FEDERAL ENERGY REGULATORY COMMISSION
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OFFICE OF ENERGY PROJECTS

Project No. 1256-029-Nebraska
Loup River Hydroelectric Project
Loup Power District

Mr. Neal Suess, President/CEO
Loup Power District
2404 15th Street
P.O. Box 988
Columbus, NE 68602-0988

Reference: Study Determination on Requests for Modifications to the Loup River Hydroelectric Project Study Plan

Dear Mr. Suess:

Pursuant to 18 C.F.R. § 5.15 of the Commission's regulations, this letter contains the determination on requests for modifications to the Loup Power District's approved Loup River Hydroelectric Project (Loup River Project or project) Study Plan. The determination is based on: the study criteria set forth in section 5.15(e) of the Commission's regulations; applicable law; Commission policy and practice; and the record of information.

Background

Loup Power District filed an updated study report (updated report) for the existing Loup River Project on August 29, 2011, filed an updated study report revision on September 7, 2011, held an updated study report meeting on September 8, 2011, and filed a summary of the updated study report meeting on September 23, 2011.

Comments on the updated study report and meeting summary were filed by the U.S. Fish and Wildlife Service (FWS) on October 20, 2011 and the Federal Energy Regulatory Commission staff (Commission staff) on October 21, 2011. Both the FWS and Commission staff recommended that new sediment transport studies be conducted pursuant to section 5.15(e) of the Commission's regulations. Loup Power District subsequently filed reply comments on the requested new studies on November 23, 2011.

Study Plan Determination

Pursuant to section 5.15(e), new study requests must show good cause and include, as appropriate to the facts of the case, a statement explaining: (1) any material changes in the law or regulations applicable to the information request; (2) why the goals and objectives of any approved study could not be met with the approved study methodology; (3) why the request was not made earlier; (4) significant changes in the project proposal or that significant new information material to the study objectives has become available; and (5) why the new study request satisfies the study criteria set forth in section 5.9(b).

As indicated in Appendix A, Commission staff's requested Alternative Project Operations and Sediment Management Study is granted with modification. FWS' requested Sediment Transport Study is not required. The bases for requiring staff's requested study and not requiring FWS' requested study are explained in Appendix B.

Finally, nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional studies.

If you have any questions, please contact Lee Emery at (202) 502-8379 or lee.emery@ferc.gov.

Sincerely,

Jeff C. Wright
Director
Office of Energy Projects

cc: Mailing List
Public Files

Enclosures: Appendix A—Summary of determinations on requested new studies
Appendix B—Staff's recommendations on requested new studies

APPENDIX A
SUMMARY OF DETERMINATIONS ON REQUESTED NEW STUDIES

Study	Requesting Entity	Approved	Approved with Modifications	Not Required
Alternative Project Operations and Sediment Management	Commission staff		X	
Sediment Transport	FWS			X

APPENDIX B

Staff's Recommendations on Requested New Studies

Below is staff's analyses and recommendations on the new studies that were requested by the U.S. Fish and Wildlife Service (FWS) and Commission staff on October 20 and 21, 2011, respectively.[1]

Alternative Project Operations and Sediment Management Study

Commission staff requested that Loup Power District (District) analyze potential changes in sediment transport based on four alternative project operations designed to mitigate project-related sediment depletion in the lower Platte River and enhance nesting habitat for interior least terns (*Sterna antillarum*) and piping plovers (*Charadrius melodus*). The four alternatives are:

Alternative 1. Release all material dredged from the settling basin to the Platte River at its confluence with the Loup Power Canal. This alternative would include construction and operation of a conveyance to transport dredged material from the settling basin (located at the head of the Loup Power Canal) to the confluence of the Loup Power Canal with the Platte River. Neither the existing North nor South Sand Management Areas (SMAs) would continue to be used for sediment disposal under this alternative.

Alternative 2. Release all material dredged from the settling basin to the South SMA. Under this alternative, all dredged material from the settling basin would be directed to the South SMA. Flow diversion into the Loup Power Canal would not change from existing project operation. The North SMA would no longer be used for sediment disposal under this alternative.

Alternative 3. Release all material dredged from the settling basin to the South SMA and modify project operation to allow sufficient flow to pass downstream into the Loup River bypassed reach during high-flow events to enhance sediment transport. The North SMA would no longer be used for sediment disposal under this alternative.

