SECTION 5

EXISTING ENVIRONMENT AND RESOURCE IMPACTS

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"Description of existing environment and resource impacts…. A potential applicant must, based on the existing, relevant, and reasonably available information, include a discussion with respect to each resource that includes: A description of the existing environment…, summaries … of existing data or studies…, [a] description of … known … potential adverse impacts and issues associated with the … [P]roject…, [a] description of … existing or proposed project facilities or operations, and management activities undertaken for the purpose of protecting, mitigating impacts to, or enhancing resources affected by the project, including a statement of whether such measures [were] required by the project license…." 18 CFR §5.6(d)(3)(i)(A), (B), (C), and (D)

In the vicinity of the Project, there are several resources that could be affected by Project operations. For each resource, the existing environment is described below. In addition, existing data or studies, existing Project facilities or operations, potential impacts, and management activities for protection, mitigation, and enhancement (PM&E) are described as applicable.

5.1 GEOLOGY AND SOILS

The potential applicant must include in the pre-application document "[d]escriptions and maps showing the existing geology, topography, and soils of the proposed project and surrounding area. Components of the description must include:" 18 CFR §5.6(d)(3)(ii)

5.1.1 Geological Features

"A description of geological features, including bedrock lithology, stratigraphy, structural features, glacial features, unconsolidated deposits, and mineral resources at the project site." 18 CFR §5.6(d)(3)(ii)(A)

The Project is located in Platte and Nance counties, Nebraska, in the Great Plains physiographic province (Flowerday, Kuzelka, and Pederson, 1998). This province is the result of a series of mountain-building events to the west, referred to as the Laramide orogeny, during the Late Cretaceous and Early Tertiary time (approximately 66.4 million years ago [mya]) (Encyclopedia Britannica, 1998). One of the resulting structures of the Laramide orogeny is the Rocky Mountains. During the uplifting of the mountains, material was eroded from the surface and deposited across the Great Plains physiographic province, creating an east-tilted surface (North Plains Groundwater Conservation District, May 5, 2008).

In the vicinity of the Project, the two uppermost bedrock formations that are encountered are the Niobrara Formation and the Ogallala Formation (U.S. Department of Agriculture [USDA] Soil Conservation Service, September 1988). The Niobrara Formation, the older of the two formations, underlies the Project in Platte County and in the far eastern portion of Nance County. In general, the Niobrara Formation lithology varies from limestone to chalk to slightly calcareous shale that was deposited during a major transgression and regression of the Cretaceous epicontinental seaway, which extended from the Hudson Bay in the north to the Gulf of Mexico in the south (Anderson, January 2006). In the vicinity of the Project, the Niobrara Formation consists of chalky shale and lime-cemented bedrock. The formation also contains large fossilized inoceramid bivalve shells, ostracods, and foraminifers (Pabian, January 1987).

The Ogallala Formation, the younger of the two formations, underlies the Project in Nance County. The Ogallala Formation was deposited during the late Miocene Epoch (10 mya) and early Pliocene Epoch (5.3 mya) and continued into the late Pliocene Epoch (approximately 2 mya). The Ogallala Formation is the result of the retreating epicontinental seaway discussed above, which led to eastward flowing rivers that carved valleys into the land surface. Sand, gravel, silt, and clay eroded from upland areas to the west and were deposited into these valleys, resulting in what is presently known as the Ogallala Formation. In general, the formation consists of heterogeneous sequences of coarse-grained sand and gravel grading upward into fine clay, silt, and sand (USDA Soil Conservation Service, September 1988). The Ogallala Formation in the vicinity of the Project consists of partly consolidated fine sands, silt, and clay with some limy zones.

Recent alluvial sedimentary deposits, consisting of clay through sand-sized particles, overlie the Niobrara and Ogallala formations.

The bedrock in the vicinity of the Project is shown in Figure 5-1. In addition to the Niobrara and Ogallala formations, the Carlile Formation may also be present in the vicinity of the Project. The Carlile Formation is similar in composition and depositional environment to the Niobrara but is slightly older.

5.1.2 Soils

"A description of the soils, including the types, occurrence, physical and chemical characteristics, erodability and potential for mass soil movement." 18 CFR §5.6(d)(3)(ii)(B)

The Project is located in the Valleys Topographic Region of Nebraska (Flowerday, Kuzelka, and Pederson, 1998). The land in the vicinity of the Project slopes from west to east at an approximate elevation of 1,580 feet above sea level at the start of the Loup Power Canal to 1,410 feet above sea level at the end of the Loup Power Canal (see Figure 5-2). The Valleys Topographic Region consists of areas with low relief along major streams that are underlain by alluvial deposits of clays, silts, sands, and gravels that are stream-deposited. The stream-deposited materials in the vicinity of the Project are within the Loup River floodplain, defined in Section 5.5.1.

The soils in the vicinity of the Project consist of silt loam, fine sandy loam, or silty clay loam material (USDA Soil Conservation Service, September 1988). The soils have a slow to moderate permeability with a moderate to high water capacity. Soils in the vicinity of the Project are also deep, well drained, and level to gently sloped. The specific soil associations that occur in the vicinity of the Project are shown in Figure 5-3.

The parent material for the majority of the soils in the vicinity of the Project consists of alluvium, calcareous alluvium, and alluvium/colluvium. The remaining soil parent material is either upland loess or stockpiled material from the construction of the Loup Power Canal (USDA Soil Conservation Service, September 1988).

The soils in the vicinity of the Project have soil erodibility (K) factors varying from 0.28 to 0.43 (USDA Soil Conservation Service, September 1988). The K factor is a unit of measure for the susceptibility of soil to erosion and rate of runoff. Soils high in clay content or soils with intermixed sand will have a low K value ranging from 0.05 to 0.2 while soils with a high silt content will have a K factor greater than 0.4 and are most susceptible to erosion and runoff. The soils with the highest K factor are encountered at depths greater than 6 inches and are overlain by soils with K factors of 0.32 and lower (USDA Soil Conservation Service, September 1988).

5.1.3 Conditions of Canal and Reservoir Shorelines

"A description of reservoir shorelines and streambanks, including: (1) [s]teepness, composition (bedrock and unconsolidated deposits), and vegetative cover; and (2) [e]xisting erosion, mass soil movement, slumping, or other forms of instability, including identification of project facilities or operations that are known to or may cause these conditions." 18 CFR §5.6(d)(3)(ii)(C)

The segments of the Loup Power Canal were constructed by excavating trapezoidal channel sections and raising embankment sections using soils that existed at, or very near to, the canal alignment. Bottom widths of the canal segments range from less than 40 feet in the Upper Power Canal to over 600 feet where the Tailrace Canal flares out above the Outlet Weir. When constructed, the original canal side slopes ranged from 3:1 to 2:1 (horizontal:vertical). Flow velocities through the Loup Power Canal are low because the average gradient is only about 3 inches per mile. However, the unlined bed and banks are continually subjected to scouring forces from water and ice. In many places, the canal banks are well vegetated and quite stable, but in many other places, the canal banks are prone to erosion. Sediment bars can form on the inside of canal bends, which can cause undermining and sloughing of the outer bank.

Photo 5-1. An undermined slope on the Lower Power Canal.

To protect and maintain the canal slopes and prevent erosion, District personnel work throughout the year using brush bundles and riprap, as follows. At numerous locations along the canal, small trees and bundles of woody vegetation that have been cleared from embankment sections are secured with cables along eroding or undermined shorelines (see Section 4, Photo 4-12). These brush bundles reduce local flow velocity and induce sediment to settle out and "naturally" re-establish the shoreline. In other locations, large riprap must be used to control bank erosion. Over the decades, broken concrete riprap has been applied along much of the Loup Power Canal to control erosion (see Section 4, Photo 4-38). Additional shore protection measures employed on the Loup Power Canal include the selective removal of trees and woody growth and the plugging and repair of rodent holes.

Two short segments of the Loup Power Canal have been designated as high-hazard reaches because an embankment failure could put nearby residential areas at risk. These reaches are in Genoa and just upstream of the Columbus Powerhouse. The District maintains stockpiles of riprap and fill material near both high-hazard reaches to quickly respond to any embankment erosion or shore protection issues.

To combat troublesome bank sloughing and erosion along the Tailrace Canal during the 1950s and 1960s, hundreds of junked automobiles were lined side by side along the embankment waterline. This Detroit riprap, as it is known locally, may not have been aesthetically pleasing, but it did stabilize the shoreline quite effectively (see Section 4, Photo 4-40).

The regulating reservoir was constructed by compacting successive layers of soil to raise embankment dikes to the specified elevation. Frequent water level fluctuation, wind driven waves, and ice are all shoreline erosion concerns in the impoundment. The south shores of both Lake Babcock and Lake North are lined with concrete riprap to control erosion.

Photo 5-2. Riprap shore protection on Lake Babcock.

On the north and east dikes forming Lake Babcock, innovative "reversed concave" concrete wave walls were constructed to handle wind-generated waves (see Section 4, Photo 4-30). On the east, south, and west dikes forming Lake North, vertical steel and concrete wave walls were constructed. These capital-intensive measures have been effective in controlling shoreline erosion in the regulating reservoir.

The embankments forming the regulating reservoir are reviewed periodically as part of FERC's Part 12(d) dam safety inspection. These embankments are considered to be stable and require only nominal monitoring. Furthermore, there has never been any mass soil movement associated with the Project.

5.2 WATER RESOURCES

The potential applicant must include in the pre-application document "[a] description of the water resources of the proposed project and surrounding area. This must address the quantity and quality (chemical/physical parameters) of all waters affected by the project, including but not limited to the project reservoir(s) and tributaries thereto, bypassed reach, and tailrace. Components of the description must include:" 18 CFR §5.6(d)(3)(iii)

As noted in Section 3, General Description of the River Basin, the Loup River Basin is part of the larger Platte River Basin. Because flows released from the Columbus Powerhouse are returned to the Platte River, water resources information for both the Loup and Platte River basins is provided in this section.

5.2.1 Drainage Area

"Drainage area." 18 CFR §5.6(d)(3)(iii)(A)

The Loup River Basin at its confluence with the Platte River has a total drainage area of approximately 15,200 square miles of total land area. At the point of diversion on the Loup River, the Loup River Basin has a total drainage area of approximately 14,300 square miles of total land area. The Platte River Basin upstream of the Loup River and the Project has a total drainage area of approximately 59,320 square miles of total land area, as shown in Section 3, Figure 3-1 (USGS, 2008).

5.2.2 Flows

"The monthly minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, specifying any adjustments made for evaporation, leakage, minimum flow releases, or other reductions in available flow." 18 CFR §5.6(d)(3)(iii)(B)

"…[M]onthly flow duration curve[s] indicating the period of record [(2003-2007)] and the location of gauging station(s), including identification number(s), used in deriving the curve; and a specification of the critical streamflow used to determine the project's dependable capacity." 18 CFR §5.6(d)(3)(iii)(C)

Available Data

Nine stream gages were used to evaluate streamflows. These nine gage locations are shown in Figure 5-4, and the seven gage locations nearest to the Project are shown in relation to the Project in Figure 5-5. Additional information for each stream gage is provided below. For USGS stream gages, information was obtained from the USGS website (USGS, 2008).

Flow in the Loup River at the point of diversion was quantified using two USGS gages:

- USGS Gage 06793000, Loup River near Genoa, NE – This gage is located on the Loup River approximately 6 miles downstream of the point of diversion, 2 miles south of Genoa on the Nebraska State Highway 39 bridge. The total and contributing drainage areas at this gage are approximately 14,320 and 5,620 square miles, respectively. The period of record for approved data is April 1929 to October 2007[1]; however, data between July 1932 and October 1943 are not available on the USGS website.
- USGS Gage 06792500, Loup River Power Canal near Genoa, NE – This gage is located on the Loup Power Canal at the downstream extent of the Settling Basin. The gage is located approximately 2 miles downstream of the point of diversion, and the period of record for approved data is January 1937 to October 2007.

Flow in the vicinity of the Project was also quantified using the following gages:

- NDNR Gage 00082100, Loup River Power Canal Return [Tailrace Canal] at Columbus, NE – This gage is located on the Tailrace Canal at the 8th Street bridge in Columbus. The gage is located approximately 4 miles downstream of the Columbus Powerhouse, and the period of record for approved data is October 2002 to September 2007.
- USGS Gage 06794500, Loup River at Columbus, NE – This gage is located on the Loup River approximately 28 miles downstream of the point of diversion, 1 mile south of Columbus on the U.S. Highway 30/81 bridge. The total and contributing drainage areas at this gage are approximately 15,200 and 6,230 square miles, respectively. The period of record for approved data is April 1934 to October 1978.
- USGS Gage 06794000, Beaver Creek at Genoa, NE – This gage is located on Beaver Creek at the Nebraska State Highway 39 bridge in Genoa. The total and contributing drainage areas at this gage are approximately 677 and 429 square miles, respectively. The period of record for approved data is October 1943 to October 2007.
- USGS Gage 06774000, Platte River near Duncan, NE – This gage is located on the Platte River approximately 9 miles upstream of the confluence of the Loup and Platte rivers, approximately 1.5 miles south of Duncan, Nebraska, on the 287th Avenue bridge. The total and contributing

[1] For the majority of the gages, 2007 data were the latest USGS approved data available for evaluation.

drainage areas at this gage are approximately 59,300 and 54,630 square miles, respectively. The period of record for approved data is May 1895 to October 2007; however, data between 1895 and 1928 is incomplete. Therefore, the period of record for continuous approved data is October 1928 to October 2007.

- USGS Gage 06796000, Platte River at North Bend, NE – This gage is located on the Platte River approximately 30 miles downstream of the confluence of the Loup and Platte rivers, approximately 1 mile south of North Bend, Nebraska, on the Nebraska State Highway 79 bridge. The total and contributing drainage areas at this gage are approximately 70,400 and 57,800 square miles, respectively. The period of record for approved data is April 1949 to November 2007.
- USGS Gage 06801000, Platte River near Ashland, NE – This gage is located on the Platte River approximately 74 miles downstream of the confluence of the Loup and Platte rivers, approximately 4 miles northeast of Ashland, Nebraska, on the U.S. Highway 6 bridge. The total drainage area at this gage is approximately 84,200 square miles; the contributing drainage area is not available from USGS. The period of record for approved data is September 1928 to October 2007.
- USGS Gage 06805500, Platte River at Louisville, NE – This gage is located on the Platte River approximately 85 miles downstream of the confluence of the Loup and Platte rivers, approximately 1 mile north of Louisville, Nebraska, on the Nebraska State Highway 50 bridge. The total and contributing drainage areas at this gage are approximately 85,329 and 71,000 square miles, respectively. The period of record for approved data is June 1953 to October 2007.

Because the nine gages listed above have varying periods of record for approved data, it was necessary to establish a consistent period of record to compare flows at various gage locations, such as comparing diverted flows off of the Loup River to returned flows into the Platte River. The earliest consistent date for which approved data were available for a majority of the gages was October 1949. The latest consistent date for which approved data were available for a majority of the gages was September 2007; stream gage data from late 2007 to the present are preliminary in nature and will be evaluated and established as approved data by USGS at some point in the future. Therefore, the period of record from October 1949 through September 2007 (Water Year 1950 through Water Year 2007) was established as the period of record for evaluation. This period of record was used for determining all flow statistics for the Project except for the Loup River gage at Columbus (USGS Gage 06794500), the Tailrace Canal gage on 8th Street in Columbus (NDNR Gage 00082100), and the Platte River gage at Louisville (USGS Gage 06805500).

The accuracy of USGS streamflow data depends primarily on the following two factors (USGS, April 11, 2008):

1. Stability of the stage-discharge relation or, if the control is unstable, frequency of the discharge measurements
2. Accuracy of observations of stage, measurements of discharge, and interpretations of records

For each stream gage, USGS describes the degree of accuracy of the streamflow records on an annual basis as follows (USGS, April 11, 2008):

- Excellent – Approximately 95 percent of the daily discharges are within 5 percent of the true value.
- Good – Approximately 95 percent of the daily discharges are within 10 percent of the true value.
- Fair – Approximately 95 percent of the daily discharges are within 15 percent of the true value.
- Poor – Daily discharges have less than "fair" accuracy.

Different accuracies may be attributed to different parts of an individual stream gage's annual record (USGS, April 11, 2008).

The accuracy of each stream gage is available on only an annual basis, not for the entire period of record established for evaluation in this PAD. Therefore, it is difficult to categorize the overall accuracy of each stream gage for the period of record. However, the typical accuracy for the majority of the annual stream gage records reviewed was described as "good" to "fair," with a small portion of annual records described as "poor." This indicates that the majority of the streamflows discussed in this PAD are within 10 to 15 percent of the actual value.

In accordance with USGS methods (USGS, April 11, 2008), daily mean discharges presented in this PAD are reported as whole numbers up to 1,000 cfs and to three significant figures for discharges above 1,000 cfs.

Flow Statistics

Point of Diversion

Monthly flow duration curves for the Loup River near Genoa were developed for Water Year 1950 through Water Year 2007. This was done by ranking the average daily flows for each month over the period of record in descending order, calculating percent exceedance[2] for each average daily discharge, and plotting the average daily

[2] The percent exceedance is the percentage of time that a given average daily discharge is equaled or exceeded.

discharges versus percent exceedance. These monthly flow duration curves are presented in Appendix C. Average daily minimum, mean, and maximum flows on the Loup River near Genoa were also calculated for the period of record for each month and are provided in Table 5-1. The daily mean flow varies between 159 cfs in October and 1,640 cfs in March.

Table 5-1. Average Daily Minimum, Mean, and Maximum Flows by Month on the Loup River near Genoa, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	8	1,030	5,200
February	13	1,380	25,000
March	17	1,640	31,700
April	4	729	17,300
May	0	657	16,200
June	0	729	40,200
July	0	353	27,500
August	0	249	70,800
September	0	263	8,880
October	0	159	4,060
November	2	469	6,460
December	3	1,150	5,000

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06793000 on the Loup River near Genoa.

Monthly flow duration curves for Loup Power Canal near Genoa were developed for Water Year 1950 through Water Year 2007 using the same procedures described above. These monthly flow duration curves are presented in Appendix C. Average daily minimum, mean, and maximum flows on the Loup Power Canal near Genoa were also calculated for the period of record for each month and are provided in Table 5-2. The daily mean flow varies between 978 cfs in December and 2,200 cfs in April.

Table 5-2. Average Daily Minimum, Mean, and Maximum Flows by Month on the Loup Power Canal near Genoa, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	5	1,160	2,790
February	9	1,590	2,990
March	13	1,900	3,160
April	93	2,200	3,350
May	12	2,050	3,430
June	94	1,950	3,250
July	132	1,380	3,320
August	0	1,300	3,090
September	0	1,610	3,320
October	4	2,010	3,220
November	3	1,900	3,560
December	1	978	3,050

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06792500 on the Loup Power Canal near Genoa.

Average daily flows at the point of diversion were quantified by adding the flows at USGS Gage 06793000 on the Loup River near Genoa and USGS Gage 06792500 on the Loup Power Canal near Genoa. Flow duration statistics were calculated by adding average daily flows at these two gages and then adjusting for losses/reductions in flow.

No substantial inflows exist between the point of diversion and the USGS gage on the Loup Power Canal near Genoa (within the Settling Basin). Average annual flow removed from the Settling Basin for dredging activities was estimated by using the average annual hours during which dredging occurs (3,400 hours/year) and the dredging capacity (61 cfs). Using the percentage of time dredging occurs for the year (39 percent), the average daily flow removed from the Settling Basin for dredging activities was estimated at 24 cfs, which is negligible relative to the amount of flow diverted and within the measuring tolerance of the stream gage. A portion of flow diverted for dredging activities returns via seepage to the Loup Power Canal downstream of the Settling Basin and to the Loup River both upstream and downstream of the point of diversion.

Flow losses between the point of diversion and the USGS gage on the Loup Power Canal near Genoa as well as between the point of diversion and the USGS gage on the Loup River near Genoa include evaporation and seepage. These evaporation losses were estimated using average daily pan evaporation data. The nearest available weather station with evaporation data, Grand Island, was used. The period of record was 1963 to 1994. Net pan evaporation data were computed by subtracting the daily precipitation data from the daily pan evaporation. The daily precipitation was obtained from the National Weather Service gage at Columbus for a period of record of 1949 to 2001 (National Oceanic and Atmospheric Administration [NOAA] National Climatic Data Center [NCDC], August 2002). Evaporation and precipitation data for the month of July were used for estimating conservatively high net pan evaporation. The net pan evaporation estimates were converted to lake evaporation using *The Climate Atlas of the United States* (NOAA NCDC, 1983).

Average daily net evaporation rates were then estimated using the lake evaporation estimates and the total surface area of the Settling Basin (approximately 330 feet wide and 10,000 feet long) and the Loup River between the point of diversion and the respective gages (approximately 100 feet wide and 6.1 miles long). The losses associated with evaporation were calculated to be approximately 1.1 acre-feet/day (0.6 cfs), which is 0.04 percent of the average daily flow for July in the Settling Basin. The losses associated with evaporation for the Loup River between the point of diversion and the USGS gage on the Loup River near Genoa were calculated to be approximately 1.1 acre-feet/day (0.5 cfs), which is 0.16 percent of the average daily flow for July of the Loup River near Genoa; therefore, evaporation losses were considered negligible with respect to the quantity of flow and not used for reduction of average daily discharges.

Sediment is dredged from the Settling Basin from late March to early June and from mid-August to November each year. Given the amount of sediment accumulation, the Settling Basin likely reseals between periods of dredging, and seepage would be minimal relative to the quantity of flow diverted and likely within the gage accuracy tolerance. In addition, seepage losses from the Settling Basin likely return to the Loup River through groundwater flows. Therefore, seepage losses between the point of diversion and the USGS gage on the Loup Power Canal near Genoa were considered negligible and not used for reduction of average daily discharges.

Monthly flow duration curves for Loup River flows at the point of diversion for Water Year 1950 through Water Year 2007 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge). These monthly flow duration curves are presented in Appendix C. Average daily minimum, mean, and maximum flows on the Loup River at the point of diversion were also calculated for the period of record for each month and are provided in Table 5-3. Daily mean flow varies between 1,550 cfs in August and 3,540 cfs in March. Average daily minimum and maximum flows on the Loup River near Genoa and on the Loup Power

Canal near Genoa may not occur on the same day; therefore, average daily minimum and maximum flows on the Loup River at the point of diversion may not result from directly adding the values shown in Tables 5-1 and 5-2.

Table 5-3. Average Daily Minimum, Mean, and Maximum Flows by Month on the Loup River at the Point of Diversion, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	304	2,190	7,270
February	367	2,970	25,952
March	293	3,540	33,080
April	1,502	2,930	18,650
May	854	2,700	18,570
June	283	2,680	41,600
July	133	1,730	29,940
August	64	1,550	72,560
September	398	1,870	11,530
October	957	2,170	6,000
November	164	2,370	7,207
December	66	2,120	5,117

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06793000 on the Loup River near Genoa and USGS Gage 06792500 on the Loup Power Canal near Genoa. Flows at the point of diversion were calculated by adding the flows at these two gages.

Tailrace Canal

Monthly flow duration curves for the Tailrace Canal at Columbus for Water Year 2003 through Water Year 2007 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge), except real-time discharge data (in 15-minute intervals) was used rather than average daily flows. These flow duration curves are presented in Appendix C. Minimum, mean, and maximum flows on the Tailrace Canal at Columbus were also calculated for the period of record for each month and are provided in Table 5-4. Mean flow varies between 891 cfs in December and 2,020 cfs in April.

Table 5-4. Minimum, Mean, and Maximum Flows by Month on the Tailrace Canal at Columbus, Water Year 2003 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	50	938	3,540
February	60	1,550	4,990
March	70	1,870	6,340
April	62	2,020	6,220
May	74	1,760	5,540
June	62	1,800	4,000
July	53	1,160	5,900
August	43	1,240	5,620
September	16	1,550	5,340
October	39	1,780	4,760
November	53	1,810	4,820
December	49	891	4,400

Note:

[a] Calculated for period October 1, 2002, through September 30, 2007, using flow records from NDNR Gage 00082100 on the Tailrace Canal at the 8th Street bridge in Columbus.

Loup River

Monthly flow duration curves for the Loup River at Columbus for April 1934 through October 1978 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge). These monthly flow duration curves are presented in Appendix C. Daily minimum, mean, and maximum flows on the Loup River at Columbus were also calculated for the period of record for each month and are provided in Table 5-5. The daily mean flow varies between 424 cfs in October and 2,070 cfs in March.

Table 5-5. Average Daily Minimum, Mean, and Maximum Flows by Month on the Loup River at Columbus, April 1934 to October 1978[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	46	797	6,090
February	20	1,280	24,700
March	105	2,070	37,400
April	60	988	27,600
May	77	1,040	19,500
June	68	1,600	50,000
July	9	668	24,800
August	2	486	77,100
September	2	468	14,700
October	28	424	7,970
November	31	637	4,150
December	30	996	4,200

Note:

[a] Calculated for period April 1, 1934, through September 30, 1978, using flow records from USGS Gage 06794500 on the Loup River at Columbus.

Beaver Creek

Monthly flow duration curves for Beaver Creek at Genoa for Water Year 1950 through Water Year 2007 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge). These monthly flow duration curves are presented in Appendix C. Daily minimum, mean, and maximum flows on Beaver Creek at Genoa were also calculated for the period of record for each month and are provided in Table 5-6. The daily mean flow varies between 80 cfs in September and 214 cfs in June.

Table 5-6. Average Daily Minimum, Mean, and Maximum Flows by Month on Beaver Creek at Genoa, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	15	86	800
February	32	133	4,400
March	30	196	4,820
April	55	174	1,650
May	55	186	5,940
June	24	214	7,010
July	0	141	10,000
August	1	94	7,220
September	3	80	1,150
October	33	84	715
November	30	90	1,070
December	17	88	680

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06794000 on Beaver Creek at Genoa.

Platte River

Monthly flow duration curves for the Platte River at Duncan for Water Year 1950 through Water Year 2007 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge). These monthly flow duration curves are presented in Appendix C. Daily minimum, mean, and maximum flows on the Platte River at Duncan were also calculated for the period of record for each month and are provided in Table 5-7. The daily mean flow varies between 691 cfs in August and 2,860 cfs in March.

Table 5-7. Average Daily Minimum, Mean, and Maximum Flows by Month on the Platte River at Duncan, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	11	1,590	8,400
February	70	2,330	10,400
March	384	2,860	22,900
April	185	2,480	18,600
May	2	2,500	18,200
June	0	2,740	23,700
July	0	1,350	23,800
August	0	691	7,100
September	0	954	9,150
October	0	1,370	8,720
November	0	1,520	6,510
December	0	1,520	8,200

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06774000 on the Platte River near Duncan.

