

STUDY 7.0

FISH PASSAGE

STUDY 7.0 FISH PASSAGE 7-1

- 1. GOALS AND OBJECTIVES OF STUDY 7-1
- 2. RELEVANT RESOURCE MANAGEMENT GOALS 7-2
- 3. BACKGROUND AND EXISTING INFORMATION 7-2
- 4. PROJECT NEXUS 7-3
- 5. STUDY AREA AND STUDY SITES 7-3
- 6. PROPOSED METHODOLOGY 7-5
- 7. CONSULTATION WITH AGENCIES, TRIBES, AND OTHER STAKEHOLDERS..... 7-7
- 8. WORK PRODUCTS 7-7
- 9. LEVEL OF EFFORT AND COST 7-8
- 10. SCHEDULE 7-8
- 11. REFERENCES 7-8

STUDY 7.0 FISH PASSAGE

The Project is located in Nance and Platte counties, where water is diverted from the Loup River and routed through the 35-mile-long Loup Power Canal, which empties into the Platte River near Columbus. The Project includes various hydraulic structures, two powerhouses, and two regulating reservoirs. The portion of the Loup River from the Diversion Weir to the confluence with the Platte River is referred to as the Loup River bypass reach.

The Project begins at the Headworks, which is located midway between Fullerton and Genoa, Nebraska, and consists of a Diversion Weir, Intake Gate Structure, and Sluice Gate Structure. The low-head Diversion Weir diverts a portion of the Loup River flow through the Intake Gate Structure into the Loup Power Canal and generation system. The Project is able to divert up to 3,500 cfs of water. This is the capacity of the Loup Power Canal as well as the limit of the District's water right.

The Loup River provides habitat for a variety of migratory, riverine fish species indicative of the region. Specific species include channel catfish, walleye, sauger, white bass, and suckers. The ability of these fish to move upstream, past the Diversion Weir and Sluice Gate Structure, may be restricted by the hydraulic characteristics (flow, velocity, and stage) at the Diversion Weir. During the May 28, 2009, Study Plan Meeting, Nebraska Game and Parks Commission (NGPC) fisheries staff stated that previous fish sampling efforts performed by NGPC on the Loup River Basin in 1996 and 1997 indicate that the District's Diversion Weir may act as a seasonal barrier to upstream fish movement. That is, NGPC is of the opinion that the structure is not a permanent or year-round barrier to upstream fish movement. The analysis proposed in this fish passage study will determine if, to what degree, and during what times of the year the Diversion Weir and Sluice Gate Structure impede riverine fish passage in the Loup River.

1. GOALS AND OBJECTIVES OF STUDY

“Describe the goals and objectives of each study proposal and the information to be obtained;” 18 CFR §5.11(d)(1)

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

The objectives of the fish passage study are as follows:

1. To evaluate the hydraulic flow, velocity, and stage parameters at the Diversion Weir and Sluice Gate Structure.
2. To determine whether fish pathways exist over the Diversion Weir, through the Sluice Gate Structure, or by other means.

2. RELEVANT RESOURCE MANAGEMENT GOALS

“Address any known resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;” 18 CFR §5.11(d)(2)

NGPC manages fisheries statewide for productive fishing opportunities. To this end, NGPC is concerned that the Diversion Weir and Sluice Gate Structure may obstruct migratory riverine fish passage and migrations, which in turn may inhibit productive fishing opportunities in state waters (HDR, August 19, 2008).

3. BACKGROUND AND EXISTING INFORMATION

“Describe existing information concerning the subject of the study proposal, and the need for additional information;” 18 CFR §5.11(d)(3)

3.1 Project Structures

The Diversion Weir consists of a 1,320-foot-long, low concrete weir. The fixed crest of the weir is at an elevation of 1,574 feet, and wooden flashboards are maintained along the top of the weir to create an effective crest elevation of 1,576 feet. The right, or south, abutment of the Diversion Weir is flanked by a dike extending approximately 3,000 feet to high ground.

The Intake Gate Structure is located on the north bank of the river. It is constructed of reinforced concrete and supports 11 steel radial gates that admit Loup River water into the Loup Power Canal. The elevation of the concrete gate sills is 1,569.5 feet, and each gate is 24 feet long with a maximum opening of 5 feet.