Alternative 4. Release all material dredged from the settling basin to the South SMA, modify project operations to allow sufficient flows to pass into the Loup River bypassed reach during high flow events to enhance sediment transport, and modify project operation to maintain a minimum flow in the Loup River bypassed reach during the tern and plover nesting

[1] The Study Plan was approved on August 26, 2009, and subsequently modified on December 20, 2010, and June 10, 2011.

season. This alternative would be identical to Alternative 3, except that project operations would be modified during the tern and plover nesting season to provide a minimum flow in the Loup River bypassed reach to provide for the development and maintenance of tern and plover nesting habitat.

Staff noted that, although the District stated in its study report that the Platte River is in dynamic equilibrium,[2] staff concluded that project operations result in a large reduction in sediment yield in the Loup River system from removal of sediment by flow diversions into the Loup Power Canal; the sediment is dredged from the settling basin and disposed in the SMAs. Furthermore, staff concluded that this sediment reduction would likely impact sediment transport further downstream in the Platte River, where it may affect channel dimensions and the formation of sandbar habitat for interior least tern and piping plover nesting in the Platte River downstream of the Loup Power Canal tailrace.

In its October 21, 2011 filing, staff justified the new study request based on the filing of significant new information in the District's updated study report filed on August 29, 2011, as supplemented on September 7, 2011. Specifically, staff noted that although the updated study report illustrates that the Platte River is in dynamic equilibrium, the report also shows that project operations result in a large reduction in sediment yield in the Loup River system. Staff noted that this reduction will likely impact sediment transport further downstream in the Platte River, which may affect channel dimensions and sandbar habitat for tern and plover nesting. Therefore, staff requested the additional study pursuant to section 5.15(e)(4) of the Commission's regulations.

Comments on the Requested Study

The District stated that it has demonstrated in its study report that the lower Platte River downstream of the Loup Power Canal tailrace is in dynamic equilibrium, is well-seated within a braided stream regime, and is flow-limited rather than supply-limited. The District stated that its removal of sediment from the settling basin and its transport of sediment to the North SMA does not cause a sediment deficiency at any of the sites studied in the updated study report. The District also disagrees with staff's conclusion that project operations would likely impact sediment transport or stream morphology on the lower Platte River

[2] A stream in dynamic equilibrium has no significant erosion (degradation) or deposition (aggradation) of sediment occurring within the stream cross section and is considered stable. The stability of a stream in dynamic equilibrium is maintained by self-correcting mechanisms that persist within a range of conditions.

downstream of the project's tailrace. In addition, the District stated that its analyses have shown that the Platte River downstream of the tailrace:

- is transporting sediment at capacity,
- is showing no signs of trending toward aggradation or degradation,
- has a channel geometry that is consistent with the rest of the Platte River, and
- is well within a braided stream regime.

The District stated that it calculated the amount of sediment dredged from the settling basin to be 35 percent of the annual sediment supply from the Loup River system.[3] The District stated that it also estimates that the sediment removed from the system corresponds to 24 percent of the sediment supply of the Platte River as calculated downstream of the project tailrace at North Bend and 12 percent of the sediment supply of the Platte River as calculated further downstream at Louisville.

The District also stated that it disagrees with staff's description of sediment removal from dredging operations in its October 21, 2011 letter as being analogous to flow released from a dam where sediment is trapped behind the dam in the reservoir. To refute staff's assertion, the District cited a study by Chen et al. (1999)[4] that found the Loup River at Genoa (near the project's diversion dam) and the Platte River at North Bend to be stable. The District stated that because the Chen study did not include the Platte River stream gaging station at North Bend in its list of stations located downstream of dams, the Chen study does not consider the Platte River at North Bend as downstream from a dam nor is it analogous to a dam.

The District also disagreed with staff's assertion in its October 21, 2011 letter that "clear water" can adversely affect channel stability. The District stated that its analyses suggest that increased flows downstream of the Loup Power Canal tailrace have been balanced by the inflowing sediment from the Platte River upstream of the tailrace (designated as site 3 in the approved study plan) as well as

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[3] In its October 21, 2011 letter, staff calculated the percentage of the sediment yield of the Loup River system delivered to the lower Platte River to be 53 percent, which is calculated as [2,004,800 – 560,000 + 350,000] / [3,370,800] = 53%. Downstream calculations are similarly calculated.