Monthly flow duration curves for the Platte River at North Bend for Water Year 1950 through Water Year 2007 were developed using the same procedures described above (that is, ranking average daily flows in descending order and calculating percent exceedance for each average daily discharge). These monthly flow duration curves are presented in Appendix C. Daily minimum, mean, and maximum flows on the Platte River at North Bend were also calculated for the period of record for each month and are provided in Table 5-8. The daily mean flow varies between 2,500 cfs in August and 7,120 cfs in March.

Table 5-8. Average Daily Minimum, Mean, and Maximum Flows by Month on the Platte River at North Bend, Water Year 1950 to Water Year 2007[a]

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	324	3,370	11,000
February	706	5,230	22,000
March	700	7,120	82,300
April	1,670	5,930	31,000
May	814	5,810	34,500
June	250	6,360	64,900
July	36	3,520	46,000
August	126	2,500	57,600
September	153	3,020	25,700
October	846	3,710	18,400
November	450	4,070	11,000
December	228	3,550	11,900

Note:

[a] Calculated for period October 1, 1949, through September 30, 2007, using flow records from USGS Gage 06796000 on the Platte River at North Bend.

Water Budget

Flow depletions on the Platte River associated with the Loup Power Canal were estimated through development of an annual water budget. Incremental and cumulative water budgets were developed for the Loup Power Canal using USGS Gage 06792500 on the Loup Power Canal near Genoa, power generation records at the Columbus Powerhouse, and NDNR Gage 00082100 on the Tailrace Canal at Columbus. As stated near the beginning of Section 5.2.2, these three data sources have varying periods of record. Based on the limiting record at the Tailrace Canal, a consistent period of record was established as October 2002 to September 2007 (Water Year 2003 through Water Year 2007).

Stream gage data consisted of real-time discharge data (typically 15-minute intervals). A volume was calculated by multiplying the real-time discharge and the respective time interval. Using these individual volumes, a cumulative total volume for each respective water year was then calculated. Discharge records are reported as whole numbers up to 1,000 cfs and to three significant figures for discharges above 1,000 cfs, in accordance with USGS methods (USGS, April 11, 2008). Average daily flows on the Loup Power Canal near Genoa and on the Tailrace Canal at Columbus are typically above 1,000 cfs; therefore, volumes derived from these flows were also reported in this PAD using three significant figures.

Discharge versus power generation curves were used along with hourly power generation records from a sample of 20 days to determine a relationship of water volume to power generation at the Columbus Powerhouse. Because the Columbus Powerhouse turbines were refurbished between March 2004 and March 2007, a water-volume-to-power-generation relationship was developed for both pre- and post-refurbishment. Monthly power generation records were then used along with the water-volume-to-power-generation relationships to calculate total water volume passing through the Columbus Powerhouse for each respective water year.

A summary of the water budget results for the Loup Power Canal are presented in Tables 5-9 through 5-11.

Table 5-9. Annual Water Volume Comparison, Loup Power Canal near Genoa to the Columbus Powerhouse, Water Year 2003 to Water Year 2007[a]

Water Year	Loup Power Canal near Genoa (acre-feet)	Columbus Powerhouse (acre-feet)	Net Gain (+)/Loss (-) (acre-feet)
2003	1,110,000	1,060,000	-50,000
2004	970,000	910,000	-60,000
2005	1,060,000	1,010,000	-50,000
2006	1,060,000	1,030,000	-30,000
2007	1,280,000	1,210,000	-70,000
Average Annual	1,096,000	1,044,000	-52,000

Note:

[a] Calculated for period October 1, 2002, through September 30, 2007, using flow records from USGS Gage 06792500 on the Loup River Power Canal near Genoa and power generation records at the Columbus Powerhouse.

The portion of the Project between the Loup Power Canal near Genoa and the Columbus Powerhouse (Upper and Lower Power Canal, Lake Babcock, Lake North, and Intake Canal) appears to lose an average of approximately 52,000 acre-feet. This loss is attributed to a combination of evaporation from the canal, water taken from the canal for irrigation, and seepage from the canal. Average annual net evaporation was estimated at 2,520 acre-feet based on the surface area of the Loup Power Canal, Lake Babcock, and Lake North and the average annual net lake evaporation from *The Climate Atlas of the United States* (NOAA NCDC, 1983). Average annual withdrawals for irrigation from the canal are estimated at 1,990 acre-feet based on the District's files of irrigator meter records. However, there are 12 identified culverts that discharge into the Loup Power Canal between the point of diversion and the

Columbus Powerhouse. They have a total drainage area of 2.8 square miles. Based on gage data and generalized estimates of mean annual runoff, the average annual runoff in the Columbus area is approximately 2 inches, which results in an annual surface water runoff of approximately 300 acre-feet/year (Missouri Basin Inter-Agency Committee, June 1969). The resulting average annual loss, approximately 47,800 acre-feet, is attributed to seepage, which is approximately 4.4 percent of the total flow diverted into the Loup Power Canal near Genoa.

The portion of the Project between the Columbus Powerhouse and the Tailrace Canal gains an average of approximately 64,000 acre-feet, as shown in Table 5-10. Much of this gain likely occurs from the Lost Creek Flood Control Channel inflows into the Tailrace Canal immediately downstream of the Columbus Powerhouse. The contributing drainage area of the Lost Creek Flood Control Channel is 15 square miles. Using the mean annual runoff for the Columbus area described above, the annual surface water runoff is approximately 1,600 acre-feet/year. In addition, there are 13 identified culverts that drain into the Loup Power Canal between the Columbus Powerhouse and the Tailrace Canal that have a total drainage area of 5.1 square miles. Using the mean annual runoff for the Columbus area described above, the annual surface water runoff of approximately 550 acre-feet/year. In addition to surface runoff, flows in the Lost Creek Flood Control Channel are attributed to seepage from the Loup Power Canal and intersection of the local groundwater table (USACE, January 1981). The net lake evaporation between the Columbus Powerhouse and the Tailrace Canal is approximately 80 acre-feet.

Table 5-10. Annual Water Volume Comparison, Columbus Powerhouse to the Tailrace Canal, Water Year 2003 to Water Year 2007[a]

Water Year	Columbus Powerhouse (acre-feet)	Tailrace Canal (acre-feet)	Net Gain (+)/Loss (-) (acre-feet)
2003	1,060,000	1,140,000	80,000
2004	910,000	980,000	70,000
2005	1,010,000	1,080,000	70,000
2006	1,030,000	1,070,000	40,000
2007	1,210,000	1,270,000	60,000
Average Annual	1,044,000	1,108,000	64,000

Note:

[a] Calculated for period October 1, 2002, through September 30, 2007, using power generation records at the Columbus Powerhouse and flow records from NDNR Gage 00082100 on the Tailrace Canal at the 8th Street bridge in Columbus.

Overall, between the Loup Power Canal near Genoa and the Tailrace Canal at Columbus, the Project appears to gain an average of approximately 12,000 acre-feet, as shown in Table 5-11. This gain is attributed to Lost Creek Flood Control Channel surface drainage, local area drainage, seepage capture, and interception of the water table. The data for Water Year 2007 show a loss of 10,000 acre-feet. Based on the annual trends from 2003 to 2006, one would expect a net gain in 2007. According to NDNR, tail water influence on the gage from high flows on the Platte River during 2007 are likely responsible for the discrepancy. NDNR will review the data and provide an update once the review is completed.

Table 5-11. Annual Water Volume Comparison, Loup Power Canal near Genoa to the Tailrace Canal, Water Year 2003 to Water Year 2007[a]

Water Year	Loup Power Canal near Genoa (acre-feet)	Tailrace Canal (acre-feet)	Net Gain (+)/Loss (-) (acre-feet)
2003	1,110,000	1,140,000	30,000
2004	970,000	980,000	10,000
2005	1,060,000	1,080,000	20,000
2006	1,060,000	1,070,000	10,000
2007	1,280,000	1,270,000	-10,000
Average Annual	1,096,000	1,108,000	12,000

Note:

[a] Calculated for period October 1, 2002, through September 30, 2007, using flow records from USGS Gage 06792500 on the Loup Power Canal near Genoa and from NDNR Gage 00082100 on the Tailrace Canal at the 8th Street bridge in Columbus.

Specific Gage Analysis

A specific gage analysis was performed using the Platte River gages near Duncan, North Bend, Ashland, and Louisville. Mean daily discharge and corresponding stage records for each gage were obtained from the USGS website at http://waterdata.usgs.gov/nwis/. The period of record for this discharge and stage data for each gage are listed in Table 5-12. The mean daily discharge versus the stage was plotted for each year for each gage. A trend line was established by determining a best fit using an exponential equation. Several points plotted above the trend line in a similar shape to the trend line, meaning a higher stage required for a given discharge. A review of the records showed that the majority of these discharges occurred between December and February. For example, a discharge of 3,000 cfs has a stage of 4.5 feet, but in December, that same discharge has a stage of 6 feet. Although not designated as ice affected by USGS, these discharges and corresponding stages from December to February appear to represent a systemic shift during this time period and were removed from the data set, thus increasing the accuracy of the predicted trend line. Specific rating curves were generated for each gage based on the stage versus discharge curves. The specific gage rating curves are located in Appendix D.

Table 5-12. Discharge/Stage Period of Record

USGS Gage	Discharge/Stage Period of Record
06774000 near Duncan	1997-2007
06796000 at North Bend	1989-2007
06801000 near Ashland	1995-2007
06805500 at Louisville	1985-2007

The Duncan gage has shown a stable trend for lower flows (ranging between 500 and 1,000 cfs) for the previous 10 years. However, at higher discharges (10,000 to 30,000 cfs), the trend has shifted from degradational to aggradational. At North Bend and Ashland, the stage trend has remained fairly stable, with aggradational and degradational trends less than 0.5 foot for discharges ranging between 500 and 30,000 cfs. The Louisville gage has shown a slightly degradational trend of less than 0.5 foot for the previous 20 years. In a few instances, a temporary decline or increase occurred. This is attributed to extrapolating the stage discharge curve for that given year. For example, in 2002, the maximum discharge at North Bend was approximately 8,000 cfs. Extrapolating the best fit line for discharges in excess of 10,000 cfs seemed to under-predict the corresponding stage.

Sediment Yield Analysis

A sediment yield analysis for the Platte River Basin was conducted by the Missouri River Basin Commission (September 1975). The Platte River Basin was divided into subwatersheds, one of which was the Loup River Basin. Sediment yields for each subwatershed were calculated by determining the sediment production from all erosion processes (sheet and rill, gully, and streambank). The calculated sediment yields for subwatersheds of interest, as well as cumulative sediment yield at points of interest in the Platte and Loup River basins, are listed in Table 5-13.

Table 5-13. Sediment Yield Analysis

Subwatershed or Reach	Sediment Yield (tons/year)	Cumulative Sediment Yield (tons/year)
Subbasin Total at Genoa above Point of Diversion		7,825,100
Sediment removed from Settling Basin	1,900,000	
Sediment passing down Loup Power Canal	700,000	
Subbasin Total at Genoa below Point of Diversion		5,225,100
Beaver Creek, Looking Glass Creek, Cherry/Dry Creek, and Loup River below Point of Diversion	1,860,300	
Load passing down Loup Power Canal to Platte River	350,000	
Loup Subbasin Yield to Platte River at Columbus		7,435,400
North Platte River trapped in Lake McConaughy	535,400	
Near North Platte from South Platte River Basin at Maxwell Diversion		2,309,700
Yield diverted at Maxwell Diversion	1,616,800	
Yield passing Maxwell Diversion		692,900
Tributaries between Maxwell Diversion and Wood River	887,200	1,580,100
Box Elder and Prairie Creek	189,800	1,769,900
Warm Slough-Silver Creek, Platte Tributaries, Jones and Clear Creek	95,500	
Upper Platte River Basin at Columbus		1,865,400
Upper Platte and Loup Subbasins to Lower Platte at Columbus		9,300,800
Platte Basin Yield including Elkhorn River		16,640,600
Total Platte Basin Yield at Louisville		16,840,000
Grand Total Platte Basin to Missouri River		16,957,700

Source: Missouri River Basin Commission, September 1975, "Platte River Basin—Nebraska, Level B Study, Land Conservation and Sedimentation," Technical Paper.

Based on the Missouri River Basin Commission study, the amount of dredged material from the Settling Basin was 1,900,000 tons per year of sediment from the Loup River (September 1975). This rate corresponds with District dredge records through 1975 for average annual material dredged (2,223,696 tons per year). However, since 1976, the average rate of sediment withdrawal by dredge has decreased to 1,233,780 tons per year. The District deposits dredged material at the North SMA (north of the Settling Basin, away from the Loup River) and at the South SMA (south of the Settling Basin, adjacent to the Loup River). Since 1976, the average annual amounts of sediment deposited at the North and South SMAs are 902,462 and 331,315 tons per year, respectively. After dredged material is deposited at the North SMA, the sand and water are conveyed through a series of ditches; a majority of the sand remains at the North SMA, and water eventually returns to the Loup Power Canal. After dredged material is deposited at the South SMA, the sand and water are conveyed adjacent to the Settling Basin in a northeasterly direction; a majority of the sand and water eventually flows back into the Loup River, as evidenced by establishment of large trees and only small changes in elevation of the South SMA. Prior to 1976, the amount of dredged material relative to the cumulative sediment yield at the mouth of the Loup and Platte rivers was approximately 26 and 13 percent, respectively. Since 1976, the amount of dredged material relative to the cumulative sediment yield at the mouth of the Loup and Platte rivers is approximately 14 and 7 percent, respectively, assuming that the dredged material at the South SMA is re-introduced to the Loup River.

5.2.3 Uses of Project Water

"Existing and proposed uses of project waters for irrigation, domestic water supply, industrial and other purposes, including any upstream or downstream requirements or constraints to accommodate those purposes." 18 CFR §5.6(d)(3)(iii)(D)

Project waters consist of flows diverted from the Loup River at the Headworks into the Settling Basin and ultimately into the Loup Power Canal. Existing uses of Project waters include hydropower generation, irrigation, habitat for fish and wildlife, and recreation. Hydropower generation at the Monroe Powerhouse occurs in a run-of-river mode. Project waters are temporarily ponded in Lake Babcock and Lake North for optimal hydropower generation at the Columbus Powerhouse. Lake Babcock and Lake North function as regulating reservoirs, not storage reservoirs. This means that the volume of water flowing into the reservoirs essentially equals the volume of water released from the reservoirs on a daily basis. Other than evaporation of water directly from the Loup Power Canal, Lake Babcock, and Lake North, water taken from the Loup Power Canal for irrigation purposes is the primary consumptive use of diverted flow. Project waters in the Loup Power Canal and the regulating reservoirs also serve aquatic habitat and recreational purposes, which are discussed in Sections 5.3 and 5.7, respectively. Currently, no new uses of Project waters are proposed.

In the vicinity of the Project, groundwater and surface water are primarily used for seasonal irrigation. In addition, a substantial amount of groundwater is used for domestic and industrial purposes in Genoa and Columbus (U.S. Environmental Protection Agency [EPA], June 2008; City of Columbus, 2007).

5.2.4 Flow Uses of Streams in the Vicinity of the Project

"Existing instream flow uses of streams in the project area that would be affected by project construction and operation; information on existing water rights and water rights applications potentially affecting or affected by the project." 18 CFR §5.6(d)(3)(iii)(E)

Instream Flows

No instream flow appropriations exist for the Loup River; however, administration of Loup River instream flows is impacted by the instream flow appropriations on the Lower Platte River, downstream of the confluence of the Loup and Platte rivers (NDNR, December 30, 2005). Downstream flow appropriators include NGPC for fish and wildlife purposes and the Metropolitan Utilities District for induced groundwater recharge. These two existing instream flow appropriations on the Lower Platte River are measured at USGS Gage 06796000 on the Platte River at North Bend and at USGS Gage 06805500 on the Platte River at Louisville.

Water Rights

As of August 2008, a total of 111 water right claims, applications, and appropriations existed within the Project Boundary, as shown in Table 5-14 (NDNR, 2008b). Claims are identified and based on one of the following: Nebraska state law of 1877, Nebraska state law of 1889, or actual and beneficial use prior to April 4, 1895 (NDNR, January 20, 2005). Beneficial use includes reasonable and efficient use of water for domestic, municipal, agricultural, industrial, commercial, power production, subirrigation, fish and wildlife, groundwater recharge, interstate compact, water quality maintenance, or recreational purposes (NDNR, August 2007). Separate applications must be filed for each new water appropriation and to obtain a permit (NDNR, January 20, 2005). Appropriations are permits to use water that have been achieved in accordance with the terms stipulated by NDNR's "Rules for Surface Water" (NDNR, January 20, 2005).

Table 5-14. Summary of Water Right Claims, Applications, and Appropriations by NDNR within the Project Boundary

Type of Use	Number of Water Right Holdings[a]	Total Allocated Annual Diversion (cfs)
Power Generation	1	3,500
Raise Dam	1	N/A
Irrigation	105	71.4
Domestic	1	0.17
Manufacturing	2	6.73
Cooling	1	56

Source: NDNR, 2008b, *Nebraska Surface Water Rights Data Retrieval*, retrieved on August 26, 2008, http://dnrdata.dnr.ne.gov/SWRCombined/SelectSearchOptions.aspx.

Note:

[a] As of August 2008, the NDNR database included no applications for water rights within the Project Boundary.

The District currently holds surface water rights from NDNR for use of 3,500 cfs for power generation (Appropriation No. A 2287). The hydropower appropriation for the Project is dated September 15, 1932[3] (NDNR, October 16, 2007). The District also holds a permit to temporarily pond water in Lake Babcock and Lake North for regulation purposes (Right/Permit ID 6222).

Nebraska water law (Nebraska State Statutes 70-668, 70-669, and 46-204) uses a priority and preference system to determine order of use for water. Priority is typically based on date of application, and preference is based on type of use. There are 973 water rights claims on the Loup River upstream of the point of diversion, with 43 being senior in priority to the District. Under Nebraska's water preference system, domestic and agricultural water use outranks water used for industrial and power generation purposes. Therefore, although the District has the senior water right in most cases, it cannot prevent consumptive uses upstream of the point of diversion for water uses with a higher preference. If a junior priority user receives waters from a senior priority user based on preference, the junior priority user must pay just compensation to the senior priority user.

[3] The District's water right is based on the date of application.

5.2.5 Water Quality

"Any federally-approved water quality standards applicable to project waters."
18 CFR §5.6(d)(3)(iii)(F)

"Seasonal variation of existing water quality data for any stream, lake, or reservoir that would be affected by the proposed project, including information on: (1) [w]ater temperature and dissolved oxygen, including seasonal vertical profiles in the reservoir; [and] (2) [o]ther physical and chemical parameters to include, as appropriate for the project; total dissolved gas, pH, total hardness, specific conductance, chlorophyll a, suspended sediment concentrations, total nitrogen (mg/L as N), total phosphorus (mg/L as P), and fecal coliform (E. coli) concentrations."
18 CFR §5.6(d)(3)(iii)(G)

Water Quality Standards

All Federally approved water quality standards for the State of Nebraska are included in Sections 303(d) and 305(b) of the Federal Clean Water Act (CWA) and in Title 117 of the Nebraska Administrative Code (33 United States Code [USC] 1251 et seq.; NDEQ, July 31, 2006).

Section 303(d) of the CWA requires states to identify and establish a priority ranking for all waterbodies in which technology-based effluent limitations required by Section 301 are not stringent enough to attain and maintain applicable water quality standards, to establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and to submit, from time to time, the (revised) list of impaired waterbodies and TMDLs to EPA. The requirements to identify and establish TMDLs apply to all waterbodies, regardless of whether a waterbody is impaired by point sources, nonpoint sources, or a combination of both (NDEQ, January 2006).

Section 305(b) of the CWA directs states to prepare a report every 2 years that describes the status and trends of existing water quality, the extent to which designated uses are supported, pollution problems and sources, and the effectiveness of the water pollution control programs (NDEQ, January 2006).

Title 117 includes three types of water quality standards—narrative criteria, numeric criteria, and an antidegradation clause—as described below:

- Narrative criteria – The narrative criteria that apply to the waters that are affected by the Project include the following (NDEQ, July 31, 2006):
    - Aesthetics – "This use applies to all surface waters of the state. To be aesthetically acceptable, waters shall be free from human-induced pollution which causes: 1) noxious odors; 2) floating, suspended, colloidal, or settleable materials that produce objectionable films, colors, turbidity, or deposits; and 3) the occurrence of undesirable or

nuisance aquatic life (e.g., algal blooms). Surface waters shall also be free of junk, refuse, and discarded dead animals."

- Biological Criteria – "Any human activity causing water pollution which would significantly degrade the biological integrity of a body of water or significantly impact or displace an identified 'key species' shall not be allowed except as specified in Chapter 2 [of Title 117]."
- Total Dissolved Gases – "Not to exceed 110 percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures."
- Toxic Substances – "Surface waters shall be free from toxic substances, alone or in combination with other substances, in concentrations that result in acute or chronic toxicity to aquatic life, except as specified in Chapter 2 [of Title 117]. Toxic substances shall not be present in concentrations that result in objectionable tastes or significant bioaccumulation or biomagnification in aquatic organisms which renders them unsuitable or unsafe for consumption."

- Numeric criteria – The numeric criteria that apply to the waters that are affected by the Project are presented in Appendix E, Tables E-1 through E-4. In addition, the State of Nebraska has developed nutrient criteria, which are a subset of numeric criteria, for lakes and impounded waters. The nutrient criteria standard applies to Lake Babcock and Lake North. The total phosphorus standard is 564 micrograms per liter (µg/L), the total nitrogen standard is 2300 µg/L, and the chlorophyll *a* standard is 29 µg/L (NDEQ, July 31, 2006).
- Antidegradation clause – Under the antidegregation clause, the water quality of surface waters, consistent with uses applied in Title 117, shall be maintained and protected. Water quality degradation that would adversely affect existing uses will not be allowed (NDEQ, July 31, 2006).

Waterbody Segments and Assigned Beneficial Uses

NDEQ has segmented all waterbodies in the State of Nebraska and has assigned beneficial uses to each designated segment (NDEQ, July 31, 2006). Segment reaches and lakes in the vicinity of the Project and their assigned beneficial uses are identified in Table 5-15. Descriptions of the use classifications follow the table. The locations of the segment reaches and lakes are shown in Figure 5-6.

Table 5-15. Assigned Beneficial Uses for Waters in the Vicinity of the Project

Waterbody	Segment Name	Basin	Segment ID	Use Classification						
				Recreation	Warmwater Aquatic Life	Public Drinking Water Supply	Agriculture Supply	Industrial Supply	Aesthetics	Key Species
Loup Power Canal	Diversion (Sec 6-16N-4W) to Sec 28-18N-2W (exits Loup River Basin into Lower Platte River Basin)	Loup River	LO1-20200	●	A		A		●	i,j
	Sec 28-18N-2W to Sec 35-17N-1E (enters Lower Platte River Basin from Loup River; exits into Middle Platte River Basin)	Lower Platte	LP1-21800	●	A		A	●	●	i,j
	Sec 35-17N-1E to Platte River (enters Middle Platte River Basin from Lower Platte River Basin)	Middle Platte	MP1-10200	●	A		A		●	i,j
Lake North	(Sec 31-18N-1E, Platte County)	Lower Platte	LP1-L0440	●	A		A	●	●	
Lake Babcock	(Sec 31-18N-1E, Platte County)	Lower Platte	LP1-L0450	●	A		A	●	●	

Waterbody	Segment Name	Basin	Segment ID	Use Classification						
				Recreation	Warmwater Aquatic Life	Public Drinking Water Supply	Agriculture Supply	Industrial Supply	Aesthetics	Key Species
Loup River	Loup River Canal Diversion (Sec 6-16N-4W) to Beaver Creek	Loup	LO1-20000	●	A*		A		●	i,j
	Beaver Creek to Platte River	Loup	LO1-10000	●	A*		A		●	i
Platte River	Wood River to Loup Power Canal (Sec 35-17N-1E)	Middle Platte	MP1-20000	●	A*		A		●	i,j
	Loup Power Canal (Sec 35-17N-1E) to Clear Creek	Middle Platte	MP1-10000	●	A*		A		●	i,j
	Clear Creek to Elkhorn River	Lower Platte	LP1-20000	●	A*	●	A		●	18,i,j,w

Source: NDEQ, July 31, 2006, Nebraska Administrative Code, Title 117, Nebraska Surface Water Quality Standards, available online at http://www.deq.state.ne.us/RuleAndR.nsf/pages/117-TOC.

Notes:

A = Class A waters (defined below)

i = Channel catfish

j = Flathead catfish

18 = Sturgeon chub

w = Walleye

* = Site-specific water quality criteria for ammonia are assigned.

The waters identified in Table 5-15 are all listed as Class A. Class A waters "are surface waters … which constitute an outstanding State or National resource, such as waters within national or state parks, national forests or wildlife refuges, and waters of exceptional recreational or ecological significance. Waters which provide a unique habitat for [F]ederally designated endangered or threatened species and rivers designated under the Wild and Scenic Rivers Act are also included. The existing quality of these surface waters shall be maintained and protected" (NDEQ, July 31, 2006).

The use classifications for the segment reaches and lakes in the vicinity of the Project are defined as follows (NDEQ, July 31, 2006):

- Primary Contact Recreation – "This use applies to surface waters which are used, or have a high potential to be used, for primary contact recreational activities. Primary contact recreation includes activities where the body may come into prolonged or intimate contact with the water, such that water may be accidentally ingested and sensitive body organs (e.g., eyes, ears, nose, etc.) may be exposed. Although the water may be accidentally ingested, it is not intended to be used as a potable water supply unless acceptable treatment is applied. These waters may be used for swimming, water skiing, canoeing, and similar activities. These criteria apply during the recreational period of May 1 through September 30."
- Warmwater Aquatic Life – "These are waters which provide, or could provide, a habitat consisting of sufficient water volume or flow, water quality, and other characteristics such as substrate composition which are capable of maintaining year-round populations of warmwater biota. Warmwater biota are considered to be life forms in waters where temperatures frequently exceed 25°C (77°F)." Waters designated as Class A – Warmwater "provide, or could provide, a habitat suitable for maintaining one or more identified key species on a year-round basis. These waters also are capable of maintaining year-round populations of a variety of other warmwater fish and associated vertebrate and invertebrate organisms and plants."
- Public Drinking Water – "These are surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses."
- Agriculture – "These are waters used for general agricultural purposes (e.g., irrigation and livestock watering) without treatment."