The Sluice Gate Structure spans the portion of the river flowing between the downstream leg of the Diversion Weir and the Intake Gate Structure. It is in place to promote formation of a scour channel along the front of the Intake Gate Structure as well as to keep the Intake Gate Structure free of debris and ice. The elevation of the sluice gate sills is 1,568 feet, and each steel gate is 20 feet long with a maximum opening of 6 feet.

3.2 USGS Flow and Gage Data

Flow velocity is an important factor exerting influence on fish migration. The data will be used to create a flow duration curve at the Diversion Weir as well as for calibration of the hydraulic model. Each gage station is accompanied by the associated rating curves and velocity and cross-sectional data used to create the rating curves. USGS data at the following two locations, shown in Figure 7-1, will provide flow data that will be used for this study:

- USGS Gage 06793000, Loup River near Genoa, NE – Available discharge data from April 1, 1929, to current for this station includes 15-minute interval data and available 15-minute interval gage height data from June 12, 1997 to current.

- USGS Gage 06792500, Loup River Power Canal near Genoa, NE – Available discharge data from January 1, 1937, to current for this station includes 15-minute interval data and available 15-minute interval gage height data from August 30, 2000, to current.

4. PROJECT NEXUS

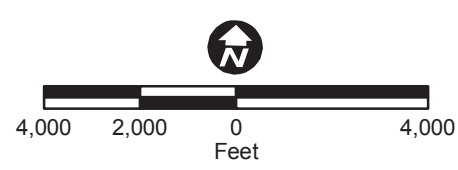
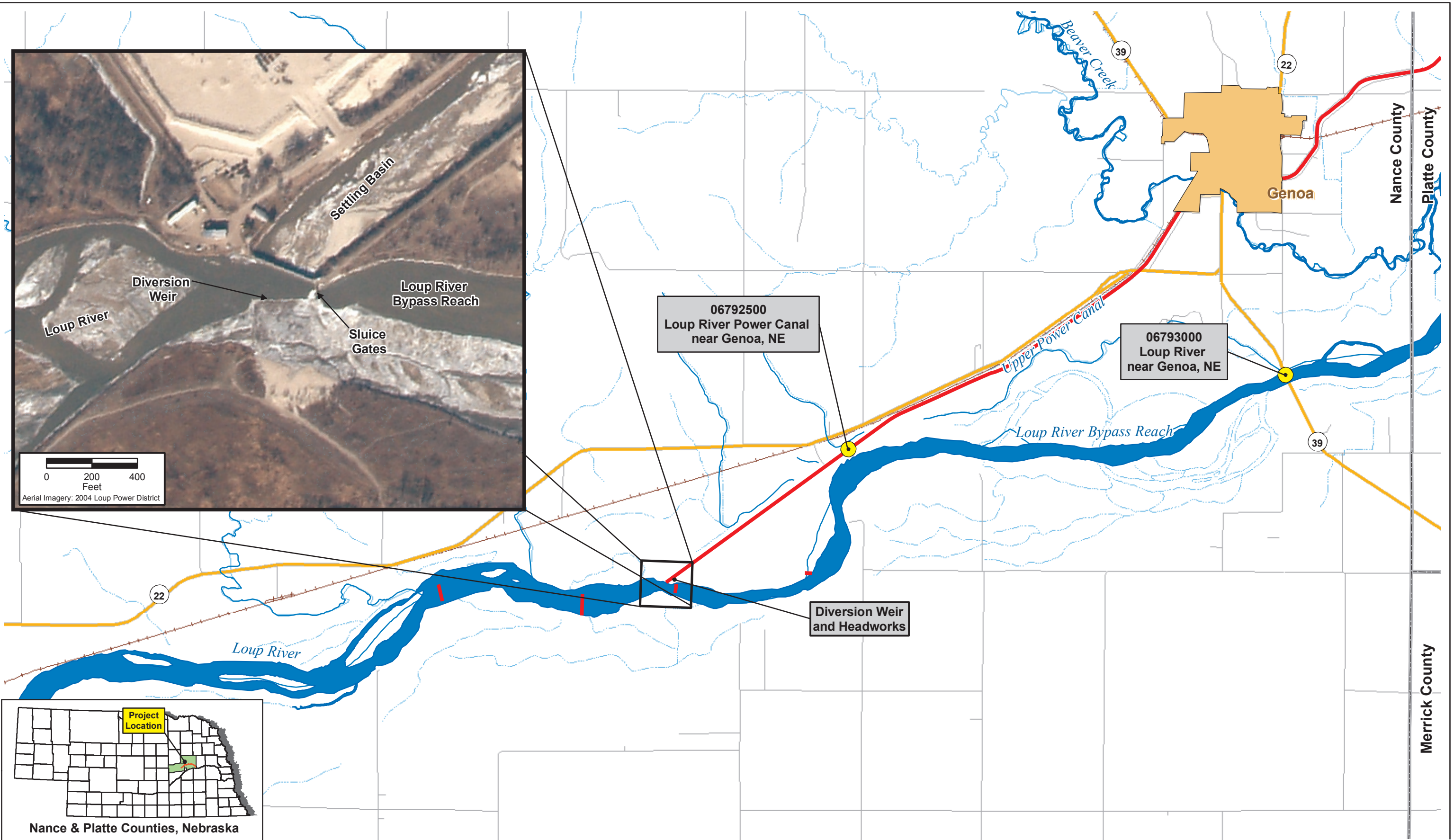
“Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied;” 18 CFR §5.11(d)(4)