[4] Chen, Abraham H., David L. Rus, and C.P. Stanton. 1999. Trends in Channel Gradation in Nebraska Streams, 1913-95. USGS Water-Resources Investigations Report 99-4103. Lincoln, NE.

from the change in channel hydraulic characteristics in the Platte River downstream of the tailrace.

The District stated that to evaluate staff's Alternative 1 using the effective or dominant discharge methodology of the study plan, it would need to make certain assumptions to alter the flow hydrograph, change the sediment particle size, change the slope of the river, or alter the depth-discharge or width-discharge relationships. Furthermore, the District stated that at site 4 (Platte River downstream of the project tailrace), Yang's Unit Stream Power[5] sediment discharge rating curve demonstrates that an average of 3,500 cubic feet per second (cfs) of water per day would be needed to transport the additional sediment load required by Alternative 1. In addition, the District stated that if the North SMA was no longer used and all sediments were released downstream under Alternative 1, there would be adverse effects on interior least tern and piping plover habitat within the North SMA. Similarly, the District also stated that if the South SMA was no longer used for sediment disposal under Alternative 1, there would be adverse affects to a recreational area at the Headworks Off-Highway Vehicle Park located within the South SMA. The District stated that it finds Alternative 1 to be impractical because of its high construction and operation costs.

The District stated that to evaluate Alternative 2 using the effective or dominant discharge methodology of the study plan, the flow hydrograph would need to be altered. The District also stated that the effects on terns, plovers, and recreation would be similar to that which would occur under Alternative 1.

With respect to Alternative 3, the District stated that during high-flow events on the Loup River, all flows greater than 3,500 cfs (the maximum hydraulic capacity of the Loup Power Canal) already flow in the Loup River bypassed reach, suggesting that evaluation of Alternative 3 would provide little useful additional information.

With respect to Alternative 4, the District stated that to implement this alternative, all sediment and flows entering the settling basin would, in essence, have to be returned to the Loup River bypassed reach. The District stated that this alternative has already been presented in Study 5.0 (Flow Depletion and Flow Diversion).

The District concluded by finding that the staff's requested new study is not needed.

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[5] Yang, Chih Ted. 1972. "Unit Stream Power and Sediment Transport." Journal of the Hydraulics Division, ASCE 98(10):1805-1826.

Discussion

Staff agrees with the District that the Platte River appears to be in dynamic equilibrium based on information presented in the updated study report. However, in this instance, being in a state of dynamic equilibrium only means that the channel is stable under ongoing project operations;[6] it does not mean that there are no ongoing adverse effects of project operations on sediment transport as discussed below.

With respect to the District's stated disagreement with our characterization that project operation is analogous to a reservoir, we note that the District's study report shows that the settling basin and project reservoirs remove 87 percent of the sediment entering the Loup Power Canal. This is a substantial amount of sediment considering that the canal conveys 67 percent[7] of the annual flow in the Loup River at the point of the diversion dam. We understand that the Loup Power Canal does not function like a dam on the Platte River. However, the result is that a substantial amount of Loup River flow enters the Platte River deficient of sediment similar to the outflow from a reservoir where incoming sediment to the reservoir has settled to the reservoir bottom.

Based on the mean daily discharges presented in table 4-1 of Study 5.0, the flow in the Loup Power Canal is about 49 percent of the combined flow of the Platte River and Loup River bypassed reach, which indicates that the "clear water" (i.e., sediment-depleted water) from the Loup Power Canal likely affects sediment transport in the Platte River downstream of the Loup Power Canal tailrace. The effects of the clear water releases according to Vanoni (1977) are to "pick up materials from the stream bed and banks until a full sediment load compatible with the material available and the transporting capacity is attained. [This action] is commonly referred to as degradation."[8] The Chen study, cited by the District, states that "river dams affect channel stability on the downstream reach; streambed degradation downstream from dams is a well-known phenomenon on alluvial streams," which illustrates that dams and reservoirs do have an effect on sediment transport.

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[6] Project operation began in 1937 and the use of the North SMA began in 1961.

[7] Table 4-4, Study 1.0 – Sedimentation provides a flow split between the Loup Power Canal and the Loup River bypass reach as 67 percent.

[8] Vanoni, V.A., Editor. 1977. Sedimentation Engineering. American Society of Civil Engineers, Manuals and Reports on Engineering Practice – No. 54. New York, NY.