- Industrial – "These are waters used for commercial or industrial purposes such as cooling water, hydroelectric power generation, or nonfood processing water; with or without treatment. Water quality criteria to protect this use will vary with the type of industry involved. Where water quality criteria are necessary to protect this use, site-specific criteria will be developed."
- Aesthetics – "This use applies to all surface waters of the state. To be aesthetically acceptable, waters shall be free from human-induced pollution which causes: 1) noxious odors; 2) floating, suspended, colloidal, or settleable materials that produce objectionable films, colors, turbidity, or deposits; and 3) the occurrence of undesirable or nuisance aquatic life (e.g., algal blooms). Surface waters shall also be free of junk, refuse, and discarded dead animals."
- Key Species – Key species are "identified endangered, threatened, sensitive, or recreationally important aquatic species associated with a particular water body and its aquatic life use class."

Available Water Quality Data

NDEQ water quality data are available both directly from NDEQ and from data stored on EPA's STORET Database (EPA, March 9, 2006). Every NDEQ segment in the vicinity of the Project, shown in Table 5-15, has some NDEQ data associated with it. Data collected at these sites include pH, chloride, turbidity, conductance, dissolved oxygen (DO), and E. coli. NDEQ has a set 5-year rotation schedule for water quality sampling in each basin in Nebraska. The Loup River Basin was sampled last in 2003 and is currently being sampled again this year (2008). However, the 2008 data are not yet available to the public and therefore are not included in this PAD.

The only data that could be found for the two regulating reservoirs, Lake Babcock and Lake North, were E. coli and microcystin[4] data for Lake North; there are no vertical profiles of temperature, pH, or DO for either reservoir. The Lake North data were collected for public health reasons at the swimming beach and are presented in Appendix E, Tables E-5 through E-7. The Lake North E. coli data were collected from 2004 through 2008 for a total of 99 samples, with 94 samples above zero and 8 exceedences of the instantaneous recreational E. coli standard of 235 (number of organisms per 100 milliliters [mL]). The seasonal geometric means of E. coli from 2004 through 2008 were all below the 30-day geometric mean standard of 126

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4 Microcystin is a toxin generated from certain strains of blue-green algae. The term "blue-green algae" is a misnomer; it is actually a type of bacteria called cyanobacteria. Only some strains of cyanobacteria can produce the toxin Microcystin. The NDEQ Health Alert monitoring for lakes does not measure algal or bacterial biomass; it measures a toxin that can be produced by that biomass that is directly harmful to human health.

(no. per 100 mL). Microcystin data were collected 35 times over the last 2 years, with 18 of those samples yielding a result greater than zero. All 18 of those samples were below the NDEQ Health Advisory Threshold of 20 parts per billion (ppb); therefore, there were no health advisories listed for Lake North in either 2007 or 2008.

As stated previously, NDEQ divided the Loup Power Canal into three segments (see Table 5-15). The only data available for segments LP1-21800 and MP1-10200 are E. coli data, which are presented in Appendix E, Tables E-8 and E-9, respectively. The E. coli data available for segment LP1-21800 were collected from May 2004 through September 2007. Of the 61 samples that were taken, 12 exceeded the standard of 235 (no. per 100 mL). The E. coli data available for segment MP1-10200 were collected from May 2005 through September 2007. Of the 40 samples that were taken, 15 exceeded the standard of 235 (no. per 100 mL).

Segment LO1-20200 has substantially more data associated with it. This segment has been sampled for temperature, DO, pH, conductivity, ammonia, and chloride, and these data are provided in Appendix E, Table E-10. Additional data, including metals and pesticide data, have been collected at this site but are not shown here. The data were collected approximately monthly from 2001 through 2006. Of the 88 samples taken of DO in this segment, there were no results below the standard of 5.0 mg/L. There were three pH measurements of the 89 collected that exceeded the pH standard of 9. Conductivity and chloride both had 89 measurements collected with no exceedences of their respective standards. There were 85 samples taken of ammonia, and only 48 were above non-detect; none of these 48 samples was greater than the ammonia standard.

The Loup River was sampled extensively in 2003. The 2003 water quality data collected within segment LO1-10000 of the Loup River are provided in Appendix E, Table E-11. This segment was not sampled again until 2008. In 2003, DO, pH, conductivity, and chloride were all measured 23 times, with no results exceeding standards. E. coli was measured 23 times, 17 of which exceeded the standard of 235 (no. per 100 mL). Ammonia was sampled 23 times but detected in only 15 samples, while nitrate plus nitrite was sampled 23 times but detected in 19 samples. Neither ammonia nor nitrate plus nitrite was detected above NDEQ standards.

Water quality data were collected on the three segments of the Platte River in the vicinity of the Project, as discussed below. Water quality data from Platte River segment MP1-20000 are available from 2001 through 2006 and are presented in Appendix E, Table E-12. During this time, there were 98 measurements of DO recorded, one of which was below the standard of 5.0 mg/L. There were 94 measurements of pH, six of which were either above or below the pH standard of 9. There were 96 measurements of conductivity, none of which exceeded the standard. There were 35 measurements of E. coli taken, 10 of which were measured at zero. Of the 25 remaining samples, three were greater than the standard of 235 (no. per 100 mL). There were 100 samples taken of ammonia and 101 samples taken of nitrate plus nitrite. Of these samples, 61 were above the detection limit for ammonia and 82 were above the detection limit for nitrate plus nitrite, none of which exceeded acute standards. Finally, there were 101 measurements of chloride, none of which exceeded the chloride standard.

Water quality data from Platte River segment MP1-10000 were only collected in 2006. There were 22 measurements of DO, none of which were below the standard of 5.0 mg/L. There were 21 measurements of pH, three of which exceeded the pH standard of 9. There were 21 measurements of conductivity and 23 measurements of chloride, none of which exceeded standards. There were 23 samples taken of ammonia and 23 samples taken of nitrate plus nitrite. Of these samples, 18 were above the detection limit for ammonia and 9 were above the detection limit for nitrate plus nitrite, none of which exceeded acute standards. Finally, there were 22 measurements of E. coli, seven of which exceeded the standard of 235 (no. per 100 mL).

Water quality data from Platte River segment LP1-20000 are available from 2002 through 2006 and are presented in Appendix E, Table E-13. In this segment, 85 measurements each of DO, pH, and conductivity were taken, none of which exceeded their respective state standards. There were 20 samples of E. coli taken, half of which exceeded the standard of 235 (no. per 100 mL). There were 83 samples taken of ammonia and 83 samples taken of nitrate plus nitrite. Of these samples, 61 were above the detection limit for ammonia and 76 were above the detection limit for nitrate plus nitrite, none of which exceeded acute standards. Finally, there were 83 measurements of chloride, none of which exceeded the chloride standard. In addition, Atrazine sampling data for segment LP1-20000 is provided in Appendix E, Table E-14. There were 82 samples taken for Atrazine during this time period, 16 of which were non-detects. Of the remaining measured values, zero exceeded the acute criteria and 12 exceeded the chronic criteria. In addition, 11 Atrazine measurements and 10 seasonal Atrazine measurements exceeded the drinking water standard of 3 µg/L.

In addition to water quality data available from NDEQ, there are water quality data associated with two USGS gages. Both of these gages are a substantial distance from the Project. The first, USGS Gage 06768000, is on the Platte River near Overton, Nebraska, which is 134 miles upstream of the confluence of the Loup and Platte rivers. This gage has daily temperature values from March 21, 1978, through February 13, 1983, and from June 1, 2004, through June 2, 2008; however, the USGS website only offers daily statistics. In addition to the daily data, there is also an extensive amount of water quality data associated with this site starting in October 1976 and proceeding monthly (or every other month) to December 2002. This data includes nutrient, bacteriological, radiological, alkalinity, chlorophyll and algal species, and organic chemical data (USGS, 2008).

The second gage, USGS Gage 06805500, is on the Platte River at Louisville, which is 85 miles downstream of where the Loup Power Canal discharges into the Platte River. This gage has daily data on water temperature, specific conductance, DO, pH, and turbidity collected since May 2007. In addition to this data, there are an extensive amount of water quality data associated with the Project starting in January 1973 and proceeding monthly to the present, including nutrient data, bacteriological data, radiological data, alkalinity related data, chlorophyll and algal species data, and organic chemical data (USGS, 2008).

Impairments

Data used for the impairment assessment can be from any agency that meets the state's data quality objectives. Water quality data assessments and defined impairments are based on the state's surface water quality standards. Where numeric criteria are defined or narrative criteria can be quantified, NDEQ uses the percent of samples exceeding criteria to define whether a waterbody is supporting its assigned beneficial uses. In line with past EPA guidance, NDEQ uses a rate of 10 percent as an indicator of an impaired waterbody. The 2004, 2006, and 2008 Integrated Report Assessment Methodology reports describe how the state determines a designation of Supporting, Impaired, or Not Assessed for each beneficial use each time the Integrated Report is published. If no additional data have been collected in the time between assessments, the category will not be changed. The 2004, 2006, and 2008 Integrated Reports are summarized in Tables 5-16 through 5-18, respectively.

Using the available water quality data described above, and according to the procedures outlined in the 2004, 2006, and 2008 Integrated Reports, NDEQ first determines whether there is enough information to make an assessment at all. If it is determined that there is indeed enough information available to make an assessment, NDEQ will determine if a waterbody is supporting (S) its designated uses; if not, NDEQ will label the segment as impaired (I). Tables 5-16 through 5-18 show the results of this process, which occurs every other year.

Table 5-16. 2004 Integrated Report

Waterbody ID	Waterbody Name	Beneficial Uses[a]							Parameter Impairing Use	Comments
		Recreation	Aquatic Life	Public Drinking Water Supply	Agriculture Supply	Aesthetics	Industrial Supply	303(d) Category[b]		
LO1-20200	Loup Power Canal	Loup not in report								
LP1-21800	Loup Power Canal	I	I					5	Fecal coliform & PCBs	Fish tissue advisory
MP1-10200	Loup Power Canal							3		
LP1-L0440	Lake North		I		S	I	S	5	pH, Nutrients	
LP1-L0450	Lake Babcock						S	2		
LO1-20000	Loup River	Loup not in report								
LO1-10000	Loup River	Loup not in report								
MP1-20000	Platte River	I	S		S			4A	E. coli & Fecal coliform	Fecal coliform TMDL approved May 2003
MP1-10000	Platte River	I	S					4A	E. coli & Fecal coliform	Fecal coliform TMDL approved May 2003
LP1-20000	Platte River	I	I		S			5	Fecal coliform & PCBs	Fish tissue advisory

Source: NDEQ, March 2004, "2004 Surface Water Quality Integrated Report," Nebraska Department of Environmental Quality, Water Quality Division, available online at http://www.deq.state.ne.us/Publica.nsf/0/9b20b5698c99413106256ac7007266c9/$FILE/200%20IR-Final.pdf.

Notes:

[a] I = Impaired; S = Supporting

[b] Category 1 = Waterbodies where all designated uses are met.

Category 2 = Waterbodies where some of the designated uses are met but there is insufficient information to determine if all uses are being met.

Category 3 = Waterbodies where there is insufficient data to determine if any beneficial uses are being met.

Category 4 = Waterbody is impaired, but a TMDL is not needed. Sub-category 4A outlines the rationale for the waters not needing a TMDL.

Category 4A = Waterbody assessment indicates the waterbody is impaired, but all of the required TMDLs have been completed.

Category 5 = Waterbodies where one or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval.

Table 5-17. 2006 Integrated Report

Waterbody ID	Waterbody Name	Beneficial Uses[a]							Parameter Impairing Use	Comments
		Recreation	Aquatic Life	Public Drinking Water Supply	Agriculture Supply	Aesthetics	Industrial Supply	303(d) Category[b]		
LO1-20200	Loup Power Canal	NA	S	NA	S		NA	2		
LP1-21800	Loup Power Canal	S	I	NA	S		NA	4B	PCBs (fish tissue)	Fish consumption advisory in effect; PCB production banned
MP1-10200	Loup Power Canal	NA		NA			NA	3		
LP1-L0440	Lake North	S	I	NA	S	S	NA	5	pH	De-list for nutrients - growing season averages for N, P, Chlor-a < criteria; List for pH
LP1-L0450	Lake Babcock	I		NA			NA	5	E. coli	
LO1-20000	Loup River	NA	S	NA			NA	2		
LO1-10000	Loup River	I	S	NA	S		NA	4A	E. coli	TMDL completed for E. coli
MP1-20000	Platte River	S	S	NA	S		NA	4A		TMDL completed for Fecal coliform, E. coli
MP1-10000	Platte River	S	S	NA			NA	4A		TMDL completed for Fecal coliform
LP1-20000	Platte River	I	I	NA	S		NA	5	E. coli, PCBs (fish tissue)	Fish consumption advisory in effect

Source: NDEQ, March 2006, "2006 Surface Water Quality Integrated Report," Nebraska Department of Environmental Quality, Water Quality Division, available online at http://www.deq.state.ne.us/Publica.nsf/0/17ddb685e0238e1d862571320063a1e2/$FILE/The%202006%20Integrated%20Report.pdf.

Notes:

[a] NA = Not Assessed; I = Impaired; S = Supporting

[b] Category 1 = Waterbodies where all designated uses are met.

Category 2 = Waterbodies where some of the designated uses are met but there is insufficient information to determine if all uses are being met.

Category 3 = Waterbodies where there is insufficient data to determine if any beneficial uses are being met.

Category 4 = Waterbody is impaired, but a TMDL is not needed. Sub-categories 4A and 4B outline the rationale for the waters not needing a TMDL.

Category 4A = Waterbody assessment indicates the waterbody is impaired, but all of the required TMDLs have been completed.

Category 4B = Waterbody is impaired, but "other pollution control requirements" are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control requirements include but are not limited to, National Pollutant Discharge Elimination System (NPDES) permits and best management practices.

Category 5 = Waterbodies where one or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval.

Table 5-18. 2008 Integrated Report

Waterbody ID	Waterbody Name	Beneficial Uses[a]							Parameter Impairing Use	Comments
		Recreation	Aquatic Life	Public Drinking Water Supply	Agriculture Supply	Aesthetics	Industrial Supply	303(d) Category[b]		
LO1-20200	Loup Power Canal	NA	S		S	S		2		
LP1-21800	Loup Power Canal	S	I		NA	S	S	5	PCBs	Fish consumption advisory in effect
MP1-10200	Loup Power Canal	I	NA		NA	NA			E. coli	
LP1-L0440	Lake North	S	S		S	S	S	1		
LP1-L0450	Lake Babcock	I					S	5	E. coli	
LO1-20000	Loup River							3		2006 IR misidentified segment
LO1-10000	Loup River	I	S		S	S		4A	E. coli	E. coli TMDL approved 1/06
MP1-20000	Platte River	S	S		S	S		1		Fecal coliform TMDL approved 5/03
MP1-10000	Platte River	I	S		S	S		4A	E. coli	
LP1-20000	Platte River	I	I	I	S	S		5	E. coli, Atrazine, PCBs	E. coli TMDL approved 9/07; Fish consumption advisory in effect

Source: NDEQ, March 2008, "2008 Water Quality Integrated Report," Nebraska Department of Environmental Quality, Water Quality Division, available online at http://www.deq.state.ne.us/Publica.nsf/0/9d72c74655475f658625741700741ad3/$FILE/2008%20final%20IR.pdf.

Notes:

[a] NA = Not Assessed; I = Impaired; S = Supporting

[b] Category 1 = Waterbodies where all designated uses are met.

Category 2 = Waterbodies where some of the designated uses are met but there is insufficient information to determine if all uses are being met.

Category 3 = Waterbodies where there is insufficient data to determine if any beneficial uses are being met.

Category 4 = Waterbody is impaired, but a TMDL is not needed. Sub-category 4A outlines the rationale for the waters not needing a TMDL.

Category 4A = Waterbody assessment indicates the waterbody is impaired, but all of the required TMDLs have been completed.

Category 5 = Waterbodies where one or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval.

As shown in Tables 5-16 through 5-18, there are three TMDL reports relating to waters in the vicinity of the Project. Each of the three reports addresses the impairment of recreational uses of the respective waterbody from bacteria. The first TMDL report was written for the Middle Platte River for fecal coliform bacteria. This report was written before the E. coli standard was enacted (NDEQ, April 2003). The two other TMDL reports address E. coli concentrations in the Loup River and in the Lower Platte River (NDEQ, December 2005; NDEQ, June 2007). All three TMDLs show that both point and nonpoint sources contribute to the bacteria loading to the waterbodies. All point sources must meet the numeric criteria at the end-of-pipe as Title 117 allows no mixing zone for bacteria. The nonpoint source load comes from a combination of human-related activities and natural background.

5.2.6 Reservoirs

"The following data with respect to any existing or proposed lake or reservoir associated with the proposed project; surface area, volume, maximum depth, mean depth, flushing rate, shoreline length, substrate composition…." 18 CFR §5.6(d)(3)(iii)(H)

The Project includes two reservoirs, Lake Babcock and Lake North, located between the Lower Power Canal and the Intake Canal. Both reservoirs function as regulating reservoirs, not storage reservoirs, of Project waters for hydropower generation at the Columbus Powerhouse. Therefore, the volume of water flowing into the reservoirs essentially equals the volume of water released from the reservoirs on a daily basis. Data for Lake Babcock and Lake North are presented in Table 5-19.

Table 5-19. Reservoir Data

	Lake Babcock	Lake North
Surface Area (acres at noted stage, MSL)	760 @ 1,531	200 @ 1,531
Volume (acre-feet at noted stage, MSL)	2,270 @ 1,531	2,083 at 1,531
Maximum Depth (feet)	12[a]	15
Mean Depth (feet)	3	11
Shoreline Length (miles)	7.5[b]	2.4[b]
Flushing Rate (cfs)	4,800[c]	4,800[c]
Substrate Composition	Silt	Silt/gravel

Notes:

[a] Lake Babcock is a very shallow lake; however, a deeper channel has developed as water flows through the lake to the Intake Canal. Maximum depth is of the channel.

[b] Shoreline length includes 1.6 miles of shoreline along the common dike separating Lake Babcock and Lake North.

[C] Maximum capacity of the Intake Canal to the Columbus Powerhouse is 4,800 cfs, which would be a combination of Lake Babcock and Lake North.

5.2.7 Downstream Reaches

"Gradient [and] downstream reaches directly affected by the proposed project."
18 CFR §5.6(d)(3)(iii)(I)

The bypassed reach of the Loup River immediately downstream of the Project displays both meandering and braided characteristics with a relatively mild slope of approximately 0.1 percent (0.001 foot/foot). Upstream of the Loup Power Canal, the Loup River has a slightly shallower gradient of approximately 0.08 percent (0.0008 foot/foot).

Photo 5-3. Aerial view of the Loup River, south of Nebraska State Highway 22 in Platte County, showing meandering and braided characteristics.

The Platte River downstream of the Tailrace Canal also displays both meandering and braided characteristics and has a relatively mild slope of approximately 0.09 percent (0.0009 foot/foot). Upstream of the Tailrace Canal and Loup River, the Platte River is a braided channel with a slightly steeper gradient of approximately 0.12 percent (0.0012 foot/foot).

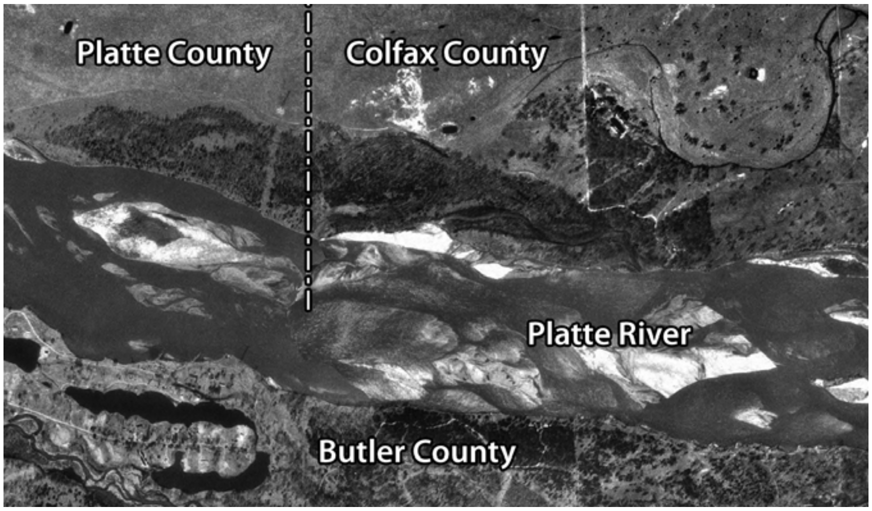

Photo 5-4. Aerial view of the Platte River, near the Platte/Colfax county line, showing meandering and braided characteristics.

5.3 FISH AND AQUATIC RESOURCES

The potential applicant must include in the pre-application document "[a] description of the fish and other aquatic resources, including invasive species, in the project vicinity. This section must discuss the existing fish and macroinvertebrate communities, including the presence or absence of anadromous, catadromous, or migratory fish, and any known or potential upstream or downstream impacts of the project on the aquatic community. Components of the description must include:" 18 CFR §5.6(d)(3)(iv)

5.3.1 Existing Fish and Aquatic Communities

"Identification of existing fish and aquatic communities." 18 CFR §5.6(d)(3)(iv)(A)

In the vicinity of the Project, fish and aquatic communities may exist in the Loup River, the Loup Power Canal, and the Lower Platte River,[5] as described below. Fish or aquatic fauna designated as threatened or endangered by Federal or state resource agencies are discussed in Section 5.6, Rare, Threatened, and Endangered Species, below. Species designated as Tier I and Tier II At-Risk Species by the Nebraska Natural Legacy Project are discussed in Appendix F along with definitions of the Tier I and Tier II designations (NGPC, August 2005).

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[5] The reach of the Platte River between the confluence of the Loup and Platte rivers (near Columbus) and the confluence of the Platte and Missouri rivers (near Plattsmouth, Nebraska).

In the Loup River Basin, nearly all soils are highly erodible when deprived of vegetative cover. Because of the highly erodible nature of the soils, nearly all streams carry heavy loads of sediment, which prevents the establishment of pools and adversely affects production of benthic organisms upon which fish depend (Bliss and Schainost, October 1973). These conditions tend to reduce production of all fishes, particularly the more desirable game fish. As a result, the bulk of stream fish populations are made up of more tolerant species, including carp and various suckers (Bliss and Schainost, October 1973). In addition, when compared to streams in more humid, heavily soiled areas of the Midwest, the Loup River is considered low in productivity (Rupp, 1981). The very nature of the shallow, braided and meandering stream, coupled with the large "bed load" of rolling sand, makes for an unstable aquatic habitat (Rupp, 1981). There are virtually no undercut banks along the Loup River due to caving, there is little underwater habitat, and the deeper holes are shifting locations constantly (Rupp, 1981).

The Loup Power Canal does not use any natural streambed and was mechanically dug during construction (Rupp, May 1973). However, benthic organisms and larval fishes may be found in the canal in the calm areas of undercut banks or in areas of bank stabilization. Willow trees were originally planted along the entire shoreline. While the trees have since been removed, the root systems remain, and water erosion has undercut the roots in some areas. Bundles of trees have been used to stabilize some areas of the bank, creating a sort of "calm water" area with substrate production (Rupp, May 1973).

Historically, several fish species have been found in the Loup Power Canal during various studies, the most recent of which occurred in the late 1960s and early 1970s. In the late 1960s, freshwater drum (*Aplodinotus grunniens*), white crappie (*Pomoxis annularis*), channel catfish (*Ictalurus punctatus*), and "five species of rough fishes" (probably species of bullhead and carp) were found in the canal (Rupp, May 1973). In the early 1970s, freshwater drum, white crappie, channel catfish, carpsucker (family Catostomidae), carp (*Cyprius carpio*), flathead catfish (*Pylodictus olivaris*), walleye (*Stizostedion vitreum*), black bullhead (*Ictalurus melas*), and white bass (*Morone chrysops*) were captured in the canal (Rupp, May 1973). Also in the 1970s, the above-listed species were found in the canal as well as goldeye (*Hiodon alosoides*) and smallmouth bass (*Micropterus salmoides*) (Bliss and Schainost, October 1973).

In the Loup River Basin and the Lower Platte River, fish were inventoried during two separate and distinct sampling exercises (Bliss and Schainost, October 1973; Peters and Parham, 2007). The fish species found are listed in Table 5-20. Each of these species has the potential to be found in the Loup River, the Loup Power Canal, and the Lower Platte River.

Table 5-20. Fish Sampled in the Loup River Basin and the Lower Platte River

Common Name	Scientific Name	Common Name	Scientific Name
Hiodontidae		Catostomidae	
goldeye[a,b]	*Hiodon alosoides*	bigmouth buffalo[b]	*Ictiobus cyprinellus*
Salmonidae		blue sucker[b]	*Cycleptus elongatus*
brown trout[a]	*Salmo trutta*	longnose sucker[b]	*Catostomus catostomus*
Cyprinidae		quillback carpsucker[a,b]	*Carpiodes cyprinus*
bighead carp[b]	*Hypophthalmichthyes nobilis*	river carpsucker[a,b]	*Carpiodes carpio*
bigmouth shiner[a,b]	*Notropis dorsalis*	shorthead redhorse[a,b]	*Moxostoma macrolepidotum*
brassy minnow[a,b]	*Hybognathus hankinsoni*	smallmouth buffalo[b]	*Ictiobus bubalus*
common carp[a,b]	*Cyprinus carpio*	white sucker[a,b]	*Catostomus commersoni*
common shiner [a]	*Notropis cornutus*	Ictaluridae	
creek chub[a,b]	*Semotilus atromaculatus*	black bullhead[a,b]	*Ictalurus melas*
emerald shiner[a,b]	*Notropis atherinoides*	blue catfish[b]	*Ictaluras furcatus*
fathead minnow[a,b]	*Pimephales promelas*	channel catfish[a,b]	*Ictalurus punctatus*
finescale dace[a]	*Phoxinus neogaeus*	flathead catfish[a,b]	*Pylodictis olivaris*
flathead chub[a,b]	*Hybopsis gracilis*	stonecat[a]	*Noturus flavus*
golden shiner[a]	*Notemigonus crysoleucas*	yellow bullhead[a]	*Ictalurus natalis*
grass carp[b]	*Ctenopharyngodon idella*	Cyprinodontidae	
longnose dace[a,b]	*Rhinichthys cataractae*	plains killifish[a,b]	*Fundulus kansae*
pearl dace[a]	*Semotilus margarita*	plains topminnow[a,b]	*Fundulus sciadicus*
plains minnow[a,b]	*Hybognathus placitus*	Gasterosteidae	
red shiner[a,b]	*Notropis lutrensis*	brook stickleback[a,b]	*Culaea inconstans*
river shiner [b]	*Notropis blennius*	Centrarchidae	
sand shiner[a,b]	*Notropis stramineus*	black crappie[a,b]	*Pomoxis nigromaculatus*
shoal chub[b]	*Macrhybopsis hystoma*	bluegill[a,b]	*Lepomis macrochirus*
sicklefin chub[b]	*Macrhybopsis meeki*	green sunfish[a,b]	*Lepomis cyanellus*
silver carp[b]	*Hypophthamichthyes molitrix*	largemouth bass[a,b]	*Micropterus salmoides*
silver chub[b]	*Macrhybopsis storeriana*	orangespotted sunfish[b]	*Lepomis humilis*
silvery minnow[a]	*Hybognathus nuchalis*	smallmouth bass[a]	*Micropterus dolomieui*
speckled chub[a]	*Hybopsis aestivalis*	white crappie[a,b]	*Pomoxis annularis*
spotfin shiner [b]	*Cyprinella spiloptera*	Atherinidae	
stoneroller[a]	*Campostoma anomalum*	brook silverside[b]	*Labidesthes sicculus*
sturgeon chub[b]	*Macrhybopsis gelida*	Poeciliidae	
suckermouth minnow[b]	*Phenacoiuis mirabilis*	western mosquitofish[b]	*Gambusia affinis*

Common Name	Scientific Name	Common Name	Scientific Name
western blacknose dace[b]	*Rhinichthys obtusus*	Sciaenidae	
western silvery minnow[b]	*Hybognathus argyritis*	freshwater drum[a,b]	*Aplodinotus grunniens*
Percidae		Polyodontidae	
Iowa darter[a]	*Etheostoma exile*	paddlefish[b]	*Polyodon spathula*
Johnny darter[b]	*Etheostoma nigrum*	Lepisosteidae	
sauger [b]	*Sander canadensis*	longnose gar[b]	*Lepisosteus osseus*
walleye[b]	*Sander vitreus*	shortnose gar[b]	*Lepisosteus platostomus*
yellow perch[b]	*Perca flavescens*	Moronidae	
Acipenseridae		white bass[b]	*Morone chrysops*
lake sturgeon[b]	*Acipenser fluvescens*	white perch[b]	*Morone Americana*
pallid sturgeon[b]	*Scaphirhynchus albus*	Clupeidae	
shovelnose sturgeon[b]	*Scaphirhynchus platorynchus*	gizzard shad[b]	*Dorosoma cepedianum*

Sources: Bliss, Quentin P., and Steve Schainost, October 1973, "Loup Basin Stream Inventory Report," Nebraska Game and Parks Commission, Bureau of Wildlife Services, Aquatic Wildlife Division; Peters, Edward J., and James E. Parham, 2007, "Draft Ecology and Management of Sturgeon in the Lower Platte River, Nebraska," Nebraska Technical Series No. 18, Nebraska Game and Parks Commission, Lincoln, Nebraska.

