Angler interviews
- Analyze results.
- Synthesize with results from other studies.

10. Land Use Inventory

Goal

- Determine specific land uses of Project lands and adjacent properties to identify potential conflicts and/or opportunities relating to Project operations, public access, recreation, and environmental resource protection.

Objectives

- Inventory land uses and access points.
- Identify opportunities to improve access and enhance public safety.
- Determine conflicts and incompatible uses.
- Identify solutions for conflicts.
- Contribute to the recreation management plan.

10. Land Use Inventory

Activities

- Use existing data and aerial photography to classify land uses.
- Conduct site visit to confirm land use classification.
- Document land uses on maps.
- Analyze results and identify conflicts.
- Synthesize with results from other studies.

11. Section 106 Compliance

Goal

- Achieve NHPA Section 106 compliance through a programmatic, ongoing consultation relationship between the District and Nebraska SHPO.

Objectives

- Identify consultation needs.
- Identify and evaluate historic properties and properties of traditional and cultural importance to Native American tribes.
- Document historic properties and develop management recommendations.
- Develop Historic Properties Management Plan.
- Develop Programmatic Agreement.

11. Section 106 Compliance

Activities

- Prepare Phase 1A archaeological overview.
- Conduct Phase 1 archaeological field studies.
- Identify places of traditional religious and cultural importance to tribes.
- Evaluate the Project as a historic district eligible for the National Register of Historic Places.
- Identify contributing elements and develop a documentation package for the historic district.

12. Ice Jam Flooding on the Loup River

Goal

- Qualitatively determine the effect, if any, of Project operations on the formation of ice jams or the severity of ice jam flooding in the Loup River bypass reach.

12. Ice Jam Flooding on the Loup River

Objectives

- Characterize the available information and its relevance to performing a qualitative analysis.
- Determine if a relationship can be found between Project operations and ice jam formation or the severity of ice jam flooding in the Loup River bypass reach.

12. Ice Jam Flooding on the Loup River

Objective

- Characterize the available information and its relevance to performing a qualitative analysis.

Associated Activities

- Collect and review NDNR ice reports for the Loup River.
- Collect flow and temperature data (water and air).

12. Ice Jam Flooding on the Loup River

Objective

- Determine if a relationship can be found between Project operations and ice jam formation or the severity of ice jam flooding in the Loup River bypass reach.

Associated Activities

- Update July 1994 USACE report tables and graphs relative to the bypass reach.
- Plot flows in the Loup Power Canal and Loup River bypass reach from November to April of each year.

Requests Not Included in the Proposed Study Plan

- Study Requests Not Included
- Study Elements Not Included

Study Requests Not Included

- Evaluation of transmission lines and whooping crane impacts.
- Water quality study for non-point pollutants and PCBs.
  - SD2 response: assess the effect of Project operations on PCB transport relative to impacts to least terns

Study Elements Not Included

- Sedimentation
  - Study size of sandbars compared to predictions by Williams and Wolman and by Parker and Wilcock
- Hydrocycling
  - Detailed study of sandbar quantity and quality including numbers, sizes and heights in lower Platte River
  - Study of pallid sturgeon similar to Auer study of lake sturgeon

Study Elements Not Included

- Flow Depletion and Flow Diversion
  - Develop flow and sediment transport model for the Loup River bypass reach
  - Study of future flow depletions on Loup River above the Diversion Weir
- Land Use Inventory
  - Interviews regarding future land development outside Project Boundary
- Ice Jam Flooding on the Loup River
  - Development of a predictive model

Study Baseline and Alternatives

In SD 2, FERC stated:

"*The environmental baseline on relicensing is the environment as it exists at the time of relicensing, not pre-project conditions. Nonetheless, this does not prevent the FWS from using a different baseline for its analysis.*"

Study Baseline and Alternatives

- Alternatives Carried Forward in SD2:
  - Proposed Action
  - Staff's Modification of the Proposed Action
  - No Action
- Alternatives Considered but Eliminated from Detailed Study in SD2:
  - Federal Government Takeover
  - Nonpower License
  - Project Decommissioning

Lunch Break

Facilitated Aquatic Resources Discussion

5. Flow Depletion and Flow Diversion
1. Sedimentation
2. Hydrocycling
3. Water Temperature in the Platte River
4. Water Temperature in the Loup River Bypass Reach
7. Fish Passage

1. Sedimentation - Goals

- The goal of the sedimentation study is to 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, the goal is to compare the availability of sandbar nesting habitat for interior least terns (*Sterna antillarum*) and piping plovers (*Charadrius melodus*) to their respective populations and to compare the general habitat characteristics of the pallid sturgeon (*Scaphirhynchus albus*) in multiple locations.

1. Sedimentation - Objectives

1. To develop a sediment budget from existing data sources.

2. To characterize sediment transport in the Loup River bypass reach and in the lower Platte River through effective discharge calculations.

3. To characterize stream morphology in the Loup River bypass reach and in the lower Platte River by reviewing existing literature on channel aggradation/degradation and cross sectional changes over time.

1. Sedimentation – Objectives continued

4. 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]).

5. To compare the availability of sandbar nesting habitat to interior least tern and piping plover nest counts on the lower Platte River and to compare these results to the relationship of interior least tern and piping plover nest counts and the availability of sandbar habitat in the Missouri River downstream of Gavins Point Dam.

1. Sedimentation – Objectives continued

6. To determine if sediment transport is a limiting factor for pallid sturgeon habitat in the lower Platte River below the Elkhorn River.