To support its claim that the Loup Power Canal does not act as a reservoir that traps sediments, the District cites the summary section of the Chen study, which does not include the Platte River gaging station at North Bend in the list of the Chen study's U.S. Geological Survey (USGS) stream gaging stations located downstream of dams. The District stated that this exclusion is evidence that the Chen study does not consider the Loup Power Canal system to function as a reservoir in terms of trapping sediments. We cannot speak to the reason that the North Bend gaging station was not included in the list of USGS stream gaging stations located downstream of dams. It is in the realm of possibilities that the USGS was unaware of the project dredging activities that have evolved during the 70 years of project operation. Therefore, we do not view the exclusion of the North Bend gaging station as evidence that the Chen study did not consider the Loup Power Canal to be analogous to a reservoir.

The District stated that there is no evidence of a sediment supply deficit downstream of the Loup Power Canal tailrace. In support of this statement, the District supplied aerial photographs of the area dating from 2003 through 2010. The District stated that, during this period, there have been no changes in the features downstream of the Loup Power Canal tailrace. We concur that Platte River appears to be in dynamic equilibrium under ongoing operations, including the project's use of the North SMA during the last 40 to 50 years. Any differences seen in the aerial photographs are likely attributed to the annual variability in the runoff. However, the aerial photographs supplied by the District show an apparent spatial variability in the distribution of open water and sediment features downstream of the Loup Power Canal tailrace. From the Loup Power Canal tailrace to at least 1-2 miles downstream, the Platte River appears to have open water confined to a single main channel as compared to the braided pattern characteristic of the Platte River further downstream. These noted spatial differences of sediment features in the Platte River are most apparent at lower flows.

The District stated that the sediment dredged from the settling basin represents 35 percent of the annual sediment supply from the Loup River system, 24 percent of the sediment supply of the Platte River at North Bend, and 12 percent of the sediment supply of the Platte River at Louisville. Although the Loup and Platte River systems have an abundance of sediment available as indicated in Table 5-6 of Study 1.0, removal of 24 percent of the sediment supply of the Platte River at North Bend would likely adversely affect sediment transport characteristics in the impacted reach as the system seeks to achieve an equilibrium sediment transport condition.

With respect to the District's statement that to evaluate Alternative 1 using the effective or dominant discharge methodology, certain assumptions would need

to be made that would render the evaluation ineffective, we agree and modify our recommendation as follows. In Study 2.0 (Hydrocycling), one of the HEC-RAS sediment transport model reaches encompassed the Loup Power Canal tailrace. This particular model was developed with the Loup Power Canal tailrace flows transporting no sediment load. The approach used to model the no sediment approach in Study 2.0 can be used to evaluate Alternative 1 in place of using the effective or dominant discharge methodology.

With respect to the District's response that to evaluate Alternative 2 using the effective or dominant discharge methodology, certain assumptions would have to be made to alter the flow hydrograph, change the average size of the sediment particles, change the slope of the river, or alter the depth-discharge or width-discharge relationships, we agree with the District. Instead, we recommend that the District not alter the flow hydrograph, average size of sediment particles, change in slope, or depth-discharge and width-discharge relationships, but keep these parameters constant. In this way, the District will be modeling existing conditions that would be used as the base condition for comparisons with the results of alternatives 3 and 4.

With respect to the District's response that during high-flow events on the Loup River, all flows greater than 3,500 cfs already pass into the Loup River bypassed reach, suggesting that evaluation of Alternative 3 would provide very little useful additional information, we find that based on the study results, there is still insufficient flow in the Loup River bypassed reach to transport all the sediment dredged from the Loup Power Canal and deposited in the South SMA. Therefore, the analysis described in this alternative is needed. Alternative 3 was designed to evaluate the effect of additional flow in the Loup River bypassed reach on stream geometry. The additional flow would be provided during the high flow events that would transport the most sediment. Current project operations result in 67 percent of the flow in the Loup River flowing into the Loup Power Canal and 33 percent flowing into the Loup River bypassed reach. This alternative alters the flow split between the Loup Power Canal and the Loup River bypassed reach to assess the changes or effects in stream geometry in the Loup River bypassed reach and the Platte River. The increased flows in the Loup River bypassed reach would be provided during the higher flow events in the Loup River.