Notes:

[a] Sampled in the Loup River Basin.

[b] Sampled in the Lower Platte River.

More recently, the NGPC *2007 Nebraska Fishing Guide* lists the following fish species as being accessible to anglers in the Project fisheries (NGPC, 2007a):

- Loup Power Canal and Loup River – carp, channel and flathead catfish, freshwater drum
- Lake Babcock – bullhead, carp, channel and flathead catfish
- Lake North – carp, channel catfish, crappie, freshwater drum, walleye

Downstream of the Columbus Powerhouse, the Tailrace Canal discharges into the Lower Platte River, which is generally described as a mid-sized, shallow (generally less than 60 centimeters deep), braided river. The construction of dikes and levees on the Lower Platte River has constricted the natural channel and eliminated or isolated most of the floodplain sloughs, backwaters, and wetlands (NGPC, August 2005). Highly varied river flows in the Lower Platte River account for a great diversity of habitats and fish species. Since 1987, approximately 48 fish species, including the Federally endangered pallid sturgeon, have been documented in the Lower Platte River (Lower Platte River Corridor Alliance, 2008).

5.3.2 Potential Impacts on Fish and Aquatic Communities

Since 1995, seven fish kills have been documented within or near the Project Boundary, as shown in Table 5-21. Of these seven fish kills, only the August 12, 2005, fish kill is linked to Project operations; the other six were the result of non-Project-related bacterial infections or thermal stress.

Table 5-21. Fish Kills

Date	Waterbody	Cause/Source	Result
August 31, 2007	Tailrace Canal	Bacterial infection and thermal stress	Unknown
August 7, 2007	Lake North	Bacterial infection	Unknown
August 7, 2007	Lake Babcock	Bacterial infection	Unknown
August 12, 2005	Loup Power Canal	Low dissolved oxygen resulting from dropping of water level by the District for maintenance on the Monroe Powerhouse	An estimated 12,000 to 15,000 dead fish, including 13,200 river carpsucker, 1,650 freshwater drum, 1,650 shad, and a few channel catfish
July 21, 2004	Loup River bypass reach	Thermal stress	15 channel catfish, 14 minnows, and one river carpsucker
July 1999	Loup River bypass reach	Low flow	Large numbers of mixed species
July 1995	Loup River bypass reach	Low flow	Unknown

Source: NDEQ, 2007, "Loup Fish Kills" Excel spreadsheet, received from John Bender, NDEQ, on July 3, 2008.

The August 12, 2005, fish kill in the Loup Power Canal was the unintended result of unusual maintenance activity at the Monroe Powerhouse. In order for District personnel to gain access to the normally submerged work area, the water level in the canal was purposely lowered. Hot weather, reduced flow, and less water volume resulted in low dissolved oxygen levels in the Loup Power Canal. To prevent a similar event from occurring, the District no longer schedules maintenance drawdowns on the Loup Power Canal during hot summer conditions.

In response to the two documented fish kills in the Loup River bypass reach, the District, in coordination with NGPC, began voluntarily allowing for a flow of 50 to 75 cfs in the Loup River bypass reach when conditions warrant. This was intended to reduce the potential for fish kills in the Loup River bypass reach due to thermal stress or low flow. In 2008, the District suspended this practice due to water accounting issues raised by NDNR. The District is currently working with NDNR to resolve these issues.

In addition to the potential effects of hot weather and reduced flow in the Loup Power Canal, fish may be affected by certain Project structures that are barriers to fish movement in both downstream and upstream directions, as described below. Furthermore, downstream passage of fish through the turbine generating units may result in injury or fatality (Rupp, May 1973). However, the stable Project fisheries indicate that turbine mortality is not a serious problem.

In the Loup River, downstream fish movement over the Diversion Weir is possible whenever there is a sufficient depth of flow over or through the flashboards. In addition, fish can easily pass under the Sluice Gates whenever they are opened.

In the Loup Power Canal, fish can move freely downstream through the Intake Gate Structure, through the Settling Basin, over the Skimming Weir, and downstream in the Upper Power Canal to the Monroe Powerhouse. Some fish continue downstream by passing through the turbine generating units or the radial bypass gate at the Monroe Powerhouse; as stated previously, the stable Project fisheries indicate that turbine mortality is not a serious problem.

Fish in the Lower Power Canal can move freely downstream, over the Sawtooth Weir, through the regulating reservoirs, and downstream in the Intake Canal to the Columbus Powerhouse. Some fish continue downstream by passing through the Penstocks and turbine generating units at the Columbus Powerhouse; again, the stable Project fisheries indicate that turbine mortality is not a serious problem. Fish in the Tailrace Canal can move freely downstream and over the Outlet Weir to the Platte River.

The Outlet Weir obstructs upstream fish movement into the Tailrace Canal except during high flow conditions on the Platte River, when the weir starts to become submerged. From the Tailrace Canal, the Columbus Powerhouse is an absolute barrier to upstream fish movement.

Fish in the regulating reservoir are free to move upstream over the submerged Sawtooth Weir, into the Lower Power Canal, and on to the Monroe Powerhouse, which is an effective barrier to further upstream fish movement. Fish in the Upper Power Canal are free to move upstream to the Skimming Weir, which is an effective barrier to entering the Settling Basin. Fish in the Settling Basin are free to move upstream to the Intake Gate Structure. Powerful adult fish may be able to pass upstream through the Intake Gate current and into the Loup River. The Diversion Weir is a barrier to upstream fish movement except when it becomes submerged by flow events in excess of 10,000 cfs. Powerful adult fish may be able to pass upstream through the Sluice Gate Structure under certain flow conditions.

Despite the fish passage impediments discussed above, the aquatic environment in the Loup Power Canal supports a large and healthy channel catfish population. Reproduction and recruitment are excellent, due in large part to a substantial amount of habitat not normally present in streams of this type. Undercut banks supported by extensive tree root systems as well as rip-rapped banks provide large areas of sanctuary from the current. This increases both survival of larval fishes and production of benthic organisms (Rupp, May 1973).

In addition to channel catfish in the Loup Power Canal, other fish species, including desirable game fish, are present in the canal and Lake North, both of which are frequently used for angling (see Section 5.7, Recreation and Land Use, below).

5.3.3 Essential Fish Habitat

"Identification of any essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act and established by the National Marine Fisheries Service." 18 CFR §5.6(d)(3)(iv)(B)

No essential fish habitat, as defined under the Magnuson-Stevens Fishery Conservation and Management Act and established by the National Marine Fisheries Services, exists in the Loup or Platte rivers or the Loup Power Canal.

5.3.4 Distribution of Fish and Aquatic Communities

"Temporal and spatial distribution of fish and aquatic communities and any associated trends with respect to: (1) [s]pecies and life stage composition; (2) [s]tanding crop; (3) [a]ge and growth data; (4) [s]pawning run timing; and (5) [t]he extent and location of spawning, rearing, feeding, and wintering habitat." 18 CFR §5.6(d)(3)(iv)(C)

The most recent studies on fish species in the vicinity of the Project occurred in the late 1960s and early 1970s, as discussed in Section 5.3.1, Existing Fish and Aquatic Communities, above. In the early 1970s, several thousand channel catfish ranging from 8 to 29 inches in length were captured in the Loup Power Canal using a hoop net and were marked (Rupp, May 1973). "This leaves no doubt of the much higher standing crop [of channel catfish] in the power canal when compared to the Loup River, even above the point of diversion at the headgates" (Rupp, May 1973). These findings suggest a relatively stationary standing crop as the Monroe and Columbus powerhouses are physical barriers to upstream fish dispersal. Downstream travel through the powerhouse buildings may be possible; however, during this study in the early 1970s, the recovery of a tagged channel catfish moving downstream through a powerhouse was not documented, indicating either that fish avoid these turbulent areas or that fish do not survive passing through the area. The siphons do not constitute a barrier in either direction (Rupp, May 1973).

Despite the physical barriers present along the Loup Power Canal, resident fish thrive and grow to considerable size. The Nebraska-state-record flathead catfish, which weighed 80 pounds, was caught in the Loup Power Canal on June 14, 1988 (NGPC, 2008a).

In efforts to collect accurate, current information on fish populations in the Loup Power Canal, and in association with the relicensing process, the District proposes a cooperative effort with NGPC to perform fish sampling in the Power Canal. As detailed in Section 6.2, Potential Studies, results from the sampling event are expected to yield species abundance, composition, and distribution data.

5.4 WILDLIFE AND BOTANICAL RESOURCES

The potential applicant must include in the pre-application document "[a] description of the wildlife and botanical resources, including invasive species, in the project vicinity. Components of this description must include:" 18 CFR §5.6(d)(3)(v)

Terrestrial fauna designated as threatened or endangered by Federal or state resource agencies are discussed in Section 5.6, Rare, Threatened, and Endangered Species, below. Species designated as Tier I and Tier II At-Risk Species by the Nebraska Natural Legacy Project are discussed in Appendix F along with definitions of the Tier I and Tier II designations (NGPC, August 2005).

5.4.1 Upland Habitat(s) and Plant and Animal Species

"Upland habitat(s) in the project vicinity, including the project's transmission line corridor or right-of-way and a listing of plant and animal species that use the habitat(s)." 18 CFR §5.6(d)(3)(v)(A)

In the vicinity of the Project, upland habitats are limited. The majority of upland areas immediately surrounding the District's property are currently managed and used for agricultural production. In most of these areas, agricultural practices extend within close proximity to Project components, with little or no native vegetative buffer. These conditions are typical for eastern Nebraska as the landscape of Nebraska was altered dramatically in the decades after European settlement (mid-1800s) primarily because of agricultural practices (Fleharty and Channell, 1997, as cited in Benedict, Genoways, and Freeman, June 1, 2000).

Vegetation

Prior to European settlement and the associated controlled fire regime, the uplands in the vicinity of the Project would have consisted of upland tallgrass prairie (NGPC, August 2005). Accordingly, the Project lies in the Tallgrass Prairie Ecoregion, as designated by The Nebraska Natural Legacy Project (NGPC, August 2005). Over 95 percent of tallgrass prairie in Nebraska has been converted to agricultural fields and other anthropogenic habitats (Kaul and Rolfsmeier, 1993; Noss et al., 1996, as cited in Benedict, Genoways, and Freeman, June 1, 2000). In tallgrass prairies, remaining patches of habitat are typically small and isolated, are grazed by non-native herbivores, and/or are being invaded by woody vegetation (Benedict et al., 1996; Bogan et al., 1995; Kaul and Rolfsmeier, 1993, as cited in Benedict, Genoways, and Freeman, June 1, 2000). The small pockets of undisturbed ground in the vicinity of the Project are likely typical of these conditions; however, portions of these areas may contain the vegetation historically typical of the Tallgrass Prairie Ecoregion, as discussed in the following paragraph and shown in Table 5-22.

Upland tallgrass prairie is dominated by big bluestem (*Andropogen gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and Canada wildrye (*Elymus canadensis*) (NGPC, August 2005). These grass species can reach 6 feet or taller, especially when rooted in rich, moist stream valleys. Tallgrass prairies also include hundreds of species of wildflowers and other forbs that support a diversity of other prairie species. Examples of these include showy goldenrod (*Solidago speciosa*), prairie blazing star (*Liatris pycnostachya*), skyblue aster (*Symphyotrichum oolentangiense*), and purple coneflower (*Echinacea sp*) (NGPC, August 2005). A more detailed list of vegetation typical of the region is provided in Table 5-22.

Table 5-22. Vegetation of the Region

Common name	Scientific Name	Common name	Scientific Name
American basswood	*Tilia americana*	pale purple coneflower	*Echinacea pallida*
American elm	*Ulmus americana*	peachleaf willow	*Salix amygdaloides*
annual buckwheat	*Eriogonum annuum*	Platte lupine	*Lupinus plattensis*
Arrowhead	*Sagittaria* spp.	poison ivy	*Toxicodendron radicans*
barnyard grass	*Echinochloa crus-galli*	prairie blazing star	*Liatris pycnostachya*
big bluestem	*Andropogon gerardii*	prairie cordgrass	*Spartina pectinata*
black medick	*Medicago lupulina*	prairie Junegrass	*Koeleria macrantha*
black walnut	*Juglans nigra*	prairie sandreed	*Calamovilfa longifolia*
blue grama	*Bouteloua gracilis*	prairie spiderwort	*Tradescantia occidentalis*
box elder	*Acer negundo*	purple prairie-clover	*Dalea purpurea*
buffalograss	*Bouteloua dactyloides*	red mulberry	*Morus rubra*
Bur oak	*Quercus macrocarpa*	red-osier dogwood	*Cornus stolonifera*
bur-reed	*Sparganium* spp.	river-bank grapevine	*Vitis riparia*
Canada goldenrod	*Solidago canadensis*	roughleaved dogwood	*Cornus drummondii*
Canada wildrye	*Elymus canadensis*	sand bluestem	*Andropogon hallii*
cattail	*Typha* spp.	sand dropseed	*Sporobolus cryptandrus*
cocklebur	*Xanthium strumarium*	sandbar willow	*Salix exigua*
common ragweed	*Ambrosia artemisiifolia*	sedge	*Carex* spp.
common threesquare bulrush	*Schoenoplectus pungens*	showy goldenrod	*Solidago speciosa*

Common name	Scientific Name	Common name	Scientific Name
dotted blazing star	*Liatris punctata*	sideoats grama	*Bouteloua curtipendula*
downy brome	*Bromus tectorum*	silver maple	*Acer saccarinum*
Eastern cottonwood	*Populus deltoides*	silverleaf scurfpea	*Pediomelum argophyllum*
false boneset	*Brickellia eupatorioides*	skyblue aster	*Symphyotrichum oolentangiense*
false indigo	*Amorpha fruticosa*	small white lady's slipper	*Cypripedium candidum*
field brome	*Bromus arvensis*	Smartweed	*Polygonum* spp.
fringed loosestrife	*Lysimachia ciliata*	smooth sumac	*Rhus glabra*
green ash	*Fraxinus pennsylvanica*	spikerush	*Eleocharis* spp.
hairy goldaster	*Heterotheca villosa*	stiff sunflower	*Helianthus pauciflorus*
hairy grama	*Bouteloua hirsuta*	switchgrass	*Panicum virgatum*
Indiangrass	*Sorghastrum nutans*	Western prairie fringed orchid	*Platanthera praeclara*
lanceleaf fogfruit	*Phyla lanceolata*	Western snowberry	*Symphoricarpos occidentalis*
lead plant	*Amorpha canescens*	Western wheatgrass	*Pascopyrum smithii*
little bluestem	*Schizachyrium scoparium*	white sweet clover	*Melilotus officinalis*
Invasive Species			
Kentucky bluegrass	*Poa pratensis*	Russian olive	*Elaaeagnus angustifolia*
red cedar	*Juniperus virginiana*	smooth brome	*Bromus inermis*
reed canarygrass	*Phalaris arundinacea*		

Sources: Sidle, John G., and Craig A. Faanes, July 16, 1997, "Platte River Ecosystem Resources and Management, with Emphasis on the Big Bend Reach in Nebraska," Northern Prairie Wildlife Research Center, retrieved on August 5, 2008, http://www.npwrc.usgs.gov/resource/habitat/plrivmgt/index.htm;
NGPC, August 2005, *The Nebraska Natural Legacy Project: A Comprehensive Wildlife Conservation Strategy*, Lincoln, Nebraska, available online at http://www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp.

Invasive vegetative species are identified in Table 5-22. The District understands the detrimental effects that the establishment of invasive species can have on the vegetative communities and the overall biological integrity of land within the Project Boundary; therefore, the District actively monitors land within the Project Boundary for invasive species. If invasive species are found, the District implements active management practices to promptly eradicate the invasive plants.

Birds

More than 300 species of resident and migratory birds have been documented in the Tallgrass Prairie Ecoregion. The region supports populations of greater prairie chicken (*Tympanuchus cupido*) and a full complement of grassland birds, including

Henslow's sparrow (*Ammodramus henslowii*), dickcissel (*Spiza americana*), grasshopper sparrow (*Ammodramus savannarum*), bobolink (*Dolichonyx oryzivorus*), vesper sparrow (*Pooecetes gramineus*), and Swainson's hawk (*Buteo swainsoni*). Although woodlands are mostly confined to stream corridors, woodland species such as Bell's vireo (*Vireo bellii*), black-and-white warbler (*Mniotilta varia*), rose-breasted grosbeak (*Pheucticus ludovicianus*), and orchard oriole (*Icterus spurius*) are common breeding species (NGPC, August 2005). A more detailed list of bird species typical of the region is provided in Table 5-23.

Table 5-23. Birds of the Region

Common Name	Scientific Name	Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*	house wren	*Troglodytes aedon*
American goldfinch	*Carduelis tristis*	indigo bunting	*Passerina cyanea*
American tree sparrow	*Spizella arborea*	interior least tern	*Sterna antillarum athalassos*
bald eagle	*Haliaeetus leucophalus*	killdeer	*Charadrius vociferus*
Baltimore oriole	*Icterus galbula*	lapland longspur	*Calcarius lapponicus*
barn swallow	*Hirundo rustica*	mallard	*Anas platyrynchos*
Bell's vireo	*Vireo bellii*	mourning dove	*Zenaida macrooura*
black-and-white warbler	*Mniotilta varia*	northern bobwhite	*Colinus virginianus*
black-capped chickadee	*Poecile atriacapillus*	northern cardinal	*Cardinalis cardinalis*
blue jay	*Cyanocitta cristata*	northern flicker	*Colaptes auratus*
blue-winged teal	*Anas discors*	northern pintail	*Anas acuta*
bobolink	*Dolichonyx oryzivorus*	orange-crowned warbler	*Vermivora celata*
brown thrasher	*Toxostoma rufum*	orchard oriole	*Icterus spurius*
brown-headed cowbird	*Molothrus ater*	pied-billed grebe	*Podilymbus podiceps*
cackling goose	*Branta hutchinsii*	piping plover	*Charadrius melodus*
Canada goose	*Branta canadensis*	purple martin	*Progne subis*
clay-colored sparrow	*Spizella pallida*	red-bellied woodpecker	*Melanerpes carolinus*
common grackle	*Quiscalus quiscula*	red-eyed vireo	*Vireo olivaceus*
common nighthawk	*Chordeiles minor*	red-headed woodpecker	*Melanerpes erythrocephalus*
common yellowthroat	*Geothlypis trichas*	red-winged blackbird	*Agelaius phoeniceus*
dark-eyed junco	*Junco hyemalis*	ring-necked pheasant	*Phasianus colchicus*
dickcissel	*Spiza americana*	rock pigeon	*Columbia livia*
Downy woodpecker	*Picoides pubescens*	rose-breasted grosbeak	*Pheucticus ludovicianus*
eastern kingbird	*Tyrannus tyrannus*	song sparrow	*Melospiza melodia*
eastern meadowlark	*Sturnella magna*	Swainson's hawk	*Buteo swainsoni*
eastern phoebe	*Sayornis phoebe*	Swainson's thrush	*Catharus ustulatus*
eastern wood-pewee	*Contopus virens*	Tennessee warbler	*Vermivora peregrina*

Common Name	Scientific Name	Common Name	Scientific Name
European starling	*Sturnus vulgaris*	vesper sparrow	*Pooecetes gramineus*
grasshopper sparrow	*Ammodramus savannarum*	warbling vireo	*Vireo gilvus*
gray catbird	*Dumetella carolinensis*	western kingbird	*Tyrannus verticalis*
great crested flycatcher	*Myiarchus crinitus*	western meadowlark	*Sturnella neglecta*
greater prairie chicken	*Tympanuchus cupido*	white-breasted nuthatch	*Sitta carolinensis*
green heron	*Butorides virescens*	white-throated sparrow	*Zonotrichia albicollis*
hairy woodpecker	*Picoides villosus*	whooping crane	*Grus americana*
Harris's sparrow	*Zonotrichia querula*	wild turkey	*Meleagris gallopavo*
Henslow's sparrow	*Ammodramus henslowii*	wood duck	*Aix sponsa*
horned lark	*Eremophila alpestris*	yellow-rumped warbler	*Dendroica coronata*
house finch	*Carpodacus mexicanus*	yellow warbler	*Dendroica petechia*
house sparrow	*Passer domesticus*		

Sources: NGPC, August 2005, *The Nebraska Natural Legacy Project: A Comprehensive Wildlife Conservation Strategy*, Lincoln, Nebraska, available online at http://www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp;
Sidle, John G., and Craig A. Faanes, July 16, 1997, "Platte River Ecosystem Resources and Management, with Emphasis on the Big Bend Reach in Nebraska," Northern Prairie Wildlife Research Center, retrieved on August 5, 2008, http://www.npwrc.usgs.gov/resource/habitat/plrivmgt/index.htm;
Johnsgard, Paul A, 2007, "A Guide to the Tallgrass Prairies of Eastern Nebraska," University of Nebraska – Lincoln, School of Biological Sciences, available online at http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1038&context=biosciornithology.

Mammals

The Tallgrass Prairie Ecoregion is home to more than 55 mammal species (NGPC, August 2005). The small mammal fauna of the region includes plains pocket gopher (*Geomys bursarius*), prairie vole (*Microtus ochrogatser*), plains pocket mouse (*Perognathus flavescens*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and Franklin's ground squirrel (*Spermophilus franklinii*) (NGPC, August 2005). White-tailed deer (*Odocoileus virginianus*) are common big game animals, and mule deer (*Odocoileus hemionus*) are infrequently found in upland grasslands. The most abundant large predator of the region is the coyote (*Canis latrans*), but other predators such as the red fox (*Vulpes vulpes*) and badger (*Taxidea taxus*) can be found as well (NGPC, August 2005). To a lesser degree, the bobcat (*Lynx rufus*), least weasel (*Mustela nivalis*), long-tailed weasel (*Mustela frenata*), and mink (*Neovison vison*) are present but generally occur in wooded areas, wetlands, and along river valleys. A more detailed list of mammals typical of the region is provided in Table 5-24.

Table 5-24. Mammals of the Region

Common Name	Scientific Name	Common Name	Scientific Name
badger	*Taxidea taxus*	Merriam's shrew	*Sorex maerriami*
beaver	*Castor canadensis*	mink	*Neovison vison*
big brown bat	*Eptesicus fuscus*	mule deer	*Odocoileus hemionus*
black-tailed jackrabbit	*Lepus californicus*	muskrat	*Ondatra zibethicus*
bobcat	*Lynx rufus*	North American river otter	*Lontra canadensis*
Brazilian free-tailed bat	*Tadarida brasiliensis*	northern grasshopper mouse	*Onychomys leucogaster*
bushy-tailed woodrat	*Neotoma cinerea*	northern pocket gopher	*Thomomys talpoides*
cottonrat	*Sigmodon hispidus*	northern short-tailed shrew	*Blarina brevicauda*
coyote	*Canis latrans*	Norway rat	*Rattus norvegicus*
dwarf shrew	*Sorex nanus*	plains harvest mouse	*Reithrodontomys montanus*
eastern cottontail	*Sylvilagus floridanus*	plains pocket gopher	*Geomys bursarius*
eastern mole	*Scalopus aquaticus*	plains pocket mouse	*Perognathus flaveescens*
eastern woodrat	*Neotoma floridana*	porcupine	*Erethrizon dorsatum*
Elliot's short-tailed shrew	*Blarina hylophaga*	prairie vole	*Microtus orchrogaster*
ermine	*Mustela erminea*	raccoon	*Procyon lotor*
fox squirrel	*Sciurus niger*	red bat	*Lasiurus borealis*
Franklin's ground squirrel	*Spermophilius franklinii*	red fox	*Vulpes vulpes*
gray fox	*Urocyon cinereogenteus*	silver-haired bat	*Lasionycteris noctivagans*
gray squirrel	*Sciurus carolinensis*	small-footed myotis	*Myotis ciliolabrum*
hoary bat	*Lasiurus cinereus*	southern bog lemming	*Synaptomys cooperi*
house mouse	*Mus musculus*	striped skunk	*Mephitis mephitis*
Keen's myotis	*Myotis septentionalis*	thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
least chipmunk	*Tamias talpoides*	Townsend's big-eared bat	*Plecotus townsendii*
least shrew	*Cryptotis parva*	Virginia opossum	*Didelphis virginiana*
least weasel	*Mustela nivalis*	western harvest mouse	*Reithrodontomys megalotis*
long-tailed weasel	*Mustela frenata*	white-footed mouse	*Peromyscus leucopus*
masked shrew	*Sorex cinereus*	white-tailed deer	*Odocoileus virginianus*
meadow jumping mouse	*Zapus hudsonicus*	white-tailed jackrabbit	*Lepus townsendii*
meadow vole	*Microus pennsylvanicus*	woodchuck	*Marmota monax*

Sources: NGPC, August 2005, *The Nebraska Natural Legacy Project: A Comprehensive Wildlife Conservation Strategy*, Lincoln, Nebraska, available online at http://www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp;
Sidle, John G., and Craig A. Faanes, July 16, 1997, "Platte River Ecosystem Resources and Management, with Emphasis on the Big Bend Reach in Nebraska," Northern Prairie Wildlife Research Center, retrieved on August 5, 2008, http://www.npwrc.usgs.gov/resource/habitat/plrivmgt/index.htm.