The Diversion Weir associated with the Project establishes a water level sufficient to divert Loup River water through the Intake Gate Structure to the Loup Power Canal. The nexus between the Diversion Weir and fish passage is that the Diversion Weir may serve as a physical barrier to upstream and downstream fish movement during the spawning period of April, May, and June.

5. STUDY AREA AND STUDY SITES

The study area includes the area around the Headworks. The study area and the locations of the USGS gages from which data will be obtained are shown in Figure 7-1.

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- Legend**
- USGS Gaging Station
 - Rivers/Streams
 - Loup Power Canal
 - Major Road
 - Local Road
 - Railroad
 - Corporate Limits
 - County Line



Fish Passage Study Area

Loup River Hydroelectric Project
FERC Project No. 1256
Proposed Study Plan

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DATE	July 2009
FIGURE	7-1

6. PROPOSED METHODOLOGY

“A detailed description of the study and the methodology to be used;” 18 CFR §5.11(b)(1)

“Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers any known tribal interests;” 18 CFR §5.11(d)(5)

The methodology for the fish passage study includes three tasks, described below.

Task 1 Data Review

Stage and discharge data available at nearby USGS Gage 06793000, Loup River near Genoa, NE, and USGS Gage 06792500, Loup River Power Canal near Genoa, NE, will be reviewed. This information was used to develop the flow duration curve at the Diversion Weir as described in Section 5 of the PAD. A flow duration curve is a plot of discharge vs. percent of time that a particular discharge was equaled or exceeded. The flow duration links the discharges, the flow depth and velocities (through the hydraulic model in Task 3, below) with a percentage of time equaled or exceeded at the Diversion Weir during the months of April, May, and June (the period of analysis).

In addition to the data described above, literature will be reviewed to determine the hydraulic conditions (flow velocity and vertical distance between upstream and downstream pools) that limit movement of migratory riverine fish species, including channel catfish, walleye, sauger, white bass, and suckers.

Task 2 Data Collection

River cross sections will be surveyed at the upstream and downstream face of the Headworks and at two additional locations: one 200 feet upstream and one 200 feet downstream of the Headworks. The cross sections will provide a basis from which to create a hydraulic model. They need to be located far enough away from the Diversion Weir that they are representative of the channel, and it is thought that 200 feet upstream and downstream is an appropriate distance.

In addition, a series of Diversion Weir headwater and tailwater elevations will be collected to develop the hydraulic relationship between the flow in the Loup River bypass reach and the tailwater elevation at the Diversion Weir. This would require that Project personnel record daily elevations at existing staff gages upstream and downstream of the Diversion Weir for the period of analysis. This would ensure that a full range of flow conditions would be recorded.

Task 3 Data Analysis

Hydraulic Modeling

A hydraulic model relating flow in the bypass reach, headwater and tailwater elevations, flow velocity over the Diversion Weir, and flow velocity through the Sluice Gate Structure will be created by developing and analyzing a baseline model, as described as follows.

The geometry for the Diversion Weir and Sluice Gate Structure will be incorporated into a mathematical model that relates flow, headwater and tailwater elevations, and velocity through and over the structures. A set of calibration flows and water surface elevations will be developed based on information at the USGS gage in the Loup River bypass reach and the Diversion Weir tailwater measurements obtained.

A set of flows will be developed, based on the spawning season flow duration curve, to route through the mathematical model. The mathematical model will predict the flow velocity over the Diversion Weir and through the Sluice Gate Structure. The flows should bracket the range of expected flows during the migration and spawning season. Because the flows are part of the flow duration curve, each flow will have a percent of time equaled or exceeded.

