

SECTION 3

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GENERAL DESCRIPTION OF THE RIVER BASIN

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*“River basin description. A general description of the river basin or subbasin, as appropriate, in which the proposed project is located, including information on: (A) The area of the river basin or subbasin and length of stream reaches therein; (B) Major land and water uses in the project area; (C) All dams and diversion structures in the basin or sub-basin, regardless of function; and (D) Tributary rivers and streams, the resources of which are or may be affected by project operations.”*  
 18 CFR §5.6(d)(3)(xiii)

As discussed in Section 1, Introduction, and as shown in Figure 1-1, the Project is located in Nance and Platte counties, Nebraska. The Project begins at the Headworks, which are located approximately 34 miles upstream of the confluence of the Loup and Platte rivers, where a portion of the Loup River flow is diverted into the 35-mile-long Loup Power Canal. The Loup Power Canal discharges to the Lower Platte River at a point approximately 2 miles downstream of the confluence of the Loup and Platte rivers. The Lower Platte River is defined as the reach between the confluence of the Loup and Platte rivers and the confluence of the Platte and Missouri rivers.

The Project is located in the Loup River Basin, which is part of the larger Platte River Basin (see Figure 3-1). Information about the Loup River Basin and the vicinity of the Project, which is only a portion of the Loup River Basin, is provided below.

### 3.1 BASIN DESCRIPTION

The Loup River Basin encompasses approximately 15,200 square miles of central Nebraska, accounting for nearly one-fifth of the state’s total land area (see Figure 3-2) (Nebraska Department of Environmental Quality [NDEQ], December 2005). The Loup River Basin originates in Sheridan County, Nebraska, and flows approximately 260 miles to Platte County and the confluence with the Platte River (NDNR, 1975, as cited in NDEQ, December 2005). The ecoregions of the Loup River Basin are the Nebraska Sandhills and the Central Great Plains (Chapman et al., 2001, as cited in NDEQ, December 2005). The watershed upstream of the Project covers approximately 14,300 square miles of total land area. The Platte River Basin upstream of the Loup River and the Project covers approximately 59,300 square miles compared to the 15,200-square-mile drainage area of the Loup River Basin.

The Loup River is comprised of three main branches, the North, Middle, and South Loup rivers, which all originate in north-central Nebraska and flow generally east/southeast. The North and Middle Loup rivers flow through the Sandhills region and are primarily fed by groundwater springs from the Ogallala Aquifer. The South Loup River flows through an area of loess hills and receives most of its flows from rainfall runoff (Fowler, June 2005). The South Loup River joins with the Middle Loup River just east of Boelus, Nebraska, and the Middle and North Loup rivers

combine to form the Loup River northeast of St. Paul, Nebraska. The Loup River then joins the Platte River southeast of Columbus.

Drainage areas transected by the Project that discharge into the Loup River bypass reach in the vicinity of the Project include the watersheds of Beaver Creek, Looking Glass Creek, Dry Creek, Cherry Creek, and a portion of Lost Creek, as shown in Figure 3-3. These streams and drainages remain separated from the Project. However, several smaller, local drainage areas enter the Loup Power Canal. There are 12 identified culverts that discharge these local drainage areas into the canal between the Headworks and the Columbus Powerhouse. In addition, there are 13 identified culverts as well as the Lost Creek Flood Control Channel (described in Section 3.2, below) that drain into the Tailrace Canal between the Columbus Powerhouse and the Platte River.

### 3.2 TRIBUTARIES

In the Loup River Basin, major tributaries of the Loup River include the South Loup River, Mud Creek, the Dismal River, the Middle Loup River, Oak Creek, the North Loup River, the Calamus River, the Cedar River, and Beaver Creek, as shown in Figure 3-2.

Loup River tributaries in the vicinity of the Project include Beaver Creek, Looking Glass Creek, Dry Creek, and Cherry Creek, as shown in Figure 3-3. The Loup Power Canal passes under Beaver Creek, Looking Glass Creek, and Dry Creek/Cherry Creek through concrete siphon structures.

Lost Creek is also in the vicinity of the Project. However, Lost Creek is unique in that the entire basin no longer drains naturally into the Platte River. Drainage from the uppermost 7.6 square miles of Lost Creek is collected and passed under the Loup Power Canal through a concrete siphon. From there, the flow is conveyed to the Loup River through a drainage ditch called Lost Creek Ditch, which predates the Project (see Figure 3-3). An additional 2 square miles downstream of the Loup Power Canal contribute to flows in the Lost Creek Ditch. As part of the U.S. Army Corps of Engineers (USACE) Lost Creek Flood Control Project, drainage east of the Lost Creek Ditch is collected in the Lost Creek Flood Control Channel. The Lost Creek Flood Control Channel begins east of U.S. Highway 81 and eventually drains into the Tailrace Canal immediately downstream of the Columbus Powerhouse before discharging into the Platte River. Lost Creek flows not captured in the Lost Creek Ditch and the Lost Creek Flood Control Channel are conveyed through a siphon along the Tailrace Canal and continue east in Lost Creek to Schuyler, Nebraska, where they discharge into the Platte River.