Amphibians and Reptiles

Fifty-three species of amphibians and reptiles are found in the Tallgrass Prairie Ecoregion, including two salamanders, five toads, six frogs, eight turtles, up to eight lizard species, and twenty-four snakes (NGPC, August 2005). Although all of the amphibians use wetlands for breeding, the Great Plains toad (*Bufo cognatus*), plains spadefoot toad (*Spea bombifrons*), and Woodhouse toad (*Bufo woodhouseii*) spend most of their adult life in uplands (NGPC, August 2005). The six-lined racerunner (*Cnemidophorus sexlineatus*) and northern prairie skink (*Eumeces septentrionalis*) inhabit dense grasslands and are relatively common but seldom seen (NGPC, August 2005). The five-lined skink (*Eumeces fasciatus*) also inhabits the Tallgrass Prairie Ecoregion but is rare (NGPC, August 2005). The bull snake (*Pituophis catenifer*), fox snake (*Elaphe vulpina*), yellow-bellied racer (*Coluber constrictor*), and plains garter snake (*Thamnophis radix*) are the most common snakes. The timber rattlesnake (*Crotalus horridus*), and copperhead (*Agkistrodon contortrix*) are venomous snakes with highly limited distributions (NGPC, August 2005). A more detailed list of amphibians and reptiles typical of the region is provided in Table 5-25.

Table 5-25. Amphibians and Reptiles of the Region

Common Name	Scientific Name	Common Name	Scientific Name
		Amphibians	
bullfrog	*Rana catesbeiana*	plains spadefoot toad	*Spea bombifrons*
Great Plains toad	*Bufo cognatus*	tiger salamander	*Ambystroma tigrinum*
northern leopard frog	*Rana pipens*	western striped chorus frog	*Pseudacris triseriata*
plains leopard frog	*Rana blairi*	Woodhouse toad	*Bufo woodhousii*
		Reptiles	
bull snake	*Pituophis catenifer*	painted turtle	*Chrysemys picta*
copperhead	*Agkistrodon contortrix*	plains garter snake	*Thamnophis radix*
eastern hognose	*Heterodon platyrhinos*	prairie racerunner	*Cnemiodophorus sexlineatus*
five-lined skink	*Eumeces fasciatus*	prairie rattlesnake	*Crotalus viridis*
fox snake	*Elaphe vulpina*	red-sided garter snake	*Thamnophis sirtalis*
lined snake	*Tropidoclonion lineatum*	ringneck snake	*Diadophis punctatus*
many-lined skink	*Eumeces multivirgatus*	six-lined racerunner	*Cnemidophorus sexlineatus*
milk snake	*Lampropeltis triangulum*	snapping turtle	*Chelydra serpentina*
northern earless lizard	*Hobrookia maculata*	spiny softshell turtle	*Apalone spinifera*
northern prairie lizard	*Sceloporus undulatus*	timber rattlesnake	*Crotalus horridus*
northern prairie skink	*Eumeces septentrionalis*	western hognose	*Heterodon nasicus*

Common Name	Scientific Name	Common Name	Scientific Name
northern water snake	*Nerodia sipedon*	yellow-bellied racer	*Coluber constrictor*
ornate box turtle	*Terrapene ornata*		

Sources: University of Nebraska, Lincoln, 2007, *Amphibians and Reptiles of Nebraska*, retrieved on September 22, 2008, http://snrs.unl.edu/herpneb/;
Central Nebraska Public Power and Irrigation District, April 17, 2008, "Reptiles and Amphibians of Lake McConaughy," *The Central Nebraska Public Power and Irrigation District*, retrieved on August 5, 2008, http://www.cnppid.com/Reptiles_amphibians.htm;
NGPC, August 2005, *The Nebraska Natural Legacy Project: A Comprehensive Wildlife Conservation Strategy*, Lincoln, Nebraska, available online at http://www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp.

5.4.2 Distribution of Species

"Temporal or spacial distribution of species considered important because of their commercial, recreational, or cultural value." 18 CFR §5.6(d)(3)(v)(B)

The following wildlife species exist in the vicinity of the Project and are of either commercial, recreational, or cultural importance:

- Bald eagle (*Haliaeetus leucocephalus*) – Nesting or wintering bald eagles are found in close association with water and prefer rivers, lakes, or reservoirs that provide a reliable food source and isolation from disturbing human activities. Large trees and snags along shorelines provide feeding and loafing perches and potential nest sites. Larger stands of mature trees that are free from disturbance provide adequate perches and protection from the winter elements and are needed for communal winter roosting. During the fall and spring migration, when most water areas are ice-free and milder weather conditions are predominate, bald eagles may be seen along virtually any waterway or impoundment in Nebraska. In the vicinity of the Project, bald eagles are commonly seen downstream of the Columbus Powerhouse. During the critical wintering period (December 15 to February 20), bald eagles are usually forced to concentrate in areas where waters remain free of ice and food is available (NGPC, 2008b). Recreational viewing of bald eagles is enjoyed by many. Minor commercial value may be seen by communities near bald eagle concentrations; however, the primary importance of the bald eagle is cultural as the bald eagle is a symbol of national pride. Additional information about the bald eagle is provided in Section 5.6, Rare, Threatened, and Endangered Species, below.

- Beaver (*Castor canadensis*) – Throughout Nebraska, including the immediate vicinity of the Project, beavers are found along streamcourses, rivers, small lakes, and marshes. The significance of the beaver in Nebraska centers on the income generated by the harvest of beaver meat and fur as well as the related recreational value derived from their pursuit. From 1942 to 1986, nearly 400,000 beavers were taken by fur harvesters in Nebraska. Harvest totals from 1981 to 1989 indicate an average annual harvest of 14,850 beavers, valued at $255,000 (NGPC, 2008b).
- Mink (*Neovison vison*) – In Nebraska, including the immediate vicinity of the Project, mink are found statewide where suitable riparian habitat, such as riverbanks and lake shores, occur. Mink are commonly noted along the state's major river systems, including the Lower Platte River. The pelts of wild mink are highly valued. From 1941 to 1989, Nebraska trappers took nearly 390,000 mink. Harvest totals from 1980 to 1989 indicate an average annual harvest of 6,400 mink, valued at over $121,000. In Nebraska, most mink are likely taken in traps set for other furbearers, such as muskrat, raccoon, and beaver (NGPC, 2008b).
- Muskrat (*Ondatra zibethicus*) – Muskrats are found throughout Nebraska wherever suitable aquatic habitat exists, and they are among the most abundant furbearers in Nebraska. In general terms, muskrats require readily accessible water, food, and secure lodging throughout the year, though these requirements vary with the season. In the case of water, the muskrat can tolerate minimal water conditions during summer and fall; however, muskrats are virtually entombed under a layer of ice in the winter and need at least 3 feet of water to survive. Economic value centers on the income generated by the harvest of muskrats by trappers for their meat and fur as well as the recreational value derived from their pursuit. From 1942 to 1989, an estimated 6.1 million muskrats were taken by fur trappers in Nebraska. Harvest totals from 1980 to 1989 indicate an average annual harvest of 95,900 muskrats, valued at over $283,000. Muskrat is highly desirable for the manufacture of women's coats. In addition, musk dried from the animal's glands is used to make perfumes and as a scent for trapping other animals (NGPC, 2008b).
- Northern bobwhite (*Colinus virginianus*) – Although Nebraska lies in the northwest corner of the northern bobwhite quail's range, good populations of northern bobwhite exist in the immediate vicinity of the Project. The northern bobwhite is a popular game bird in the area.
- Raccoon (*Procyon lotor*) – In Nebraska, raccoons are common statewide and are most abundant in eastern Nebraska. The raccoon is an important and valuable furbearer in Nebraska. From 1941 to 1989, more than 1.7 million raccoons were taken by fur hunters and trappers in Nebraska.

Harvest totals from 1980 to 1989 indicate an average annual harvest of 73,000 raccoons, with a total value of $1,281,000. This represents over 50 percent of the average annual value of all furbearers harvested in Nebraska from 1980 to 1989. Raccoon pelt prices influence the harvest of all other furbearers as high raccoon pelt prices stimulate harvest of raccoons and other species. The raccoon's durable fur is used in the manufacture of coats, hats, and trimming (NGPC, 2008b).

- Ring-necked pheasant (*Phasianus colchicus*) – Consistent with several states nationwide, the ring-necked pheasant is considered one of the premier upland game birds in Nebraska and in the immediate vicinity of the Project. The ring-necked pheasant could potentially inhabit all uplands in the vicinity of the Project and is readily hunted for its meat. The commercial and recreational importance of the ring-necked pheasant is substantial statewide.
- White-tailed deer (*Odocoileus virginianus*) – The white-tailed deer is the most abundant and most widely distributed game animal in North America. Accordingly, this species is a year-round inhabitant of both the natural and agricultural lands in the vicinity of the Project. Annual harvest in Nebraska has been about 28,000 since 1987. Nebraska hunters spend about 300,000 hunter-days hunting for white-tailed deer each year. The monetary impact of white-tailed deer hunting is substantial as hunters spent about $1.2 million for white-tailed deer hunting permits in 1990. The total amount spent on white-tailed deer hunting in Nebraska is $7 million to $8 million annually (NGPC, 2008b).
- Wild turkey (*Meleagris gallopavo*) – Nebraska's wild turkey range includes most major river drainages, including the Lower Platte River, and the Pine Ridge country in the northwest corner of the state. Turkeys have also adapted to many small, isolated woodlands, shelterbelts, and thinly wooded stream courses. Nebraska ranks 48th in the nation in woodland acreage but 19th in the harvest of wild turkeys. Since Nebraska's first wild turkey season in 1962, about 286,000 permit holders have taken more than 124,000 birds. The 1995 statewide harvest for the spring and fall shotgun and archery seasons was about 8,000 birds (NGPC, 2008b).

In efforts to promote wildlife habitat and conservation, the District has worked with NGPC to develop the Loup Lands Wildlife Management Area[6] (WMA). This is a 485-acre parcel located within the Project Boundary near the Headworks that is owned by the District and leased to NGPC (see Figure 5-8, Sheets 1 and 2). The

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6 Nebraska's state wildlife areas are managed by NGPC's Wildlife Division for the enhancement of wildlife habitat and for public hunting and fishing. However, they are open to many other activities, including hiking, bird watching, nature study, and primitive camping.

Loup Lands WMA consists of river-bottom habitat/riparian habitat and is open to the public for both wildlife viewing and hunting. All of the above-noted species may inhabit the Loup Lands WMA.

In addition to the Loup Lands WMA, the Lake Babcock Waterfowl Refuge is partially located within the Project Boundary. The refuge consists of Lake Babcock, Lake North, and adjoining lands and is regulated by NGPC (see Figure 5-8, Sheet 3). The refuge was established in the 1940s to provide and conserve waterfowl habitat. At the refuge, hunting is restricted, boating is restricted during open waterfowl season, and fishing is restricted in Lake Babcock but allowed year-round in Lake North (163 Nebraska Administrative Code [NAC] 4-019). Additional detail about Lake Babcock Waterfowl Refuge is provided in Section 5.7, Recreation and Land Use.

5.5 WETLANDS, RIPARIAN, AND LITTORAL HABITAT

The potential applicant must include in the pre-application document "[a] description of the floodplain, wetlands, riparian…, and littoral [habitats] in the project vicinity. Components of this description must include:" 18 CFR §5.6(d)(3)(vi)

"A list of plant and animal species, including invasive species, that use the wetland, littoral, and riparian habitat." 18 CFR §5.6(d)(3)(vi)(A)

"A map delineating the wetlands, riparian, and littoral habitat." 18 CFR §5.6(d)(3)(vi)(B)

"Estimates of acreage for each type of wetland, riparian, or littoral habitat, including variability in such availability as a function of storage at a project that is not operated in run-of-river mode." 18 CFR §5.6(d)(3)(vi)(C)

5.5.1 Floodplain

A floodplain is the area adjacent to a watercourse that is inundated by a particular flood event. It includes the floodway, which consists of the channel and any adjacent areas that carry flood flows. The 100-year floodplain is that which has a 1 percent annual chance of being flooded.

The Project, however, has no defined flood flows, no floodplain, and no floodway. The 35-mile-long Loup Power Canal is an artificial conduit, not a natural watercourse. It is completely gated at the upstream end and was designed to accommodate all inflow from its insignificant drainage area. Natural flood hydrology and analysis are neither appropriate nor relevant to the Project and the Loup Power Canal.

Natural floodways and floodplains do exist along the Loup River and Platte River at either end of the Project. Flood studies have been performed for both rivers, and Federal Emergency Management Agency (FEMA) flood insurance maps are available for both Nance and Platte counties. However, these maps are not included in the PAD due to inconsistencies in the maps and elevations of Project features and flood elevations.

A 100-year flood event on the Loup River would overtop, and probably damage, the Diversion Weir, but it would not otherwise impact the Project Headworks or disrupt Project operations. A 500-year flood event, similar to that experienced in 1966, could inundate much of the Headworks area and impact water levels in the Upper Power Canal downstream to Genoa. An event of this magnitude would disrupt Project operations.

A 100-year flood event on the Platte River at Columbus would overtop the Outlet Weir and raise the water level in the Tailrace Canal upstream to the Columbus Powerhouse. Project operations would not be disrupted, but the Tailrace Park area would likely be inundated.

5.5.2 Wetlands

Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328). Neither wetland delineations (in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* [Environmental Laboratory, January 1987]) nor vegetative surveys have been conducted in the vicinity of the Project. Instead, wetlands have been identified and their areas approximated through the use of National Wetlands Inventory (NWI) mapping[7] and aerial imagery.

Based on NWI maps, there are approximately 3,110 acres of wetlands in the vicinity of the Project. The wetland systems along the Loup Power Canal are classified as primarily lacustrine and riverine because of the canal and regulating reservoirs (see Table 5-26). The NWI maps also show sporadic patches of palustrine, forested/scrub shrub, emergent, aquatic bed, and other unclassified wetland types in the vicinity of the Project. The specific wetland types and areas are listed in Table 5-26 and are shown in Figure 5-7, Sheets 1 through 14.

[7] NWI digital data files are records of wetland locations and classifications as developed by USFWS. The data provide consultants, planners, and resource managers with information on wetland locations and types. It is not the intent of NWI to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys. Boundaries are therefore generalized in most cases. The quality of the wetland data is variable mainly due to source photography, ease or difficulty in interpreting specific wetland types, and survey methods. Wetland types and areas (boundaries) in the vicinity of the Project are also subject to the NWI variability described by USFWS.

Table 5-26. Wetland Types in the Vicinity of the Project

Wetland Type		Area (acres)	Percent
Lacustrine[a]	unconsolidated bottom[d]	1,310	42.1
Riverine[b]	lower perennial[e] with an unconsolidated bottom	840	27.1
Palustrine[c]	forested/scrub shrub	660	21.1
	emergent	230	7.5
	aquatic bed[f]	40	1.4
Other	unclassified	30	0.8
Total		3,110	100.0

Source: USFWS, 1992, "National Wetlands Inventory – Nebraska." St. Petersburg, FL: USFWS, NWI.

Notes:

[a] Lacustrine – a system that includes wetland and deepwater habitats that are situated in a topographic depression or dammed river channel, lacking persistent vegetation with greater than 30 percent aerial coverage, and with a total area exceeding 20 acres (Cowardin et al., December 1979).

[b] Riverine – a system including all wetlands and deepwater habitats contained within a channel excluding wetlands dominated by persistent vegetation or wetlands containing oceanic salts in excess of 0.5 parts per thousand (Cowardin et al., December 1979).

[c] Palustrine – a system that includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, mosses, or lichens; the area is less than 20 acres and water depth in the deepest part of the basin is less than 2 meters at low water (Cowardin et al., December 1979).

[d] Unconsolidated bottom – At least 25 percent of the bottom is covered with particles smaller than stones and has a vegetative cover of less than 30 percent.

[e] Lower perennial – a system where the gradient is low and the water velocity is slow. There is no tidal influence, and some water flows throughout the year. The substrate consists or rock, cobbles, or gravel with occasional patches of sand (Cowardin et al., December 1979).

[f] Aquatic bed – wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years (Cowardin et al., December 1979).

The Project has created substantial wetland areas and several wetland types along the Settling Basin, the Upper and Lower Power Canals, Lake Babcock, Lake North, and the Tailrace Canal. The American lotus (*Nelumbo lutea*), part of the lily family, can be found in Lake Babcock. This American lotus population is the furthest west population until California (USDA NRCS, 2008).

Photo 5-5. American lotus at Lake Babcock.

Without the continual supply of water provided by the Loup River, the lacustrine and riverine systems present in the vicinity of the Project would no longer function as classified. The reduction in water supply would be more conducive to a palustrine system or no wetland system.

5.5.3 Riparian Habitat

Riparian habitat is defined as the "transition zone between aquatic and upland habitat. These habitats are related to and influenced by surface or subsurface waters, especially the margins of streams, lakes, ponds, wetlands, seeps, and ditches" (National Water Quality Monitoring Council, August 8, 2007).

The only obvious riparian habitat within the Project Boundary occurs near the Headworks, along the Loup River; however, there has been no systematic survey conducted that documents riparian habitat within the Project Boundary. Due to the close proximity of agricultural practices along the majority of the Loup Power Canal, adjacent riparian habitat is limited.

5.5.4 Littoral Habitat

Littoral habitat is defined as a zone that extends from the bank of a waterbody to a depth of 6.6 feet or to the maximum extents of non-persistent vegetation if found at depths greater then 6.6 feet (Cowardin et al., December 1979). There is littoral habitat near and around the Headworks as well as Lake Babcock and Lake North; however, there has been no systematic survey conducted that documents littoral habitat within the Project Boundary.

5.5.5 Plant and Animal Species

Plant species commonly found in the wetland, riparian, and littoral habitat in the vicinity of the Project are listed in Table 5-27 and in Section 5.4, Wildlife and Botanical Resources, above.

Table 5-27. Common Wetland Plants

Common Name	Scientific Name	Indicator Status[b]
American elm	*Ulmus americana*	FAC
black medick	*Medicago lupulina*	FAC
box elder	*Acer negundo*	FAC
Eastern cottonwood	*Populus deltoides*	FAC
prairie blazing star	*Liatris pycnostachya*	FAC
river-bank grapevine	*Vitis riparia*	FAC
roughleaved dogwood	*Cornus drummondii*	FAC
Russian olive[a]	*Elaaeagnus angustifolia*	FAC
switchgrass	*Panicum virgatum*	FAC
barnyard grass	*Echinochloa crus-galli*	FACW
fringed loosestrife	*Lysimachia ciliata*	FACW
green ash	*Fraxinus pennsylvanica*	FACW
peachleaf willow	*Salix amygdaloides*	FACW
prairie cordgrass	*Spartina pectinata*	FACW
red-osier dogwood	*Cornus stolonifera*	FACW
reedcanary grass[a]	*Phalaris arundinacea*	FACW
salt cedar[a]	*Tamarix ramosissima*	FACW
silver maple	*Acer saccarinum*	FACW
American lotus	*Nelumbo lutea*	OBL
arrowhead	*Sagittaria spp.*	OBL
bur-reed	*Sparganium spp.*	OBL
cattail	*Typha spp.*	OBL
common threesquare bulrush	*Schoenoplectus pungens*	OBL
false indigo	*Amorpha fruticosa*	OBL
lanceleaf fogfruit	*Phyla lanceolata*	OBL
purple loosestrife[a]	*Lythrum salicaria*	OBL
sandbar willow	*Salix exigua*	OBL
sedge	*Carex spp.*	OBL/FACW
spikerush	*Eleocharis spp.*	OBL/FACW
smartweed	*Polygonum spp.*	OBL/FACW/FAC
leafy spurge[a]	*Euphorbia esula*	NI

Sources: Sidle, John G., and Craig A. Faanes, July 16, 1997, "Platte River Ecosystem Resources and Management, with Emphasis on the Big Bend Reach in Nebraska," Northern Prairie Wildlife Research Center, retrieved on August 5, 2008, http://www.npwrc.usgs.gov/resource/habitat/plrivmgt/index.htm;
NGPC, August 2005, *The Nebraska Natural Legacy Project: A Comprehensive Wildlife Conservation Strategy*, Lincoln, Nebraska, available online at http://www.ngpc.state.ne.us/wildlife/programs/legacy/review.asp.

Notes:

[a] Invasive species.

[b] Indicator status – the range of estimated probabilities (expressed as a frequency of occurrence) of a species occurring in wetlands versus non-wetlands across the entire distribution of the species (USDA NRCS 2008):

FAC = Facultative; equally likely to occur in wetlands or non-wetlands (estimated probability 34 to 66 percent).

FACW = Facultative Wetland; usually occurs in wetlands (estimated probability 67 to 99 percent), but occasionally found in non-wetlands.

OBL = Obligate Wetland; occurs almost always (estimated probability 99 percent) under natural conditions in wetlands.

NI = Not Indicated

Invasive plant species that may occur in wetlands in the vicinity of the Project include, but are not limited to, Russian olive (*Elaaeagnus angustifolia*), reedcanary grass (*Phalaris arundinacea*) leafy spurge (*Euphorbia esula)*, purple loosestrife (*Lythrum salicaria)*, and salt cedar (*Tamarix ramosissima)* (Sidle and Faanes, July 16, 1997; NGPC, August 2005).

Several species of fish, birds, mammals, amphibians, and reptiles are known to inhabit wetland, riparian, and littoral habitat similar to that in the vicinity of the Project. Some of the more common species include the largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), plains topminnow (*Fundulus sciadicus*), red-winged blackbird (*Agelaius phoeniceus*), mallard (*Anas platyrynchos*), Canada goose (*Branta canadensis*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), beaver (*Castor canadensis*), bullfrog (*Rana catesbeiana*), tiger salamander (*Ambystroma tigrinum*), Great Plains toad (*Bufo cognatus*), snapping turtle (*Chelydra serpentine*), painted turtle (*Chrysemys picta*), and the fox snake (*Elaphe vulpine*) (NGPC, August 2005). For a more comprehensive list of animal species in the vicinity of the Project, see Sections 5.3, Fish and Aquatic Resources, and 5.4, Wildlife and Botanical Resources, above.

5.6 RARE, THREATENED, AND ENDANGERED SPECIES

The potential applicant must include in the pre-application document "[a] description of any listed rare, threatened and endangered, candidate, or special status species that may be present in the project vicinity. Components of this description must include:" 18 CFR §5.6(d)(3)(vii)

"A list of Federal- and state-listed, or proposed to be listed, threatened and endangered species known to be present in the project vicinity." 18 CFR §5.6(d)(3)(vii)(A)

Federal and state agencies list a number of species that occur in the vicinity of the Project as rare, threatened, or endangered (RTE). The RTE species that are known to occur in Nance and Platte counties as well as in adjacent counties with tributaries to the Loup River or with portions of the Lower Platte River are listed in Table 5-28. For each species, the Federal status under the Endangered Species Act of 1973 (ESA) and state status under Nebraska's Nongame and Endangered Species Conservation Act (NESCA) are shown. In addition, the NatureServe conservation status global and state ranks are provided for each species. These ranks provide an estimate of extinction risk and are based on a one-to-five scale, ranging from critically imperiled (1) to demonstrably secure (5). These status assessments are based on the best available information and consider a variety of factors, such as abundance, distribution, population trends, and threats (NatureServe, 2008). Detailed descriptions, including species occurrence, history, and habitat requirements, of the species listed in Table 5-28 are provided in Section 5.6.3, below.

Table 5-28. RTE Species that May Occur in the Vicinity of the Project or May Be Affected by the Proposed Relicensing of the Project[a]

Common Name	Scientific Name	Federal Status[b]	State Status[b]	Global Rank[c]	State Rank[c]	Nearest County of Known Occurrence
Birds						
Piping plover	*Charadrius melodus*	T	T	G3	S2	Nance and Platte
Interior least tern	*Sterna antillarum athalassos*	E	E	G4T2Q	S2	Nance and Platte
Whooping crane	*Grus americana*	E	E	G1	S1	Nance
Bald eagle	*Haliaeetus leucophalus*		T	G5	S1	Platte
Mammals						
North American river otter	*Lontra canadensis*		T	G5	S2	Boone

Common Name	Scientific Name	Federal Status[b]	State Status[b]	Global Rank[c]	State Rank[c]	Nearest County of Known Occurrence
Fish						
Lake sturgeon	*Acipenser fulvescens*		T	G3G4	S1	Saunders
Sturgeon chub	*Macrhybopsis gelida*		E	G3	S1	Nance and Platte
Pallid sturgeon	*Scaphirhynchus albus*	E	E	G2	S1	Saunders
Plants						
Small white lady's slipper	*Cypripedium candidum*		T	G4	S1	Platte
Western prairie fringed orchid	*Platanthera praeclara*	T	T	G3	S3	Boone

Sources: Associated General Contractors – Nebraska Chapter, 2007, "Nebraska Threatened and Endangered Species Identification Guide," available online at http://www.nlc.state.ne.us/epubs/R6000/H053-2007.pdf;
NatureServe, 2008, *NatureServe Explorer: An Online Encyclopedia of Life* [web application], Version 4.6, Arlington, VA: NatureServe, retrieved on May 9, 2008, http://www.natureserve.org/explorer/.

Notes:

[a] These species were included based on letters (USFWS, July 2008; NGPC, September 23, 2008), meetings, and discussions with associated agencies (see Appendix A).

[b] E = endangered; T = threatened.