With respect to the District's response with regard to Alternative 4 that to implement this alternative, all sediment and flows entering the settling basin would, in essence, have to be returned to the Loup River bypassed reach due to insufficient flow in the Loup River bypassed reach, we note that Alternative 4 is identical to Alternative 3 except that project operations would be modified during the tern and plover nesting season (mid-April through mid-August) to provide a

minimum flow in the Loup River bypassed reach to allow development and maintenance of tern and plover nesting habitat. We understand that there will be insufficient flow in the Loup River bypassed reach to transport all the sediment dredged from the Loup Power Canal. However, this alternative was precisely designed to evaluate the effect of additional flow in the Loup River bypassed reach on stream geometry and additional potential habitat provided to the terns and plovers.

Staff Recommendation

Pursuant to section 5.15(e)(4), we recommend that the District implement our requested Alternative Project Operations and Sediment Management Study. As noted above, the District's updated study report includes significant new information demonstrating that project operations result in a large reduction in sediment yield in the Loup River system. This reduction will likely impact sediment transport further downstream in the Platte River, which may affect channel dimensions and sandbar habitat for tern and plover nesting. The recommended study would determine the benefits of alternative project operations and sediment management activities at protecting tern and plover nesting habitat.

For the reasons discussed above, Alternative 1, as requested by staff on October 21, 2011, should be modified so that the HEC-RAS sediment transport model would be used to assess Alternative 1 in place of using the effective or dominant discharge methodology. In addition, the base condition for Study 2.0, which is hydrocycling, should be used as the base condition for Alternative 1.

We recommend that alternatives 3 and 4 be completed as we requested on October 21, 2011. Alternative 2 should be developed and considered the base condition for comparison to Alternatives 3 and 4. We recommend that the District provide all relevant output data so we have sufficient information necessary to assess any differences in sediment transport related to alternative project operation. This information should include, but not be limited to width, depth, area, flow, velocity, and stream bed material gradation.

Sediment Transport Study

FWS requested that the District conduct a new sediment transport study. The study would provide for sediment transport modeling for a period of 30 years. FWS stated that additional modeling is needed to allow assessment of project operation for the anticipated term of any new license issued for the project.

In addition, FWS stated that the existing analysis in Study 2.0 did not consider possible bed material gradations. FWS stated that the coarsening of bed

material over time would lead to reduced sediment transport rates and reduced rates of change in mean bed elevations. FWS also stated that the model output data presented in the updated report for Study 2.0, which are limited to mean invert elevations, do not allow for an adequate evaluation of changes in sediment transport and bed material gradation. Therefore, FWS requested that the new study include a summary of model output data for sites 3, 4, and 5 that would include mass balance of sediment loads and bed material gradation for these sites. FWS stated that the requested study is necessary to assess the effects of project operation on sediment transport.

Comments on the Requested Study

The District submitted the Study 2.0 report as part of the updated study report. The District considers the updated study report sufficient to address the requirements described in the approved study plan. The District stated that it simulated 20 years of flow and sediment transport that consisted of a 3-year warm up period, a 16-year validation and calibration period and 1 year of alternative project operations corresponding to one of three non-sequential alternative hydrologic conditions. These non-sequential alternative hydrologic conditions included a typical wet, dry, and normal year. The District stated that project operations could only be modeled for a 1-year period because of the large quantity of sub-daily input data needed to represent hydrocycling in the model. The District also stated that simulating durations greater than 1 year is beyond the capability of the model. The District stated that the model calculates the transport rate and capacity based on bed material gradation and the hydraulics at each cross section and adjusts the cross section accordingly. Furthermore, the District also stated that mean bed elevation is the most appropriate indicator of the long-term trend of the river.

Discussion

The District has already conducted a sediment transport analysis using the HEC-RAS model. The sediment potential in HEC-RAS was computed by grain size fraction that allows sorting and armoring. The HEC-RAS algorithms allowed the simulation of the coarsening of bed material over time that would lead to reduced sediment transport rates and reduced rates of change in mean bed elevations. The model simulated long-term trends of scour and deposition that result from modifying the frequency and duration of water discharge and stage. After warm up, validation, and calibration, one year of project operations corresponding to hydrocycling and run-of-river operations were modeled for normal, dry, and wet stream flows.

The FWS did not show good cause for a new study pursuant to section 5.15(e), because it did not describe to what degree the results of the additional modeling would be better than that already provided by the approved study.

Staff Recommendation

As discussed above, the District has already conducted a sediment transport study that sufficiently analyzes the effects of project operations (run-of-river and hydrocycling) on sediment transport in the Platte River. Therefore, we do not recommend the FWS' requested Sediment Transport Study.

Document Content(s)