7. To investigate the relationship between sedimentation and ice jam flooding.

2. Hydrocycling - Goal

- The goal of the hydrocycling study is to determine if Project hydrocycling operations adversely affect or benefit the habitat used by interior least terns, piping plovers, and pallid sturgeon in the lower Platte River. The physical effects of hydrocycling will be quantified and compared to alternative conditions.

2. Hydrocycling - Objectives

1. To conduct a gage analysis using existing U.S. Geological Survey (USGS) and NDNR flow and stage data to accurately determine the timing, frequency, rate of change, travel time, and magnitude of sub-daily flow and stage changes attributable to Project hydrocycling at established gage locations in the Tailrace Canal and the lower Platte River.

2. Hydrocycling – Objectives continued

2. 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 (actual) and alternative conditions in the study area.

2. Hydrocycling – Objectives continued

3. To determine the flow characteristics (magnitude and occurrence) during the interior least tern and piping plover nesting season compared to a maximum (benchmark) flow event occurring just prior to, or during, initiation of the nesting season. This will indicate the potential for nest inundation due to both hydrocycling and alternative conditions.

4. To assess effects, if any, of hydrocycling on sediment transport parameters (see Study 1.0, Sedimentation).

2. Hydrocycling – Objectives continued

5. To compare river stage variations of Project hydrocycling with flow and stage variations of the every-third-day cycling program on the Missouri River below Gavins Point Dam (or another relevant example) to identify material differences in potential effects on inundation of interior least tern and piping plover nests and pallid sturgeon habitat.

3. Water Temperature in the Platte River - Goal

- The goal of the study of water temperature in the Platte River is to determine if Project operations materially affect water temperature in the pallid sturgeon's associated habitat reach of the lower Platte River.

3. Water Temperature in the Platte River - Objectives

1. To collect existing flow and temperature data from selected USGS gages on the Platte River, the Elkhorn River, and Salt Creek.

2. To analyze gage data to determine if the water temperatures monitored at the Platte River gage at Louisville, Nebraska, are consistent with water temperatures monitored at the Elkhorn River gage and the Salt Creek gage.

4. Water Temperature in the Loup River Bypass Reach - Goal

- The goal of the study of water temperature in the Loup River bypass reach is to determine if Project operations (flow diversion) materially affect water temperature in the Study Reach.

4. Water Temperature in the Loup River Bypass Reach - Objectives

1. To coordinate with the U.S. Geologic Survey (USGS) to install temperature sensors in the Loup River at the Diversion Weir and in the Loup River bypass reach at USGS Gage 06793000, Loup River near Genoa, NE.

2. To collect and review ambient air temperature data at the National Weather Service (NWS) atmospheric station located at Genoa.

3. To collect and review flow data at USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE.

4. Water Temperature in the Loup River Bypass Reach – Objectives continued

4. To analyze the collected ambient air and water temperature and flow data.

5. To estimate the relationship between flow in the Loup River bypass reach, ambient air temperature, and water temperature.

6. To describe and quantify the relationship, if any, between diversion of water into the Loup Power Canal and water temperature in the Study Reach of the Loup River bypass reach.

5. Flow Depletion and Flow Diversion - Goals

- The goals of the flow depletion and flow diversion study are to determine if Project operations result in a flow depletion on the lower Platte River and to what extent the magnitude, frequency, duration, and timing of flows affect the Loup River bypass reach.
- The results will be used to determine if the Project operations relative to flow depletion and flow diversion adversely affect the habitat used by interior least tern and piping plover populations, the fisheries, and the riverine habitat in the Loup River bypass reach and the lower Platte River.

5. Flow Depletion and Flow Diversion - Objectives

1. To quantify flow depletion in the Loup Power Canal, regulating reservoirs, and Loup River bypass reach by calculating consumptive use and making a comparison to alternative conditions.

2. To determine the net consumptive losses associated with Project operations compared to alternative conditions.

3. To use existing gage data to develop flood frequency and flow duration curves in the Loup River bypass reach for current Project operations and for alternative operations.

5. Flow Depletion and Flow Diversion – Objectives continued

4. To use current and historic USGS gage rating curves to evaluate change in stage in the Loup River bypass reach during Project operations and compare against alternative hydrographs.

5. To evaluate historic flow trends on the Loup and Platte rivers since Project inception.

5. Flow Depletion and Flow Diversion – Objectives continued

6. To determine the extent of interior least tern and piping plover nesting on the Loup River above and below the Diversion Weir.

7. To determine the relative significance of the Loup River bypass reach to the overall fishery habitat for the Loup River.

7. Fish Passage - Goal

- The goal of the fish passage study is to determine if a reasonable pathway exists for fish movement upstream and downstream of the Diversion Weir.

7. Fish Passage - Objectives

1. To evaluate the hydraulic flow, velocity, and stage parameters at the Diversion Weir and Sluice Gate Structure.

2. To review stage and discharge data available at nearby U.S. Geological Survey (USGS) gage stations (USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE).

7. Fish Passage – Objectives continued

3. To collect hydraulic information, including surveying river cross sections at the upstream and downstream face of the Headworks and recording headwater and tailwater elevations at the Diversion Weir.

4. To review literature to determine velocity and depth criteria for upstream fish passage at the Diversion Weir.

5. To review flow duration curves at the Diversion Weir.

7. Fish Passage – Objectives continued

6. To develop a hydraulic model to determine the flow split between the Diversion Weir and sluice gates for a range of flows.

7. To determine whether fish pathways exist over the Diversion Weir, through the Sluice Gate Structure, or by other means.

Future Meetings & Next Steps

- May 5: Cultural Resources; Study 11
- May 11: Recreational Resources; Studies 8, 9, 10
- May 27-28: Continued Discussion as needed; Studies 1-12
- July 1: Additional discussion as needed
- Others as necessary