[c] G = global

S = state

1 = Critically imperiled because of extreme rarity (5 or fewer occurrences)

2 = Imperiled because of rarity (6 to 20 occurrences)

3 = Rare or uncommon (on the order of 21 to 100 occurrences)

4 = Apparently secure

5 = Demonstrably secure

T = Infraspecific taxon (trinomial), refers to a subspecies or variety and is used only in global ranks (for example, G2T2)

Q = Questionable taxonomy (either the taxon is not generally recognized as valid or there is reasonable concern about its validity or identity, globally or at the state level)

5.6.1 Available Reports Pertaining to RTE Species

"References to any known [B]iological [O]pinion, status reports, or recovery plan[s] pertaining to a listed species." 18 CFR §5.6(d)(3)(vii)(C)

The most recent, available reports (including biological assessments, biological opinions, conservation assessments, management plans, and recovery plans) that have been written about the species identified in Table 5-28 are listed in Table 5-29. These reports were developed by or in cooperation with Federal and state agencies to provide detailed, site-specific management actions for private, Federal, and state cooperation in conserving listed species and their ecosystems (USFWS, April 2008).

Table 5-29. Reports Pertaining to Federally and State-listed RTE Species

Species	Report	Report Type
Piping plover	U.S. Fish and Wildlife Service. June 28, 1994. "Draft Revised Recovery Plan for Piping Plovers (*Charadrius melodus*) Breeding on the Great Lakes and Northern Great Plains." Twin Cites, MN: U.S. Fish and Wildlife Service.	Management plan
Piping plover	67 Federal Register (FR) 57637-57717. September 11, 2002. "Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northern Great Plains Breeding Population of the Piping Plover; Final Rule." Department of the Interior, Fish and Wildlife Service.	Management plan
Interior least tern	U.S. Fish and Wildlife Service. September 1990. "Recovery Plan for the Interior Population of the Least Tern (*Sterna antillarum*)." Twin Cites, MN: U.S. Fish and Wildlife Service.	Management plan
Whooping crane	Canadian Wildlife Service and U.S. Fish and Wildlife Service. March 2007. International Recovery Plan for the Whooping Crane (*Grus americana*). Ottawa: Recovery of Nationally Endangered Wildlife (RENEW) and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.	Management plan
Whooping crane	43 FR 20938-20942. May 1978. "Endangered and Threatened Wildlife and Plants, Determination of Critical Habitat for the Whooping Crane; Final Rule." Department of the Interior, Fish and Wildlife Service.	Management plan
North American river otter	Boyle, Steve. September 2, 2006. "North American River Otter (*Lontra canadensis*): A Technical Conservation Assessment." USDA Forest Service, Rocky Mountain Region.	Conservation assessment
Sturgeon chub	U.S. Fish and Wildlife Service. March 2001. "Updated Status Review of the Sicklefin and Sturgeon Chub in the United States." Denver: U.S. Fish and Wildlife Service.	Status review

Species	Report	Report Type
Pallid sturgeon	U.S. Fish and Wildlife Service. 1993. "Pallid Sturgeon (*Scaphirhynchus albus*) Recovery Plan." Bismarck, ND: U.S. Fish and Wildlife Service.	Management plan
Pallid sturgeon	Peters, Edward J., and James E. Parham. 2007. "Draft Ecology and Management of Sturgeon in the Lower Platte River, Nebraska." Nebraska Technical Series No. 18. Nebraska Game and Parks Commission. Lincoln, NE.	Management plan
Western prairie fringed orchid	U.S. Fish and Wildlife Service. 1996. "*Platanthera praeclara* (Western Prairie Fringed Orchid) Recovery Plan." Ft. Snelling, MN: U.S. Fish and Wildlife Service.	Management plan

5.6.2 Federally Designated Critical Habitat

"Extent and location of any federally-designated critical habitat, or other habitat for listed species in the project area." 18 CFR §5.6(d)(3)(vii)(D)

Federally designated critical habitat is defined as the specific areas that contain physical or biological features essential to the conservation of the species that may require special management considerations or protection under the ESA (National Research Council, 2005). Although there is Federally designated critical habitat for the whooping crane in central Nebraska (discussed in Section 5.6.3, below), there is currently no Federally designated critical habitat for any of the RTE species in the vicinity of the Project.

Critical habitat was designated for piping plovers on September 11, 2002 (67 FR 57637-57717). The habitat in Nebraska is located on the Platte River from Lexington, Nebraska, to the confluence with the Missouri River (252 miles), the Loup River (68 miles), and the eastern portion of the Niobrara River (120 miles). The shoreline of Lake McConaughy was excluded because USFWS maintained that it was already adequately managed under plans developed by the Central Nebraska Public Power and Irrigation District. USFWS also excluded sand pits because they do not meet the physical and biological requirements of critical habitat (National Research Council, 2005). On February 14, 2003, the Nebraska Habitat Conservation Coalition filed a lawsuit against USFWS before the U.S. District Court in Nebraska. The lawsuit was filed to invalidate the designation of critical habitat. On October 13, 2005, the Nebraska Habitat Conservation Coalition won the case against USFWS. U.S. District Judge Lyle Strom vacated and remanded all critical habitat designation in Nebraska and ordered USFWS to re-conduct the economic analysis and re-assess the critical habitat designation for the piping plover (U.S. District Court for the District of Nebraska, October 13, 2005). Thus, there is currently no Federally designated critical habitat for any of the RTE species in the vicinity of the Project.

5.6.3 Species Occurrence, History, and Habitat Requirements

"Identification of habitat requirements." 18 CFR §5.6(d)(3)(vii)(B)

"Temporal and spatial distribution of the listed species within the project vicinity." 18 CFR §5.6(d)(3)(vii)(E)

For each RTE species that may occur in the vicinity of the Project or may be affected by the proposed relicensing of the Project, the species occurrence, history, and habitat requirements are discussed below.

Piping Plover

Piping plover on nest with eggs. Photo courtesy of the Tern and Plover Conservation Partnership.

The Northern Great Plains population of piping plovers was listed as Federally threatened on December 11, 1985 (50 FR 50726-50733). Critical habitat was designated for this species on September 11, 2002 (67 FR 57637-57717), but this designation was vacated on October 13, 2005 (see Section 5.6.2, above, for additional information). No critical habitat is currently designated in the State of Nebraska for the piping plover.

Historically, piping plovers bred across three geographic regions: the U.S. and Canadian Northern Great Plains region (from Alberta to Manitoba and south to Nebraska), the Great Lakes region, and the Atlantic Coast region. The current breeding range of the Northern Great Plains population is very similar to the historic range accounts. Most of the breeding pairs in the U.S. portion of the population's range are in Montana, North Dakota, South Dakota, and Nebraska. In Nebraska, piping plovers are distributed along the Missouri, Niobrara, Loup, and Platte rivers throughout the breeding season, but habitat has been reduced along the Missouri and Platte rivers. The breeding range of piping plovers is on the Missouri River along the Nebraska state border from Fort Randall Dam to the Niobrara River and from Gavins Point Dam to Ponca State Park (TRC Mariah Associates Inc., 2007). Along the central reach of the Platte River, loss of sandbar habitat has caused many piping plovers to nest on sand and gravel mine spoil piles (Sidle and Kirsch, 1993). Most nesting on the Platte River occurs on the Lower Platte River, where encroachment is least advanced. There is also a nesting population on the sandy beaches of Lake McConaughy (67 FR 57637-57717).

Since 1987, NGPC has coordinated and conducted a standardized least tern and piping plover survey on the Lower Platte River system from Columbus to Plattsmouth. The survey consists of counting nesting colonies, adult birds, nests, and chicks on both the river and at associated sand and gravel mines. Piping plovers are routinely seen and are also known to nest at the Project's North SMA. This area has been included in the NGPC survey since 2007[8] (NGPC, November 30, 2007; Tern and Plover Conservation Partnership, July 30, 2008). A review of survey information from 1987 to 2007 indicated a decline in piping plover numbers in Nebraska since the 1980s. During this time period, Project operations have been unchanged. During the 2007 survey, all observed river nesting colonies were noted downstream from the Nebraska State Highway 92 bridge in Douglas County, near Venice, Nebraska, and no colonies were observed on the river from the confluence of the Loup and Platte rivers to the Nebraska State Highway 92 bridge (NGPC, 2007b). The occurrence and nesting success of the piping plover on the Loup and Platte rivers, at sand and gravel mines, or at the North SMA varies each year for any number of possible reasons, which may include weather, flood, drought, predation, habitat destruction, and human disturbance.

Piping plovers mainly use the Loup and Platte rivers for breeding, feeding, and nesting. Piping plovers breed in open, sparsely vegetated habitats, along sand and gravel shores of rivers and lakes, and in alkaline wetlands and sand flats. These migratory birds spend approximately 3 to 4 months on the breeding sites. Piping plovers arrive in mid-April with nesting and egg-laying commencing in mid-May. Hatching occurs in late May to mid-June. During this time, the home range is limited to the wetland, lakeshore, or section of beach on which the nest is located. The shallow nests, frequently lined with small pebbles or shell fragments, are located on dry salt flats, barren sandbars, or gravel beaches with less than 5 to 20 percent vegetation. Piping plovers frequently nest in least tern colonies.

Diet items may include marine worms, insects, crustaceans, mollusks, and other small marine invertebrates. Piping plovers leave the nesting sites in August. Although no one critical factor can be attributed to the decline of the species, possible reasons for decline in population include habitat alteration and destruction, over-utilization of piping plover habitat by humans, weather events, predation, and inadequate regulatory mechanisms (USFWS, June 28, 1994).

8 Piping plovers have been known to nest at the North SMA since the 1980s; however, the North SMA has only been included in the NGPC survey since 2007.

Interior Least Tern

Interior least tern and eggs.

Interior least tern on nest. Photo courtesy of U.S. Fish and Wildlife Service.

The interior least tern was listed as a Federally endangered species on May 28, 1985 (50 FR 21784-21792). On April 22, 2008, USFWS initiated a 5-year review of this species (73 FR 21643-21645). No critical habitat has been designated for the interior least tern.

The interior least tern is migratory and historically bred along the Missouri, Mississippi, Arkansas, Ohio, Red, and Rio Grande river systems and rivers of central Texas. The historic breeding range extended from Montana to Texas and from southern Indiana to New Mexico. Currently, the interior least tern continues to breed throughout most of these river systems, although its distribution is restricted to less altered river segments. This species has a breeding range located on the Missouri River along the State of Nebraska border from Fort Randall Dam to the Niobrara River and from Gavins Point Dam to Ponca State Park (TRC Mariah Associates Inc., 2007). Within Nebraska, interior least terns breed along the lower section of the Niobrara River (from Keya Paha County to the Missouri River), and current distribution here is similar to historic distribution. Interior least terns are also distributed and breed along the Platte River from North Platte, Nebraska, to the Missouri River and along the South Platte River to Ogallala, Nebraska. On the Loup River, interior least terns breed as far west as Arcadia, Nebraska, but are most common between St. Paul, Nebraska, and the Loup River's confluence with the Platte River at Columbus.

Since 1987, NGPC has coordinated and conducted a standardized least tern and piping plover survey on the Lower Platte River system from Columbus to Plattsmouth. The survey consists of counting nesting colonies, adult birds, nests, and chicks on both the river and at associated sand and gravel mines. Least terns are routinely seen and are also known to nest at the Project's North SMA and this area has been included in the NGPC survey since 2007[9] (NGPC, November 30, 2007; Tern and Plover Conservation Partnership, July 30, 2008). A review of survey information from 1987 to 2007 indicated that least tern numbers have more or less remained stable in Nebraska since the 1980s. During this time period, Project operations have been unchanged. During the 2007 survey, all observed river nesting colonies were noted downstream from the Nebraska State Highway 92 bridge, and no colonies were

9 Interior least terns have been known to nest at the North SMA since the 1980s; however, the North SMA has only been included in the NGPC survey since 2007.

observed on the river from the confluence of the Loup and Platte rivers to the Nebraska State Highway 92 bridge (NGPC, 2007b). As with the piping plover, the occurrence and nesting success of the least tern on the Loup and Platte rivers, at sand and gravel mines, or at the North SMA varies each year for any number of possible reasons, which may include weather, flood, drought, predation, habitat destruction, and human disturbance

Similar to the piping plovers, interior least terns arrive in late April to mid-June. Interior least terns nest in colonies on open sandbars, gravel beaches, or exposed flats. The nest is a shallow depression with small stones, twigs, or other debris nearby. Egg laying begins in late May with an incubation of 17 to 28 days. Fledging occurs 3 weeks after hatching, and departure from the colonies is usually complete by early September. The home range during breeding is limited to a reach of the river near the nest; however, this species has been known to fly up to 3.2 kilometers from the nest site to forage.

Interior least terns feed primarily on small fish, but their diet may also include crustaceans, insects, mollusks, and annelids. Although no one critical factor may be attributed to the decline of the species, possible population pressures include habitat alteration and destruction as well as human disturbance (USFWS, September 1990).

Whooping Crane

Whooping cranes. Photo by Rocky Hoffman, Nebraska Game and Parks Commission. Copyright © Nebraska Game and Parks Commission. All rights reserved.

The whooping crane was listed as Federally endangered on March 11, 1967, and critical habitat was designated for this species on May 15, 1978 (32 FR 4001; 43 FR 20938-20942). A 56-mile-long, 3-mile-wide stretch of the Platte River between Lexington and Shelton, Nebraska, is designated as critical habitat for this species (Canadian Wildlife Service and USFWS, March 2007).

The historical range of the whooping crane extended from the Arctic coast south to central Mexico and from Utah east to New Jersey, South Carolina, Georgia, and Florida. Although whooping cranes once numbered greater than 10,000, it has been estimated that only 500 to 1,400 whooping cranes inhabited North America in 1870. In the late 1800s, the whooping crane disappeared from the heart of its breeding range in north-central United States. By 1937, only two small breeding populations remained (a population is approximately 200 individuals). The last surviving bird of the Louisiana population died in captivity in 1950. The other remaining population had only 18 recorded individuals in 1939.

In Nebraska, whooping cranes use the Platte River as a stop-over during migration for a period of one day to several weeks. The migration period in Nebraska is approximately March 23 through May 10 and September 16 through November 16 (NGPC, September 23, 2008). The cranes roost on submerged sandbars in wide, unobstructed channels that are isolated from human disturbance. The only self-sustaining wild population of whooping cranes migrates through the Great Plains to nest near the Wood Buffalo National Park in Northwest Territories and Alberta, Canada, and winters in the central Gulf Coast of Texas at Aransas National Wildlife Refuge. Along the Platte River, no records of the whooping crane exist east of Chapman, Nebraska (approximately 10 miles northeast of Grand Island). A variety of habitats, including cropland, palustrine wetlands, and riverine habitats, are used for feeding and roosting sites.

Food sources during migration consist of frogs, fish, plant tubers, crayfish, insects, and agricultural grains. Migrating birds use stop-over habitats to meet immediate needs for energy and nutrient provision while waiting for appropriate weather conditions to continue migration.

Possible threats to the whooping cranes include human settlement, over-utilization of water rights to estuary inflows in Texas, human-caused mortality, disturbance of breeding and wintering grounds, disease (for example, avian tuberculosis), predation, global warming and associated climate change, loss of genetic diversity, chemical spills in the wintering area, and collisions with power lines and fences (Canadian Wildlife Service and USFWS, March 2007; National Research Council, 2005).

Currently, there are no known populations of whooping cranes in the vicinity of the Project. In 2006, there was a documented sighting of an isolated family group of whooping cranes on the Loup River approximately 8 miles upstream of Genoa (NGPC, October 2, 2008a). This sighting is believed to be an isolated occurrence during the migration season. These birds do not typically frequent this area and are usually found within the area designated as critical habitat. No additional sightings have been documented in the vicinity of the Project before or after 2006.

Bald Eagle

Bald eagle. Copyright © Nebraska Game and Parks Commission. All rights reserved.

The bald eagle is a large raptor native to most of North America. Unregulated hunting in the late 1800s caused the first major declines in this species. Further declines were caused in the mid-1900s due to the use of chlorinated hydrocarbon insecticides, such as dichlorodiphenyltrichloroethane (DDT), which caused softening in bird eggshells resulting in low reproductive success (Buehler, 2000). The bald eagle was listed by USFWS as an endangered species on February 14, 1978 (16 USC 1531-1544). After the banning of DDT and protection under the ESA, bald eagle numbers increased

(Buehler, 2000; 50 CFR 17). On August 11, 1995, USFWS reclassified the species as threatened in the lower 48 states (60 FR 36000-36010). In 1999, USFWS proposed to remove the bald eagle as a Federally listed species (64 FR 36454-36464). NGPC reclassified the bald eagle as threatened in the state of Nebraska in 2000. On June 28, 2007, the bald eagle was formally removed from the list of Federally threatened and endangered species (50 CFR 17). The bald eagle remains Federally protected by both the Bald and Golden Eagle Protection Act (16 USC 668a-d) and the Migratory Bird Treaty Act (16 USC 703-712). Currently, NGPC staff, in consultation with experts outside the agency, have reviewed the status of the bald eagle in Nebraska and are recommending that this species be removed from listing under NESCA (NGPC, 2008c).

In 2007, there were 51 active bald eagle nests in Nebraska. A collection of the nests were documented along the Loup River system and near the confluence of the Loup and Platte rivers (NGPC, 2008c). Bald eagles are commonly observed flying and perching along the canal below the Columbus Powerhouse. Substantial threats to this species include shooting and trapping; pesticides and other contaminants; ingestion of lead, plastics, and other foreign materials; collision with stationary and moving objects; electrocution; habitat degradation; and human disturbance at nest sites and winter roosts (Buehler, 2000). Further information on this species is provided in Section 5.4, Wildlife and Botanical Resources.

North American River Otter

North American river otter. Photo courtesy of U.S. Fish and Wildlife Service.

The North American river otter is a long, slender, partially aquatic mammal. This species was listed as endangered by NGPC in 1980. The species was later down-listed to threatened in 2005, after a series of successful reintroductions.

Historically, river otters once occupied most major drainages in Canada and the continental United States. River otters were historically common in all major waterways of Nebraska, including the Loup and Platte rivers (Jones, 1962 and 1964, as cited in Boyle, September 2, 2006). Otters were eventually extirpated from Nebraska as well as Colorado and nearly extirpated from Kansas, South Dakota, and Wyoming in the early 1900s. As a result of conservation measures and reintroductions, small populations of otters have become reestablished in these states. Currently, river otters are distributed throughout North America, with higher population densities in coastal habitats and areas of low human density. Although historically distributed throughout the southwestern United States, populations in this area are sparse or extirpated (Melquist, Polechla, and Toweill, 2003). Inland populations are most abundant in lowland or valley marshes interconnected with meandering streams and small lakes.

River otters are relatively common in many major river systems, but they have become less common in heavily settled areas.

NGPC released river otters to seven sites between 1986 and 1991, including sections of the South Loup River (in Custer County), the Calamus River (in Loup County), the North Platte River (above Lake McConaughy), the Platte River (near Kearney), the Cedar River (in Wheeler County, a tributary of the Loup River), the Niobrara River (in Sheridan County), and the Elkhorn River (in Antelope County). Recent observations suggest that river otters have become established in several watersheds, with the highest quality and most extensive habitat in the Platte River (north of Lake McConaughy and from Dawson County to Hamilton County) and its tributaries. Otters are highly mobile, moving in response to food availability or environmental conditions, making home range size and location extremely dynamic.

The Nebraska Cooperative Fish and Wildlife Research Unit, in cooperation with NGPC, is currently conducting a study on the home range and habitat use of river otters in the Big Bend area of the Platte River. The final season of trapping and implanting transmitters will begin in September 2008 (Nebraska Cooperative Fish and Wildlife Research Unit–USGS, 2007). No abundance estimates are currently available.

River otters are social animals that hunt and travel together, using the same resting sites, latrines, and dens. This species is active year-round and does not migrate. Breeding can occur in March and April but is extremely variable. Breeding may take place on land or in water and may occur anywhere within the female's home range. Females give birth and rear young in abandoned dens of other aquatic mammals. Natal dens may occasionally be found up to a few hundred feet from water.

The river otter's diet consists primarily of fish, but may also include crustaceans, mollusks, insects, birds, and small mammals. Bobcat, mountain lion, gray wolf, red fox, and bald eagles have been reported as predators to river otters. Threats to the river otter include destruction and degradation of habitat, water pollution, human settlement and recreational use of riparian areas, and incidental trapping and illegal take (Boyle, September 2, 2006).

Currently, there are no known populations of river otters in the vicinity of the Project. This species was included because they are a highly mobile species and the nearest location of release was in Wheeler County, along the Cedar River. The Cedar River drains into the Loup River and could be a possible conduit for movement of river otters.

Lake Sturgeon

Lake sturgeon. Photo by Wayne Davis (http://www.epa.gov/bioiweb1/html/photos_fish_freshwater.html).

Historically, lake sturgeon were distributed from the rivers of the Hudson Bay watershed in Saskatchewan and Manitoba, Canada, east to the St. Lawrence estuary, and south throughout the upper and middle Mississippi River and Great Lakes basins and included populations in Tennessee, Ohio, and lower Mississippi drainages. It is currently considered rare throughout the species' historic range. Distribution has been extended to the Missouri River and the Platte River in Nebraska (in Douglas, Sarpy, and Saunders counties). The lake sturgeon is currently listed as threatened in the State of Nebraska under NESCA.

Lake sturgeon are benthic (bottom dwelling), found in shallow water with gravel or rocky substrate in the Lower Platte and Missouri rivers. This species inhabits large rivers, lakes, and reservoirs where small benthic organisms, such as snails, crayfish, and aquatic insect larvae, are abundant. The gravelly and sandy substrates serve as spawning habitat along the edges of sandbars.

The lake sturgeon diet is very similar to diets of other sturgeon species. They feed primarily on crustaceans, but also eat small fish and insects. Threats to this species may include pollution, lack of spawning habitat, fragmentation of habitat by dams, and decreasing water levels in the Platte River (NGPC, August 2005).

Currently, there are no known occurrences of lake sturgeon within the vicinity of the Project (NGPC, October 2, 2008b). The nearest known occurrence is documented in the Lower Platte River near the confluence of the Lower Platte and Elkhorn rivers. This species was included in this discussion because it is a riverine species and has the potential to migrate nearer to the vicinity of the Project.

Sturgeon Chub

Sturgeon chub. Photo by David Ostendorf, Missouri Department of Conservation.

Historically in Nebraska, sturgeon chub were found in the Missouri River along the eastern side of the state and in scattered locations in the lower Niobrara River, the Republican River, Loup River, Elkhorn River, Platte River, and Brazile Creek. Recent records have only found sturgeon chub in the Platte and Missouri rivers. The sturgeon chub is currently listed as threatened in the State of Nebraska under NESCA.

Sturgeon chub prefer large, free-flowing riverine systems characterized by swift flows, highly variable flow regimes, braided channels, high turbidity, and sand/fine gravel substrates. They have been collected in side chutes and backwater, which they may use for spawning. Sturgeon chub are often captured with a fish of the same genus, a sicklefin chub (*Macrhybopsis meeki*), in water less than 3 feet deep (USFWS, March 2001).

The sturgeon chub diet consists of small aquatic insects. Reduction of turbidity, channelization, modified water flows, loss of spawning habitat, de-watering, and sediment transport may be threats to this species (NGPC, August 2005).

Currently, there are no known occurrences of sturgeon chub within Nance or Platte County or in the vicinity of the Project (NGPC, October 2, 2008b). This species was included in this discussion because it is a riverine species and has the potential to migrate nearer to the vicinity of the Project.

Pallid Sturgeon

Pallid sturgeon. Photo by Ken Bouc. Copyright © Nebraska Game and Parks Commission. All rights reserved.

The pallid sturgeon (*Scaphirynchus albus*) is a descendent of a group of ancient (Paleozoic) fish. Historically, pallid sturgeon were more abundant in the main stem and major tributaries of the Missouri and Mississippi rivers than they are currently. In 1905, Forbes and Richardson estimated that pallid sturgeon comprised 1 in 5 sturgeon collected in the lower Missouri River (USFWS, 1993). In the late 1970s, 1 in every 398 river sturgeon collected in the lower Missouri and middle Mississippi were pallid sturgeon (Carlson et al., 1985). There are no sturgeon sampling records in the Platte River during this time period. Because of continued decline of this species, on September 6, 1990, USFWS listed this species as Federally endangered (55 FR 36641-36647). No critical habitat is designated for this species; however, six recovery priority management areas were identified in the recovery plan for the pallid sturgeon. One of these six areas is the confluence of the Lower Platte River and the Missouri River (National Research Council, 2005).

Pallid sturgeon generally prefer cool (32° to 85° Fahrenheit), wide turbid rivers. The main habitat occupied by this species is submerged sand flats and gravel bars. Sturgeon are found in locations with many islands, at the mouths of tributaries, and downstream ends of sandbars where currents converge (National Research Council, 2005). These locations are thought to provide valuable feeding areas for this species. These fish are most often found over a sandy substrate within waters with a velocity of 0.3 to 1.0 feet per second (fps) (USFWS 1993). Swigle (2003) studied pallid sturgeon in a section of the Platte River from its confluence with the Loup River near Columbus downstream to the mouth of the Missouri River. As a bottom-dwelling fish, the pallid sturgeon used areas downstream from sunken sandbars for feeding.

These areas create pockets of slow bottom flows, and most pallid sturgeon were typically found at depths of 1.3 m.

A strong bottom flow velocity at spawning areas is a critical element for successful spawning of sturgeon species. Pallid sturgeon are likely to spawn in fast-flowing sections of the main stem portion of rivers (Swigle 2003). Based on a study by Peters and Parham (2007), pallid sturgeon were theorized to be using the Platte River for spawning, although no definite spawning beds have been located. The estimated spawning area nearest to the Project was in Sarpy County near Ashland, Nebraska, where 7 larval pallid sturgeon were collected during a drift net sampling collection from 1998 to 2004 (Peters and Parham, 2007). Adult pallid sturgeon were captured, measured, evaluated, and tagged. The tags allowed researchers to track the fish after release. The nearest recorded occurrence of this species to the Project is in Sarpy County, near the confluence of the Platte and Elkhorn rivers. Rapid, long distance migrations both upstream and downstream may occur during April or May, with little movement in the summer and winter months. A variety of environmental cues, including water temperature and discharge, are important guidance mechanisms for fish migration (Swigle, 2003). According to a study by Swigle (2003), upstream migrations for pallid and shovelnose sturgeon begins in April, when river temperatures ranged from 8.4° to 16.8° Celsius. Increased temperatures may indirectly influence sturgeon movement by triggering increased flows via melt runoff. Previous studies have found positive relationships between discharge and sturgeon movement, possibly indicating that onset of spawning is initiated by typical spring flooding of rivers (Swigle, 2003). Pallid and shovelnose sturgeon are reported active in the Missouri and Mississippi rivers at temperatures of 4° Celsius or greater. Pallid sturgeon hatcheries have determined that ideal spawning temperatures in the hatchery environment range from 15.5° to 18.5° Celsius immediately prior to spawning. Shovelnose sturgeon, a similar species, are documented to spawn in late May through early June, when water temperatures are between 19° and 21° Celsius (Peters and Parham, 2007).