Hydraulic Conditions at the Diversion Structure

The difference in upstream and downstream water surface elevations at the Diversion Weir and the average velocity across the Diversion Weir and through the Sluice Gate Structure will be tabulated for all flows in the evaluation flow set (see Hydraulic Modeling under Task 3, above). The tabulated results will be compared to the fish passage criteria. This will allow creation of a table that documents the hydraulic conditions in the Loup River and the percent of time during the spawning period when the conditions in the river (that is, over the Diversion Weir and through the Sluice Gate Structure) are a barrier to riverine fish movement. The end result of this task is calculation of the time duration that the Diversion Weir serves as a barrier to riverine fish movement (channel catfish, walleye, sauger, white bass, and suckers) upstream in the Loup River.

Alternative Fish Pathways

The hydraulic data will be analyzed to determine whether usable fish pathways exist over the Diversion Weir, through the Sluice Gate Structure, or by other means. The percent of time that the Diversion Weir is a barrier to upstream movement during the migration season will be calculated.

7. CONSULTATION WITH AGENCIES, TRIBES, AND OTHER STAKEHOLDERS

This study plan has been developed based on discussions with agencies prior to submittal of the PAD and during multiple study plan meetings that followed the submittal of the Proposed Study Plan.

The District presented an overview of the goals, objectives, and activities associated with Study 7.0, Fish Passage, at the Study Plan Meeting held on April 21, 2009. The meeting was attended by representatives of FERC, NGPC, Nebraska Department of Environmental Quality, U.S. Fish and Wildlife Service, and National Park Service, as well as others. Minor comments related to the wording of the study objectives and to differentiating study objectives versus study activities were received and are incorporated as a result of this meeting.

The District conducted an additional Study Plan Meeting on May 27-28, 2009, to discuss in more depth the specific activities associated with the aquatic resources studies, including Study 7.0, Fish Passage. Most of the attendees at the April 21, 2009, meeting (listed above) also attended this meeting. Discussion specific to this fish passage study occurred on May 28, 2009, and resulted in two minor revisions to the study: the fish passage evaluation has been expanded to include all migratory fish species that may be affected by the Diversion Weir, and a new activity has been added under Objective 2 to calculate the percent of time during the migration season that the Diversion Weir is a barrier to upstream fish movement.

The discussions from both meetings were documented in meeting transcripts, which are available on the District's relicensing website (<http://www.loup.com/relicense/html/agencymeetingsresources.html>).

8. WORK PRODUCTS

“Provisions for periodic progress reports, including the manner and extent to which information will be shared; and sufficient time for technical review of the analysis and results;” 18 CFR §5.11(b)(3)

The intended work product for the fish passage study is a study report. The study report will document the hydraulic conditions at the Diversion Weir and the duration (if any) that the Diversion Weir serves as a barrier to riverine fish passage during the spawning and migration period. Along with the study report, a database of the data gathered and used in the analysis will be available.

Updates regarding the fish passage study will be included in the study progress reports to be submitted to FERC in March 2010 and June 2010.

9. LEVEL OF EFFORT AND COST

“Describe considerations of level of effort and cost, as applicable.” 18 CFR §5.11(d)(6)

It is estimated that the fish passage study will cost approximately \$70,000. This work will be completed by qualified water resources engineers and biologists.

10. SCHEDULE

“A schedule for conducting the study;” 18 CFR §5.11(b)(2)

“The potential applicant's proposed study plan must also include provisions for the initial and updated study reports and meetings provided for in §5.15.” 18 CFR §5.11(c)

The fish passage study is scheduled to begin in the first quarter of 2010, and the Fish Passage study report will be available in the third quarter of 2010. In addition, the District will prepare a consolidated Initial Study Report for Studies 1.0 through 12.0 that describes progress and results (as appropriate) for each study. In accordance with the District's Process Plan and Schedule, the Initial Study Report will be available in August 2010, and a study meeting will be held within 15 days, per 18 CFR §5.15(c)(2). An Updated Study Report will be available in August 2011 to provide information on progress and results for second season studies (as needed).

11. REFERENCES

HDR. August 19, 2008. Meeting notes from agency meeting. Available online at http://www.loup.com/relicense/html/documents/Meeting_Resources/AgencyResources/08aug08/08aug19meetingnotes.pdf.