The diet of a pallid sturgeon is dominated by large river minnows and shiners but may also include snails, small mussels, and immature aquatic insects. Human-related activities such as flow modification for navigation, agricultural water use, and over fishing may be the factors responsible for the decline of this species (Swigle, 2003).

Currently, there are no known occurrences of the pallid sturgeon in the vicinity of the Project. The most recent survey done by Peters and Parham (2007) found the nearest occurrence to be in the Lower Platte River at the confluence of the Elkhorn and Platte rivers. Pallid sturgeon have not been documented upstream beyond this point in the Platte River, and there have been no documented occurrences in the Loup River. This species is included in this discussion because it is a riverine species and has the potential to migrate nearer to the vicinity of the Project. In addition, resource management agencies have expressed concern that Project operations (hydrocycling) may affect pallid sturgeon that may inhabit the Platte River downstream of the confluence with the Elkhorn River.

Small White Lady's Slipper

Small white lady's slipper. Photo by T.G. Barnes, USDA-NRCS PLANTS Database.

The small white lady's slipper is a member of the orchid family. Its range in Nebraska is throughout the Loup River Valley in the Mixedgrass Prairie Ecoregion and in the eastern Sandhills. This species prefers moist to wet sedge meadows, wet prairies, and wet-to-mesic tallgrass prairies. The small white lady's slipper is listed as threatened in the State of Nebraska under NESCA.

The small white lady's slipper blooms in the end of May to early June. Threats to this orchid may include conversion of meadows to cropland and development, invasive species, reduced groundwater levels, annual mid-summer haying, and herbicide spraying (NGPC, August 2005).

There are documented occurrences of small white lady's slipper in Platte County (NGPC, October 2, 2008b). Currently, there are no known populations located in the vicinity of the Project.

Western Prairie Fringed Orchid

Western prairie fringed orchid. Photo by M. Marinovich, HDR.

The Western prairie fringed orchid was Federally listed as threatened on September 28, 1989 (54 FR 39857-39863). On March 30, 2006, USFWS initiated a 5-year review of this species (71 FR 16176-16177). No critical habitat has been designated for this species.

The Western prairie fringed orchid is found in the eastern two-thirds of Nebraska, from Cherry and Keith counties in the west to the Missouri River in the east. This species is a perennial orchid found in wet-mesic to mesic tallgrass prairie, specifically in unplowed, calcareous prairies and sedge meadows. The soils are usually Udolls or Udic Ustolls (humid to intermittently dry mollisols, or prairie soils) on gentle to moderate slopes. In tallgrass prairies, the Western prairie fringed orchid is associated with *Andropogon* spp., *Sorghastrum* sp., and *Panicum* sp. In sedge meadows, the orchid is associated with *Carex* spp. and *Eleocharis* spp. There is evidence that orchid ecology is tied to mycorrhizal fungi symbiotic associations.

In Nebraska, this orchid blooms almost exclusively in the last week of June to the first two weeks of July. Flowering may be suppressed by litter accumulation and stimulated by fire. Western prairie fringed orchids may be threatened by habitat modification or destruction, over-utilization for commercial or scientific purposes, predation, inadequacy of existing regulatory mechanisms such as protection, and decrease of a singular pollinator species (hawk moths) due to pesticide use (USFWS, 1996).

Populations are known to occur in Boone, Cherry, Dodge, Garfield, Grant, Greeley, Hall, Holt, Lancaster, Loup, Madison, Otoe, Pierce, Rock, Saline, Sarpy, Seward, and Wheeler counties, and may occur at other sites in Nebraska. Currently, there are no known populations located in Nance and Platte counties or in the vicinity of the Project.

5.6.4 Effects of the Project

The nature and extent of adverse impacts on RTE species from continued operation of the Project under a new license are not known. Ongoing effects on RTE fish from continued Project operations and Project-related activities might be associated with minimum stream flows, water temperatures, regulation of peak flows, habitat access, and sandbar spawning habitat quality. Some ongoing Project operations and Project-related activities (for example, dredging of the canal, formal and dispersed recreation) have the potential to affect RTE plant or animal populations, if present in the vicinity of the Project. Practices are in place to protect piping plovers and interior least terns, in particular, which are known to occur in the vicinity of the Project, as discussed in Section 5.6.5, below.

5.6.5 Existing or Proposed Protection, Mitigation, and Enhancement Measures

Since the 1980s when the piping plover and interior least tern were listed as threatened and endangered, respectively, the District has cooperated with resource agencies to implement measures to protect these species. The primary existing PM&E measure for piping plovers and interior least terns is the voluntary cooperation among the District, USFWS, NGPC, and the Tern and Plover Conservation Partnership. The isolation, broad expanse, and frequent wetting of the North SMA, described in Section 4.2.7, have made it a popular nesting site for piping plovers and interior least terns, whose nesting period ranges from late April to late July. Since 1984, the District has voluntarily cooperated with USFWS, NGPC, and the Tern and Plover Conservation Partnership to protect the nesting birds. This has led to cessation of dredging activity during the nesting/fledging season each year, as follows. District personnel watch closely for the arrival of piping plovers and interior least terns in the North SMA. When the birds have been sighted, the District contacts USFWS or the Tern and Plover Conservation Partnership. At this time, the District begins making plans to stop dredging soon. Typically, dredging is stopped in early June until mid- to late August, allowing the birds to nest, forage, and raise young in the sandy habitat.

Dredging and discharge resume when the last young have fledged and the birds have begun their winter migration.

Before dredging is stopped each year, the District protects nesting areas by maintaining a sand berm and positioning cut trees so as to divert the discharge water. A number of deterrent methods have also been used to direct nesting to the safest and most suitable habitat in the North SMA. By continuing dredging operations outside of the nesting/fledging season, the District continues to provide suitable, productive habitat for the piping plovers and interior least terns.

In addition to the District's efforts, Preferred Rocks of Genoa, USFWS, and NGPC have developed an MOU to ensure cooperative, proactive management strategies to avoid negative impacts on piping plovers and interior least terns from Preferred Rocks of Genoa's industrial operations while avoiding delay of these operations. The District and the Tern and Plover Conservation Partnership are cooperating parties to the MOU. Although the MOU has not been signed by all parties, it is being implemented informally, and the District continues to work with USFWS, NGPC, and the Tern and Plover Conservation Partnership to alter dredging activities during the nesting season to further protect these species (Preferred Rocks of Genoa, USFWS, and NGPC, 2008).

Along with the MOU, Preferred Rocks of Genoa has developed an Adaptive Management Plan (AMP) (see Appendix G) for the North SMA to address the actions that Preferred Rocks of Genoa will take to improve nesting habitat within the Active Habitat Zone (AHZ), to monitor piping plover and interior least tern nesting, to discourage nesting in areas of sand removal activity during the nesting season, and to protect nests and colonies outside of the AHZ. After 2 years of informally implementing the MOU and AMP, this plan and process appear to be succeeding in the goals of protecting the nesting birds as well as allowing for the continued deposition of dredged material and removal of sand.

Photo 5-6. The North SMA in 2007, before construction of a protective berm.

Photo 5-7. Protective berm in 2008; limbs and branches stabilize sand.

Photo 5-8. Protective berm for piping plovers and interior least terns in 2008.

Photo 5-9. Discharge pipe extension to divert water around berm in 2008.

Photo 5-10. Windrowing used to direct birds to a safe nesting area in 2008.

Photos 5-6 through 5-10, above, were provided by the Tern and Plover Conservation Partnership.

5.7 RECREATION AND LAND USE

The potential applicant must include in the pre-application document "[a] description of the existing recreational and land uses and opportunities within the project boundary. The components of this description include:" 18 CFR §5.6(d)(3)(viii)

5.7.1 Existing Recreational Facilities

"Text description illustrated by maps of existing recreational facilities, type of activity supported, location, capacity, ownership and management." 18 CFR §5.6(d)(3)(viii)(A)

The Project Boundary encompasses approximately 5,200 acres of land, all of which is critical to the continued operation of the Project. The majority of the Project Boundary lends itself to recreational opportunities, and with few exceptions,[10] these recreational opportunities are open to public use free of charge.

[10] Areas immediately adjacent to the settling basin and the Monroe and Columbus powerhouses are restricted from public access because of safety concerns.

Central to the District's recreational facilities is the Loup Power Canal. The canal is approximately 35 miles long, has approximately 70 miles of shoreline (not including the 10 miles of shoreline surrounding Lake Babcock and Lake North), and is fully accessible to the public via access roads on both sides. The public access roads allow for primitive camping, hiking, biking, and bird watching/eagle viewing opportunities along the canal. In addition, fishing for carp, channel and flathead catfish, and freshwater drum in the canal is very popular. The canal's most productive fishing opportunities occur downstream of the Skimming Weir, siphons, Monroe Powerhouse, Columbus Powerhouse, and Outlet Weir, all of which are described in Section 4.2, Project Facilities and Components (NGPC, 2008d).

Within the Project Boundary, along the length of the Loup Power Canal, the District owns and operates five developed recreation areas containing nearly 1,500 acres of land and 1,100 acres of water (see Figure 5-8, Sheets 1 through 5). These recreation areas are open to the public, some from May 1 to November 1 and others year-round (weather permitting), and it is estimated that there are 150,000 annual user visits to the various recreational amenities of the District's property, including these recreation areas. District personnel maintain the facilities throughout the year, allowing visitors the following recreational opportunities, all of which are free of charge: water skiing, swimming, boating, camping, fishing, biking, hiking, picnicking, bird watching, photography, and Off-Highway Vehicle (OHV) riding. The specific recreational opportunities available at the five developed recreation areas (listed west to east) are provided below. Locations of all recreation facilities are shown in Figure 5-8, Sheets 1 through 5.

- Headworks Park – Headworks Park, which includes East Camp, Park Camp, Trailhead Camp, and Weir Park Camp, is located 6 miles west of Genoa on Highway 22 and is north of the Loup Power Canal (see Figure 5-8, Sheet 2). This 10-acre recreation area features 12 electrical hookups for campers, picnic areas (with shelters, picnic tables, picnic grills, potable water, and wheelchair-accessible toilets), swimming in a small lake, and fishing in small lakes and in the canal.

Photo 5-11. Entrance to Headworks Park.

Associated with Headworks Park is Headworks OHV Park (see Figure 5-8, Sheet 1). Headworks OHV Park is owned by the District and maintained by the Nebraska Off Highway Vehicle Association (NOHVA).[11] This 1,200-acre site is located south of the Loup Power Canal (separate from Headworks Park north of the canal) and includes open areas and approximately 50 miles of sandy trails that are accessible to all-terrain vehicles, dirt bikes, and snowmobiles. The park operates year-round, with the exception of closures during District dredging activities (generally March 15 to May 15 and August 15 to September 20), and is estimated to receive 20,000 annual user visits (NOHVA, April 23, 2007). In addition, Headworks OHV Park hosts NOHVA's annual spring and fall OHV jamborees. The most recent jamboree occurred on June 21 and 22, 2008. The event hosted 1,603 participants from Nebraska, Iowa, South Dakota, Kansas, Oklahoma, Minnesota, and Texas. Proceeds from the jamborees support local emergency community services in Genoa and Fullerton (NOHVA, April 23, 2007).

[11] NOHVA is a not-for-profit organization of over 2,900 members. NOHVA serves the interests of OHV enthusiasts in Nebraska by acting as liaison between OHV enthusiasts and Federal, state, and local government entities. NOHVA advocates environmentally sound, law-abiding, safety-minded, family-oriented, and responsible off-highway recreation.

Photo 5-12. Headworks OHV Park, which hosts NOHVA's annual spring and fall OHV jamborees and receives approximately 20,000 annual user visits.

In 2003, NOHVA conducted a member survey to determine the economic impact of ATV and dirtbike use in Nebraska. Based on the findings, Headworks OHV Park and its users provide substantial economic stimulus to local businesses in and around Genoa (NOHVA, February 2004).

- Lake Babcock Park (aka Loup Park) – Lake Babcock Park is located on the north and west shores of Lake Babcock, just north of Columbus (see Figure 5-8, Sheet 3). This well-developed, 40-acre site includes camping areas (50 trailer spaces with electricity provided and 120 tent spaces), playground areas, pedestrian/bike trails, and a picnic shelter. Other specific amenities include picnic tables, benches, fire grates, potable water, and wheelchair-accessible toilets. In addition, Lake Babcock Park offers fishing access to the 600-acre Lake Babcock, which contains bullhead, carp, and channel and flathead catfish. At Lake Babcock, boats are restricted to 5 miles per hour with no wake, and no boating is allowed during bird migration periods (NGPC, 2008d).

- Lake North Park – Lake North Park is located 4 miles north of Columbus and is the District's most popular recreation area (see Figure 5-8, Sheet 3). This site features 2 miles of beaches, two boat ramps, camping areas (25 trailer spaces with electricity provided and 100 tent spaces), and picnic shelters. Other specific amenities include fire grates, potable water, and wheelchair-accessible toilets. In addition, Lake North Park offers fishing access to the 200-acre Lake North, which contains carp, channel catfish, crappie, freshwater drum, and walleye. All boats are allowed at Lake North (NGPC, 2008d).

Photo 5-13. Lake North, which opened in the mid-1960s.

Photo 5-14. Lake North, the District's most popular recreation area today.

- Columbus Powerhouse Park – Columbus Powerhouse Park is located adjacent to the Columbus Powerhouse, which is 3 miles north on US 30 and 3rd Avenue (see Figure 5-8, Sheet 4). This 4-acre park is open year-round and features a camping area, a playground, a picnic area, and fishing. Specific amenities include grills and wheelchair-accessible toilets.
- Tailrace Park – Tailrace Park is located at the confluence of the Tailrace Canal and the Platte River, 3 miles east and 1 mile south of Columbus (see Figure 5-8, Sheet 5). This 9-acre park is noted for its exceptional fishing. Tailrace Park also offers a playground area and picnic facilities with notable forested scenery.

In an effort to ensure the safety of swimmers at the District's aquatic recreational facilities, the District visually monitors for blue-green algae growth, and NDEQ performs weekly sampling for microcystin (a toxin generated by certain strains of blue-green algae). If NDEQ sampling detects microcystin, the District posts notices to warn swimmers.

In addition to the above-referenced developed recreation areas and in cooperation with Columbus Area Recreational Trails, Inc. (CART), the District sponsors and maintains a public trail network within the Project Boundary. Essentially, the trail system abuts the north, west, and south perimeters of the Lake Babcock/Lake North area, with 18th Avenue acting as the eastern perimeter. The trails within this trail system are described below and are shown in Figure 5-8, Sheets 1 through 5:

- Two Lakes Trail – Two Lakes Trail was built in 2000 with a combination of government and privately donated funds (see Figure 5-8, Sheet 3). The trail winds 2.4 miles along the north shores of Lake Babcock and Lake North and consists of an 8-foot-wide concrete path, which is compliant with the Americans with Disabilities Act (ADA). Two Lakes Trail offers recreational opportunities for joggers, cyclists, runners, rollerbladers, walkers, bird watchers, and nature enthusiasts and was awarded the Millennium 2000 Community Trail Award.[12]

Photo 5-15. Bicycle riders enjoying the District's trail network.

- Bob Lake Trail – Bob Lake Trail is a 1.3-mile-long, 9-foot-wide crushed limestone trail that skirts the southwest perimeter of Lake Babcock (see Figure 5-8, Sheet 3).

[12] Millennium Trails was a national initiative of the White House Millennium Council, in partnership with the Department of Transportation, that recognized, promoted, and stimulated the creation of trails to "honor the past and imagine the future" as part of America's legacy for the year 2000 (White House Millennium Council, 2008).

Photo 5-16. Castner's Crossing footbridge, which crosses the Loup Power Canal and connects the Two Lakes Trail and the Bob Lake Trail.

- Robert White Trail – Robert White Trail is a 1.5-mile crushed limestone trail that follows the southern perimeter of Lake Babcock from Bob Lake Trail to 18th Avenue (see Figure 5-8, Sheet 3).

As discussed in Section 5.4, Wildlife and Botanical Resources, the Loup Lands WMA is a 485-acre parcel within the Project Boundary, located near the Headworks, that is leased to NGPC (see Figure 5-8, Sheets 1 and 2). The Loup Lands WMA is open to the public for both wildlife viewing and hunting.

In addition to the Loup Lands WMA, the Lake Babcock Waterfowl Refuge is partially located within the Project Boundary. The refuge consists of Lake Babcock, Lake North, and adjoining lands, was established in the 1940s, and is regulated by NGPC (see Figure 5-8, Sheet 3). Approved and restricted recreation activities at the Lake Babcock Waterfowl Refuge are as follows (163 NAC 4-019):

- All hunting is prohibited in the posted area.
- The operation of all vessels is prohibited upon the waters of the refuge during the open waterfowl season (with the exception of District vessels necessary for Project operation and maintenance), except that portion of the refuge know as Lake North, where vessels may be operated at any time during the year for the purpose of pleasure or fishing.

- Fish may be taken by any otherwise legal means during the entire year in Lake North, but shall be prohibited in Lake Babcock during an open waterfowl season.

In addition to the previously noted cooperatives between the District and civic groups such as NOHVA and CART, the District has successfully worked with the Boy Scouts and Girl Scouts on multiple projects that provide the scouts opportunities to perform community service while adding to the District's recreational amenities. The District has provided building materials and manpower for these projects, and following project completion, the District adopts the maintenance activities associated with these projects. Some examples of successful projects are as follows:

- Creation of Contemplation Point, a small area where diverted local drainage is conveyed over rocks, resulting in calming sounds similar to a babbling brook. A wheelchair-accessible picnic table was also installed at this location.
- Construction of multiple kiosks that include trail maps and announcements.
- Installation of name plates on trees along trails (to aid in species identification).
- Construction and installation of bird nesting habitat and bat houses.

5.7.2 Recreational Use

"Current recreational use of project lands and waters compared to facility or resource capacity." 18 CFR §5.6(d)(3)(viii)(B)

The combined recreational facilities on District property are used during more than 150,000 annual user visits, with Lake North Park receiving the most user visits and the semiannual OHV Jamboree at Headworks OHV Park drawing 1,500 to 2,000 participants in the spring and in the fall. Standard camping capacities at each recreation area are noted in Section 5.7.1, above; however, during peak camping weekends, overflow campsites are available.

Recreation use varies both seasonally and throughout the week, with heaviest use occurring in the summer, on weekends, and on holidays. Overall, the District's recreational facilities are frequently used by the public with limited periods of overcrowding. The District's facilities are often at full capacity on the Memorial Day, Independence Day, and Labor Day holiday weekends; otherwise, there is typically ample opportunity for recreational use. Details on facility utilization are as follows:

- Camping Areas – Developed camping areas are typically used throughout the summer, with space available most of the time, including weekends. However, there are times when all developed facilities are used on major holiday weekends or during the NOHVA OHV spring and fall jamborees. Nearly unlimited primitive camping areas are available along the entire length of the Loup Power Canal.

- Boat Launch Areas – The District has two boat launch areas, each with one boat launch lane. These facilities provide adequate lake access.
- Trails – The District has over 5 miles of trails that are used on a daily basis and provide ample opportunity for public use.
- Playground Areas – The District maintains playground equipment at all of its developed recreation areas. This equipment is frequently used on weekends and after school hours but is not crowded.
- Swimming Areas – Swimming is allowed in designated areas at Headworks Park and Lake North Park.

The District's recreational facilities are frequently used but are not considered crowded during average-use times (excluding major holiday weekends). When it is considered that nearly the entire Project Boundary is available for public recreation (including primitive camping), overall recreational use is minimal in terms of overall recreational capacity. Therefore, potential increases in future recreation facility demand could be accommodated by the existing facilities.

5.7.3 Current and Future Recreation Needs

"Current and future recreation needs identified in current State Comprehensive Outdoor Recreation Plans, other applicable plans on file with the Commission, or other relevant local, state, or regional conservation and recreation plans." 18 CFR §5.6(d)(3)(viii)(D)

Current and future recreation needs are identified in state, regional, and local plans, as described below.

In the Nebraska *State Comprehensive Outdoor Recreation Plan* (SCORP), the state is divided into seven regions; the Project is located in Region 3 (NGPC, 2006). The SCORP makes no specific reference to the existing Project-related recreation opportunities or any existing recreation needs associated with the Project; however, the SCORP does speak in generalities concerning the growing population in Region 3. Regarding recreation needs in Region 3, the SCORP states the following (NGPC, 2006):

- "New facilities, including lodging, should be in regions where population is growing."
- "Region 3 should focus on new acquisition and development because of growing populations."

In the *2004 Nebraska Tourism Industry Development Plan*, the state is divided into seven regions; the Project is located in the Lewis and Clark Region (Nebraska Travel and Tourism Division, 2004). The Tourism Industry Development Plan lists public and industry recommendations that were made by local residents who attended a series of public meetings. Suggestions specific to the Project are listed below:

- "Develop wildlife viewing opportunities at Lake Babcock, north of Columbus."
- "Encourage trail development at Lake Babcock, north of Columbus."
- "Maintain the Loup River Canal Trail (Genoa to Columbus) as a primitive hiking trail accessible to the public."

CART is a §501(c)(3) non-profit organization that is composed of a group of volunteers who envision a series of human-powered transportation and recreation routes through the community of Columbus (CART, 2008a). The CART Master Plan identifies multiple alignments for proposed trails within the Project Boundary. The Master Plan does not assign specific names to the proposed trails; however, their proposed alignments are generally described as follows (CART 2008b):

- Proposed trail that begins at the Lower Power Canal's mouth at Lake Babcock and follows the Lower Power Canal an unspecified distance west
- Proposed trail that begins at the outlet of Lake Babcock and follows the Intake Canal to the Columbus Powerhouse
- Proposed trail that begins at the Columbus Powerhouse and follows the Tailrace Canal to its confluence with the Platte River
- Proposed trail that provides a direct north/south connection between Two Lakes Trail and Lakeview School
- Proposed trail that would parallel 18^{th} Avenue between the outlet of Lake Babcock and the grade divide between Lake Babcock and Lake North

The City of Columbus has both a Parks Department and a Community Development Department; however, the dealings of these entities are restricted to the City's jurisdictional limits and do not include the Project Boundary. The City of Columbus also has a Comprehensive Plan (City of Columbus, October 2005). The only discussion in the Comprehensive Plan related to recreation and the Project is found in Section 3.5, Growth Centers, and consists of the recommendation for a bikeway between the city center and Tailrace Park.

Nance County, Platte County, and Genoa do not have formal recreation departments or related plans.

5.7.4 Existing Shoreline Buffer Zones

"Existing shoreline buffer zones within the project boundary." 18 CFR §5.6(d)(3)(viii)(C)

The Loup Power Canal differs considerably from a natural waterway. It is an artificial channel constructed in a narrow corridor through rural agricultural lands and is flanked on both banks by access and maintenance roads. Naturally occurring riparian areas are largely absent from the canal corridor, and agricultural lands abut the Project Boundary along most of its length. The District has allowed the corridor area to become naturally vegetated with the exception of unpaved access roads that require maintenance as well as areas of bank stabilization.

Where the Loup Power Canal alignment intersected tributaries of the Loup River, siphons were constructed. Thus, the canal and the tributary streams remain hydraulically separated. As discussed in Section 5.2.2, Flows, in the Water Budget subsection, the actual area contributing drainage to the Loup Power Canal is quite small. Therefore, the extent of sediment and nutrient loading into the canal is limited and extensive shoreline buffer zones are not required for water quality purposes. Furthermore, the embankment sections of the Loup Power Canal are protected from off-site runoff and any associated sediment and nutrient loads.

The Project Boundary is much wider adjacent to the Headworks and the regulating reservoirs. In these locations, substantial buffer zones exist between the canal and reservoir shoreline and surrounding urban development or agricultural areas. There is little need or opportunity to enhance these existing shoreline buffer zones.

5.7.5 Current Shoreline Management Plan or Policy

"If the potential applicant is an existing licensee, its current shoreline management plan or policy, if any, with regard to permitting development of piers, boat docks and landings, bulkheads, and other shoreline facilities on project lands and waters." 18 CFR §5.6(d)(3)(viii)(E)

It is District policy to allow public use of Project lands consistent with Project security and public safety considerations. No private homes, cottages, docks, landings, bulkheads, or other facilities are allowed on District lands, although one private cottage still exists on District land, with a lease set to expire in 2013. This lease will not be renewed, per the current policy of the District.

Two exceptions to the above-noted policy are as follows:

1. The District has an existing agreement with Preferred Rocks of Genoa that allows Preferred Rocks of Genoa access to District property in order to gather and remove sand from the North SMA for processing and ultimate off-site shipment.

2. The District has multiple agreements with local landowners that allow these landowners to draw irrigation water from the Loup Power Canal.

5.7.6 National Wild and Scenic River or State-Protected River

"A discussion of whether the project is located within or adjacent to a: (1) [r]iver segment that is designated as part of, or under study for inclusion in, the National Wild and Scenic River System; or (2) [s]tate-protected river segment." 18 CFR §5.6(d)(3)(viii)(F)

The Project is not located within or adjacent to a river segment that is designated as part of, or under study for inclusion in, the National Wild and Scenic River System. In addition, the Project is not located within or adjacent to any state-protected river segments.

5.7.7 National Trails System or Wilderness Area

"Whether any project lands are under study for inclusion in the National Trails System or designated as, or under study for inclusion as, a Wilderness Area."
18 CFR §5.6(d)(3)(viii)(G)

Although the Mormon Pioneer National Historic Trail follows the Platte River through Nebraska and is in close proximity to the Project Boundary, no Project lands are under study for inclusion in the National Trails System or for designation as a Wilderness Area.

5.7.8 Regionally or Nationally Important Recreation Areas

"Any regionally or nationally important recreation areas in the project vicinity."
18 CFR §5.6(d)(3)(viii)(H)

No National Recreation Areas exist either in or in close proximity to the Project Boundary.

In 1981, at the time of the previous relicensing effort, it was believed that "in general, the Loup Power system fishery could be described as excellent, and of regional importance to east-central Nebraska" (Rupp, 1981). In addition, "concerning the overall resources of both the canal and river and project effects on these resources, in my judgment, the power project has substantially improved the fishery resource and greatly enhanced recreational opportunities" (Rupp, 1981). The same claim of regional importance could likely be made in reference to the other recreational opportunities provided by District facilities and operations, including camping, boating, walking/biking, swimming, nature viewing, picnicking, and OHV riding.

5.7.9 Non-Recreational Land Use and Land Management

"Non-recreational land use and management within [and adjacent to] the project boundary." 18 CFR §5.6(d)(3)(viii)(I)

Non-recreational land use within the Project Boundary is managed for, and directly related to, the operation and maintenance of the Project. No other uses are contemplated or acceptable.

Non-recreational land use adjacent to the Project Boundary is estimated as shown in Table 5-30. Generally, land use within these areas is dominated by agriculture (see Figure 5-9).

Table 5-30. Land Use

Land Use	Percent Cover
Agricultural	90.18
Natural Areas[a]	6.03
Residential[b]	2.76
Institution[b]	0.64
Industrial[b]	0.28
Commercial[b]	0.08
Transportation[b]	0.03
Total	100.00

Notes:

[a] Includes Riparian Forest and Woodlands as well as Wetlands and Open Water, as shown in Figure 5-9, Land Use.

[b] Included in the Urban Land/Roads coverage in Figure 5-9, Land Use.

5.8 AESTHETIC RESOURCES

The potential applicant must include in the pre-application document "[a] description of the visual characteristics of the lands and waters affected by the project … [including] … the dam, natural water features, and other scenic attractions of the project and surrounding vicinity...." 18 CFR §5.6(d)(3)(ix)

The Project is located in a gently rolling rural landscape typical of Nance and Platte counties. It is a very linear development, extending approximately 36 miles across the countryside with a Project Boundary width that only occasionally exceeds 500 feet. With few exceptions, the land bordering the Project Boundary is dedicated to agricultural use. Exceptions include where the Upper Power Canal passes through

Genoa; the 1,200-acre regulating reservoir, located 3 miles north of Columbus; and the final 3-mile reach of the Tailrace Canal, which borders a large industrial park.

The Project elements most often visible to the public, which are primarily viewed from vehicles traveling on public roads and highways, are the tranquil, slow-flowing, unlined segments of the Loup Power Canal extending from the Headworks to the Platte River. These canal segments were formed by excavation and embankment of native soils. In general appearance, the canal is visually attractive and not much different than the natural streams that flow through the landscape every few miles. Three low weirs and five hydraulic siphons are located along the Loup Power Canal. Similar to the bridges that span the canal, these are low-profile, passive structures with no moving parts; therefore, they do not materially detract from the overall quality of the viewshed.

All segments of the Loup Power Canal are bordered on both sides with unpaved, lay-of-the-land access and maintenance roads. Some segments have a degree of surface treatment on at least one side of the canal to permit emergency access to important Project structures during inclement weather conditions. Nearly all canal roads are open to vehicle, bicycle, and pedestrian access by the public. However some sections are closed to vehicle access because of safety and security issues, recurring vandalism, and other illegal activities.

The regulating reservoirs are clearly constructed impoundments, similar to a recreation lake or water supply reservoir. In the upper reaches, the reservoirs also display some aspects of a natural lake, such as bordering wetlands and forested areas. Lake Babcock and Lake North are a designated waterfowl refuge (including 0.5 mile north of 83rd Street, 0.5 mile east of 18th Avenue, 0.5 mile south of 65th Street, and 0.5 mile west of 48th Avenue) (see Figure 5-8, Sheet 3). Lake North, the smaller and deeper cell, is also a popular camping, fishing, and water recreation destination. The District has surrounded the regulating reservoir with public access and recreational opportunities while striving to preserve its appealing aesthetic qualities.

A wide Intake Canal extends for about 2 miles from Lake Babcock to the Columbus Powerhouse, and the Tailrace Canal extends about 5.5 miles from the powerhouse to the Platte River. Decades ago, an interesting, but visually intrusive, bank stabilization method was employed in the Tailrace Canal. Junked automobiles were placed side by side along sections of canal prone to erosion and sloughing. These cars are now partially buried and obscured by vegetation to the extent that make and model are difficult to identify. They have become visual artifacts of the Project, and the District has no plans to remove them.

The Tailrace Canal ends at the 700-foot-long Outlet Weir, where water overflows into the Platte River. The sight and sound of the continuously falling water is very pleasant. The District has established Tailrace Park, a frequently-used recreation site, on both sides of the canal at the outlet. Tailrace Park is a favorite community fishing spot but suffers from extensive littering and vandalism.

The Loup Power Canal corridor is visually pleasing and blends well into the rural fabric of the landscape. The corridor provides water, food, and shelter for wildlife. It offers many scenic vistas and adds interest and diversity to the surrounding agricultural viewshed. The reservoirs and surrounding Project lands are visually attractive and highly valued by the community for the public use opportunities they provide. Some necessary, but less visually pleasing, Project elements include shore protection measures (woody brush and riprap), locally stored materials (soil and riprap) for emergency dike repair, and signage "congestion" at the public use and recreation areas.

Photos 5-17 through 5-23, below, present the aesthetic qualities of the Loup Power Canal and reservoir elements described above. Additional Project photos are provided in Section 4 and Section 5.7, Recreation and Land Use, above.

Photo 5-17. View of the Upper Power Canal.

Photo 5-18. The Upper Power Canal siphon at Genoa.

Photo 5-19. View of the Lower Power Canal.

Photo 5-20. Camping at Lake North.

Photo 5-21. View of the Tailrace Canal.

Photo 5-22. The Outlet Weir at the Platte River.

Photo 5-23. View of the Outlet Weir from the east bank.

The more developed and operational elements of the Project include the Headworks and floating Hydraulic Dredge, the Monroe Powerhouse, and the Columbus Powerhouse.

The Headworks include the Diversion Weir, Intake Gate Structure, Sluice Gate Structure, maintenance buildings, gate operator residence, boiler house, storage buildings, floating Hydraulic Dredge, and North and South SMAs. These structures, with the exception of the Hydraulic Dredge, are located at the upstream end of the Settling Basin. Together, these features give the Headworks area a functional and industrial visual appearance consistent with the activities that take place there. However, the Headworks area is not open to the public nor is it visible from any public roads or residences.

The extensive North and South SMAs, located on either side of the 2-mile-long Settling Basin, are substantial visual features. The North SMA rises over 80 feet high and covers approximately 320 acres. Except for the steel pipelines leading to it, the North SMA has the appearance of a partially vegetated sandy bluff. Public access is restricted because of several safety issues and because this area is used for nesting by one threatened and one endangered bird species. The South SMA is located between the Settling Basin and the Loup River. This undulating, partially timbered landscape serves as both a sand deposition area and a popular OHV park.

Outside the immediate flow diversion and sand management operations area, the District has developed Headworks Park, a very popular recreation area, on both sides of the lower Settling Basin and Loup Power Canal. Headworks Park has several small lakes and wetlands associated with it. Although parts of the Headworks area are more functional than natural in appearance, it is well maintained and attracts substantial recreational activity.

Photos 5-24 through 5-26, below, present the aesthetic qualities of the flow diversion and sand management elements described above. Additional Project photos are provided in Section 4.

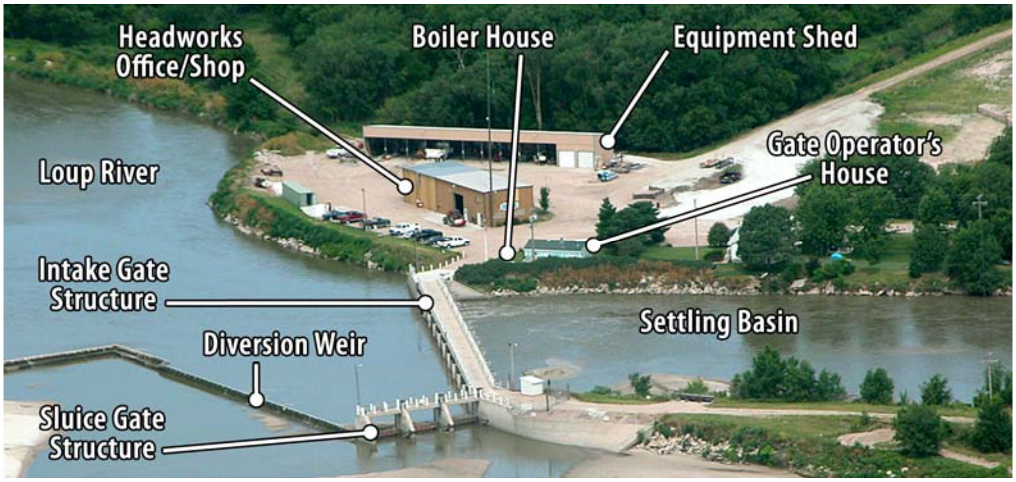

Photo 5-24. Aerial view of the Headworks.

Photo 5-25. View of the Settling Basin and an access road.

Photo 5-26. Camping at Headworks Park.

The Monroe Powerhouse recovers energy from the 32-foot drop that separates the Upper Power Canal from the Lower Power Canal. It is a concrete structure with an adjacent outdoor substation and a nearby operator's residence. The art deco design and white paint of the powerhouse present an interesting contrast to the surrounding land forms and heavy vegetation. The Monroe Powerhouse is visible from a public road bridge that crosses the canal approximately 0.5 mile downstream.

The Columbus Powerhouse is the primary energy generation feature of the Project. All of the features discussed above exist to deliver water to this important structure. The Powerhouse Inlet Structure at the terminus of the broad Intake Canal extending from Lake Babcock is surmounted by four concrete columns that support a gate hoisting apparatus. This distinctive structure is visible on the skyline from U.S. Highway 30 in Columbus.

Three large steel Penstocks emerge between and below the gate hoist columns and angle down to enter the Columbus Powerhouse building. The silver-painted penstock pipes are 20 feet in diameter and 320 feet long. Each one leads to a hydraulic turbine located in the lower level of the powerhouse. Water drops 112 feet from the Intake Canal to the Tailrace Canal. The concrete powerhouse is painted white and constructed in the art deco style with numerous windows. It is an attractive and well-maintained structure. Columbus Powerhouse is viewed by many hundreds of people each day from nearby roads and highways. The substation/switchyard to the east is visually overshadowed by the majestic appearance of the Columbus Powerhouse. The adjacent Powerhouse Park is a popular site to observe bald eagles during cold weather when they gather in large numbers to feed in the open water below the powerhouse.

Photos 5-27 through 5-29, below, present the aesthetic qualities of the powerhouse elements described above. Additional Project photos are provided in Section 4 and Section 5.7, Recreation and Land Use, above.

Photo 5-27. Aerial view of the Monroe Powerhouse.

Photo 5-28. The Columbus Powerhouse and substation.

Photo 5-29. The art deco style of the Columbus Powerhouse.

In summary, the Project is generally attractive and visually compatible with all surrounding lands and waters. The single possible exception to this may be that, under certain conditions, Project flow diversions affect the visual appearance of the bypassed reach of the Loup River. However, the Project and its operation have become embedded in the landscape, and the visual environment has adapted to it over the decades.

5.9 CULTURAL RESOURCES

The potential applicant must include in the pre-application document "[a] description of the known cultural or historical resources of the proposed project and surrounding area." 18 CFR §5.6(d)(3)(x)

5.9.1 Existing Discovery Measures

"Existing discovery measures, such as surveys, inventories, and limited subsurface testing work, for the purpose of locating, identifying, and assessing the significance of historic and archaeological resources that have been undertaken within or adjacent to the project boundary." 18 CFR §5.6(d)(3)(x)(B)

Since the 1930s, numerous archaeological surveys and excavations have occurred in the vicinity of the Project during unrelated infrastructure (such as road and civic) improvement projects and research projects. The Project facilities are located among cultural resources that have been identified during these surveys; however, no formal cultural resources surveys have been conducted within the Project Boundary for this relicensing proceeding.

For this proceeding, the District obtained archival information from the Nebraska State Historical Society (NSHS) regarding known (that is, previously identified or reported) cultural resources in the vicinity of the Project, including, but not limited to, historic standing structures locations and descriptions, archaeological resources locations and descriptions, and inventory survey locations. Summaries of this information are provided in Table 5-31.[13] The District also met with the Nebraska State Historic Preservation Office (SHPO) to discuss relicensing of the Project and to obtain additional information related to cultural resources.

5.9.2 Identification of Historic or Archaeological Site(s)

"Identification of any historic or archaeological site in the … project vicinity, with particular emphasis on sites or properties either listed in, or recommended by the State Historic Preservation Officer or Tribal Historic Preservation Officer for inclusion in, the National Register of Historic Places." 18 CFR §5.6(d)(3)(x)(A)

[13] Table 5-31 contains privileged information and has been withheld from the publicly available PAD.

Historic Structures

During early coordination meetings and correspondence, Nebraska SHPO noted that the entire Project is likely considered to be a historic district eligible for listing on the National Register of Historic Places (NRHP). Nebraska SHPO representatives toured the Project with District personnel in June 2007. While the entire extent of the historic district has not yet been evaluated, a brief summary of the historical background of the Project is as follows.

Federal and state legislative and financial efforts cleared the way for construction of the Project in the 1930s. Designed by Harza Engineering, a Chicago firm, the Project was constructed in less than 3 years using primarily local labor and infusing the local economy with much needed money during the depths of the Great Depression. Hundreds of jobs, canal right-of-way (ROW) purchases, and other easements boosted the primarily agricultural economy. The historic district appears to be significant according to definitions under the National Park Service (NPS) guidelines.

The facility components, which are described in Section 4.2, include the Diversion Weir Structure, Settling Basin, Skimming Weir, siphons, Monroe and Columbus powerhouses (designed during the Art Deco period), Lake Babcock, Sawtooth Weir, and recreation areas. In addition, the dustpan dredge, called Pawnee, has been used continuously since 1937. These structures and components are largely undisturbed and appear to maintain integrity under NPS guidelines.

Archaeological Sites

Thirteen archaeological sites have been recorded adjacent to the Project between the point of diversion on the Loup River and the confluence of the Loup and Platte rivers. These resources are shown in Table 5-31.[14]

Of particular interest are a group of sites associated with the pre-contact and historic period villages near present-day Genoa. These sites comprise a large occupation area that is bisected by the Loup Power Canal. Archival documentation suggests that fill material used during construction in the 1930s was taken from these site locations.

A number of identified sites are particularly noteworthy. Based on the limited information available, they appear to retain integrity and have diverse artifact assemblages, though none appear to be formally evaluated by a Federal agency. In addition, no cultural materials associated with these sites have been documented within the Project Boundary.

[14] Table 5-31 contains privileged information and has been withheld from the publicly available PAD.

Table 5-31 contains privileged information and is located in Volume 3, Privileged.

5.10 SOCIO-ECONOMIC RESOURCES

The potential applicant must include in the pre-application document "[a] general description of socio-economic conditions in the vicinity of the project. Components of this description include general land use patterns (e.g., urban, agricultural, forested), population patterns, and sources of employment in the project vicinity." 18 CFR §5.6(d)(3)(xi)

Although the Project is located in Nance and Platte counties near Genoa, Monroe, and Columbus, the District's service area includes Boone, Nance, Platte, and Colfax counties and part of Madison County. An estimated 51,000 people reside in the service area (U.S. Census Bureau, March 20, 2008). Based on the location of Project infrastructure, however, the primary socioeconomic impact area of the Project is within Nance and Platte counties.

All power generated by the Project is purchased by NPPD at the substations located at the Monroe and Columbus powerhouses. Then the District purchases electricity wholesale from NPPD and distributes it to the District's customers. The District purchases, sells, and delivers approximately 1.2 billion kilowatt hours of electric energy annually to approximately 18,000 wholesale and retail customers throughout the service area.

5.10.1 Land Use

Most of the land area in Nance and Platte counties is used for agriculture. About 52 percent of the land area in Nance County is cropland, and about 83 percent of the land area in Platte County is cropland (USDA National Agricultural Statistics Service, 2008). Total agricultural land (including cropland and rangeland) occupies 90 percent of Nance County and 93 percent of Platte County (University of Nebraska-Lincoln, 2005). Land within cities and villages occupies less than 1 percent of Nance County and about 2 percent of Platte County (U.S. Census Bureau, August 15, 2006; University of Nebraska-Lincoln, 2005). The remainder of the area in each county is riparian forest and woodland, water, and wetland (University of Nebraska-Lincoln, 2005).

Cities and villages in the vicinity of the Project include Genoa, Monroe, and Columbus. With the exception of limited residential and commercial development in the vicinity of Genoa, land use along the Loup Power Canal west of Lake Babcock is agricultural, with the canal providing irrigation for agriculture. There are 105 water right appropriations for water in the canal at 78 irrigation water withdrawal points along the length of the canal (as of July 2008, according to the District's records). Under Nebraska's priority and preference system, irrigator rights approved by the state are junior water rights to the District's but are given preference for agricultural use as priority users of water. See Section 5.2.4, Flow Uses of Streams in the Vicinity of the Project, above, for additional information on water rights.

Some residential development is occurring in the vicinity of Lake Babcock and Lake North, but land use in this area largely consists of agriculture. The District owns and operates five developed recreation areas containing nearly 1,500 acres of land and 1,100 acres of water (see Section 5.7, Recreation and Land Use, above). Land use along the Intake Canal is a mixture of residential and agricultural uses, and land use along the Tailrace Canal is agricultural, industrial, and residential. A residential area near the southern extent of the Intake Canal and the Columbus Powerhouse is anticipated to continue to develop. Residential, commercial, and industrial areas near the Tailrace Canal are also anticipated to grow (City of Columbus, October 2005).

5.10.2 Population

The population of Nance County was estimated at 3,572 in 2007 (U.S. Census Bureau, March 20, 2008). The population of Nance County has declined since reaching a peak of 8,926 in 1910 (U.S. Census Bureau, March 27, 1995). The population in Nance County declined by 11.8 percent from 1990 to 2007, while the population of Nebraska increased by 12.4 percent (U.S. Census Bureau, March 27, 1995; U.S. Census Bureau, March 20, 2008).

The population of Platte County was estimated at 31,849 in 2007 (U.S. Census Bureau, March 20, 2008). The population of Platte County has increased since 1950, after declines in the 1930 and 1940 censuses (U.S. Census Bureau, March 27, 1995). Population growth in Platte County has occurred in Columbus, while the population in the remainder of the county has declined. From 1990 to 2007, the population of Platte County increased by 6.8 percent, about half of the rate of increase for Nebraska (U.S. Census Bureau, March 27, 1995; U.S. Census Bureau, March 20, 2008). Population trends in Nance County, Platte County, and the State of Nebraska are shown in Table 5-32.

Table 5-32. Population Trends in Nance and Platte Counties and Nebraska

	1970	1980	1990	2000	2006	2007
Nance County	5,142	4,740	4,275	4,038	3,625	3,572
Platte County	26,508	28,852	29,820	31,662	31,408	31,849
Nebraska	1,483,493	1,569,825	1,578,385	1,711,263	1,763,765	1,774,571

Sources: U.S. Census Bureau, March 20, 2008, "County Datasets: Annual Population Change (Nebraska)," *Population Estimates*, retrieved on August 11, 2008, http://www.census.gov/popest/counties/CO-EST2007-popchg2000_2007.html;
U.S. Census Bureau, March 27, 1995, "Nebraska, Population of Counties by Decennial Census: 1900 to 1990," retrieved on August 11, 2008, http://www.census.gov/population/cencounts/ne190090.txt.

Communities in the vicinity of the Project include Genoa in Nance County and Monroe and Columbus in Platte County. The population of Genoa has declined from 1,082 in 1990 to 892 in 2006. The population of Monroe, about 300 people, has fluctuated slightly. Columbus is the largest city in the vicinity of the Project and in Platte County. Columbus grew 7 percent between 1990 and 2000 and 2 percent between 2000 and 2006 (U.S. Census Bureau, March 20, 2008; U.S. Census Bureau, March 27, 1995). Population trends in Genoa, Monroe, and Columbus are shown in Table 5-33.

Table 5-33. Population Change in Communities in the Vicinity of the Project

	1990	2000	2001	2002	2003	2004	2005	2006
Genoa	1,082	981	967	941	907	898	894	892
Monroe	309	307	302	300	302	300	303	310
Columbus	19,480	20,971	21,092	20,948	20,905	20,911	21,125	21,414

Source: U.S. Census Bureau, June 27, 2007, "Subcounty Population Datasets (Nebraska)," *Population Estimates*, retrieved on August 11, 2008, http://www.census.gov/popest/cities/SUB-EST2006-states.html;
U.S. Census Bureau, 1991, Census of Population and Housing, 1990. *American FactFinder*. Retrieved on August 11, 2008. http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_tabId=DEC2&_submenuId=datasets_1&_lang=en&_ts=228243640647.

5.10.3 Employment

In Nance County, total employment based on place of work increased by less than 1.9 percent from 2001 to 2006 (Bureau of Ecomonic Analysis, April 24, 2008a). Farm employment declined by 6.4 percent, while non-farm employment increased by 5.1 percent. The unemployment rate for Nance County was 2.7 percent in 2007 (Nebraska Department of Labor, 2008).

The economy of Nance County is based primarily on agriculture. The leading sectors of employment are as follows, given as percentages of total employment (Bureau of Economic Analysis, April 24, 2008a):

- Agriculture – 25 percent
- Local government – 17 percent
- Health care – 9 percent
- Retail trade – 8 percent
- Other services – 8 percent
- Transportation and warehousing – 4 percent

- Wholesale – 3 percent
- Accommodations and food – 3 percent

In Platte County, total employment based on place of work increased by 5.8 percent from 2001 to 2006 (Bureau of Economic Analysis, April 24, 2008a). Farm employment declined by 6.2 percent, while non-farm employment increased by 6.5 percent. The unemployment rate for Platte County was 2.4 percent in 2007 (Nebraska Department of Labor, 2008).

The economy of Platte County is based primarily on manufacturing. The leading sectors of employment are as follows, given as percentages of total employment (Bureau of Economic Analysis, April 24, 2008a):

- Manufacturing – 24 percent
- Retail trade – 12 percent
- Local government – 10 percent
- Health care – 8 percent
- Construction – 7 percent
- Other services – 6 percent
- Accommodations and food – 5 percent
- Agriculture – 5 percent

The District employs 124 people, including 30 whose employment is directly related to the Project. Employment trends for Nance and Platte counties are shown in Table 5-34.

Table 5-34. Employment Trends in Nance and Platte Counties

Employment Sector	Nance County		Platte County	
	2001	2006	2001	2006
Farm	561	525	1,235	1,158
Non-farm	1,474	1,549	21,333	22,725
Total Employment[a]	**2,035**	**2,074**	**22,568**	**23,883**

Source: Bureau of Economic Analysis, April 24, 2008a, "Local Area Personal Income," [Table CA25 NAICS for Nebraska, Nance and Platte Counties, 2001-2006.], *Regional Economic Accounts*, retrieved on April 24, 2008, http://www.bea.gov/bea/regional/reis/default.cfm?catable=CA25N&series=NAICS.

Note:

[a] Total employment is by place of work. Employment includes full and part time.

5.10.4 Economic Development

One of the District's objectives is to promote economic and industrial growth. Over the years, the District has substantially contributed to economic development in Nance and Platte counties through its Headworks OHV Park, strategic land development, and provision of attractive electric power rates.

Headworks OHV Park near Genoa, discussed in Section 5.7.1, Existing Recreational Facilities, attracts approximately 20,000 visitors per year. OHV and dirt bike riders spend an estimated $4.8 million per year in Nebraska on day trips to Headworks OHV Park, including an estimated $53,000 in Genoa during a semi-annual jamboree event (NOHVA, February 2004). Proceeds from the jamborees are used to pay operating expenses of the park and to support local emergency community services in Genoa and Fullerton (NOHVA, June 29, 2008).

The District has purchased land for industrial development and worked with the City of Columbus and the Chamber of Commerce to attract approximately 70 manufacturing companies and 6,000 jobs to the Columbus area. The District has acquired over 1,000 acres (all of which are outside of the Project Boundary), developed them, and sold them to industries. Two major industries recently attracted to the Columbus area are Archer Daniel Midlands, which operates a corn processing plant and is adding new cogeneration facility, and KATANA-Summit, LLC, which manufactures towers for wind-powered electricity generation facilities.

Preferred Rocks of Genoa is a newly formed aggregate company located adjacent to the Project's Headworks and North SMA. Preferred Rocks of Genoa removes sand that has been dredged from the Settling Basin and stored at the North SMA and processes this silica sand product used in oil and gas drilling operations. At full production, Preferred Rocks of Genoa plans to remove and process over 1 million cubic yards of sand per year.

Finally, the attractive electric power rates that the District offers are a major factor in attracting a variety of industries and their many associated jobs to the area.

5.10.5 Income

In Nance County, per capita personal income was $27,603 in 2006, an increase of $5,791 over the per capita income in 2001. Per capita income in Nance County in 2006 was 80 percent of the Nebraska average (Bureau of Economic Analysis, April 24, 2008b). The median income for a family of four was $38,682 in 1999, increasing to an estimated $46,700 in 2007 (Nebraska Department of Economic Development, January 31, 2008).

In Platte County, per capita personal income was $29,903 in 2006, an increase of $4,717 over the per capita income in 2001. Per capita income in Platte County in 2006 was 87 percent of the Nebraska average (Bureau of Economic Analysis, April 24, 2008b). The median income for a family of four was $47,783 in 1999, increasing to an estimated $57,500 in 2007 (Nebraska Department of Economic Development, January 31, 2008).

In Nance County, taxable sales increased by 35 percent between 2000 and 2007. In Platte County, taxable sales increased by 31 percent in the same time period. In the State of Nebraska, taxable sales increased by 31 percent between 2000 and 2007. In Nance County, per capita taxable sales were 31 percent of Nebraska per capita taxable sales in 2007. In Platte County, per capita taxable sales were 85 percent of Nebraska per capita taxable sales in 2007 (Nebraska Department of Revenue, 2008).

5.11 TRIBAL RESOURCES

The potential applicant must include in the pre-application document information related "to the extent that existing project … operation affect[s] … tribal cultural or economic interests, e.g., impacts of project-induced soil erosion on tribal cultural sites." 18 CFR §5.6(d)(3)(xii)(A)

"Identification of Indian tribes that may attach religious and cultural significance to historic properties within the project boundary or in the project vicinity; as well as available information on Indian traditional cultural and religious properties, whether on or off of any federally-recognized Indian reservation…." 18 CFR §5.6(d)(3)(x)(C)

The District understands that a FERC license is a Federal undertaking and requires compliance with preservation statutes and adherence to Native American trust responsibilities. FERC will develop a program for consultation with Native American Tribes, Nebraska SHPO, the District, and other interested parties in order to meet these requirements, including planning for a scoping meeting to review the Project and preservation and trust responsibilities.

A review of the Native American Consultation Database indicates that the Omaha Tribe of Nebraska and the Pawnee Nation of Oklahoma have formal claims to the general area in the vicinity of the Project. However, no part of the Project is located on Federally recognized tribal lands. As mentioned in Table 5-31, known sites within the Project Boundary have not been evaluated for significance as locations of traditional cultural value. The District has attempted to meet with natural and cultural resources representatives of the Omaha Tribe of Nebraska and the Pawnee Nation of Oklahoma. To date, these meetings have not occurred because of schedule conflicts. The District will continue its efforts to coordinate with these tribes prior to the FERC scoping meeting.