### 3.3 CLIMATE

Average annual precipitation in the Loup River Basin ranges from 18.3 inches at Valentine, Nebraska, near the northwest portion of the Loup River Basin to 25.8 inches at Fullerton, Nebraska, in the southeast portion of the Loup River Basin. Average precipitation during the growing season (May 1 to September 30) ranges from 12.8 inches at Valentine to 16.9 inches at Fullerton (Nebraska Department of Natural Resources [NDNR], December 30, 2005). Temperatures in the Loup River Basin are highly variable, as is typical of the Central Great Plains, with hot summers and cold winters. July is typically the hottest month, with average lows in the mid-60s and average highs in the upper 80s. Summer daily high temperatures in the upper 90s and low 100s are not uncommon. January is typically the coldest month, with average lows in the lower teens and average highs in the lower 30s. Winter low temperatures below zero are not uncommon (The Weather Channel, 2008).

### 3.4 MAJOR LAND USES

The predominant land use in the Loup River Basin is agriculture, with ranch and pasture lands primarily in the Sandhills portion of the Loup River Basin and row crop farmland comprising the majority of the Central Great Plains portion of the Loup River Basin. About one-third, or approximately 3 million acres, of agricultural lands in the Loup River Basin are classified as arable or suitable for cultivation, and approximately 2 million acres are classified as suitable for irrigation. Within the Loup River Basin boundaries, there are 56 municipal communities, with only one community, Columbus, having a population above 20,000 (NDEQ, December 2005).

The predominant land use in the vicinity of the Project is row crop agriculture. The two larger communities in the vicinity of the Project are Genoa and Columbus. Genoa is located approximately 6.5 miles northeast of the point of diversion for the Loup Power Canal, and Columbus is located approximately 3 miles southwest of the Columbus Powerhouse and Lake Babcock.

### 3.5 MAJOR WATER USES

Water uses in the Loup River Basin are various, consisting of domestic, industrial, livestock, irrigation, and others, including a hydroelectric project on the Cedar River (see Figure 3-2) that is owned and operated by the Village of Spalding, Nebraska. As of October 1, 2005, a total of 15,824 registered groundwater wells existed within the Loup River Basin. Because wells drilled prior to 1993 were not required to be registered, additional non-registered wells likely exist. With water from approximately 10,000 groundwater wells supplying water to approximately 1.3 million acres, irrigation is the largest use of groundwater in the Loup River Basin. The majority of the approximately 1,200 surface water appropriations present as of October 1, 2005, are also used for irrigation purposes and are typically located on major streams (NDNR, December 30, 2005).

Water uses in the vicinity of the Project are generally similar to that of the overall basin, with most groundwater and surface water being used for irrigation. In addition, a substantial amount of groundwater is used for domestic and industrial purposes in Genoa and Columbus. In addition to hydropower generation at the Project, important non-consumptive surface water uses in the vicinity include recreation and habitat for aquatic life.

Loup River water diverted into the Loup Power Canal is used primarily for power generation and recreation. Water uses adjacent to the Loup Power Canal are allowed through water rights granted by the State of Nebraska (see Section 5.2.4, Flow Uses of Streams in the Vicinity of the Project, for more information). In addition to water rights held by the District, there are 109 water right appropriations adjacent to the Loup Power Canal: 105 are for irrigation, 2 are for manufacturing, 1 is for cooling, and 1 is for domestic use. According to the District's records, as of July 2008, there were 78 irrigation water withdrawal points along the length of the Loup Power Canal. A standardized agreement between each irrigator and the District provides for safe and reasonable access to water in the Loup Power Canal.

### 3.6 DAMS AND DIVERSION STRUCTURES

Three storage dams and reservoirs and three diversion dams are located in the Loup River Basin for purposes of irrigation, flood control, recreation, and fish and wildlife habitat (see Figure 3-2 and Table 3-1). The three storage dams and reservoirs are as follows (U.S. Bureau of Reclamation, 2008):

- Virginia Smith Dam and Calamus Lake (formerly Calamus Dam and Reservoir) – Virginia Smith Dam is located on the Calamus River approximately 4 miles upstream of its confluence with the North Loup River and approximately 5.5 miles northwest of Burwell, Nebraska.
- Sherman Dam and Reservoir – Sherman Dam is located on Oak Creek approximately 5 miles northeast of Loup City, Nebraska.
- Davis Creek Dam and Reservoir – Davis Creek Dam lies across a tributary of Davis Creek about 5.5 miles south of North Loup, Nebraska.

The three diversion dams are as follows (U.S. Bureau of Reclamation, 2008):

- Kent Diversion Dam – Kent Diversion Dam is located on the North Loup River approximately 8 miles upstream of its confluence with the Calamus River.
- Milburn Diversion Dam – Milburn Diversion Dam is located approximately 5 miles upstream of Milburn, Nebraska, on the Middle Loup River.
- Arcadia Diversion Dam – Arcadia Diversion Dam is located on the Middle Loup River approximately 8.5 miles upstream of Arcadia, Nebraska.

All six of these facilities were constructed as part of the Pick-Sloan Missouri Basin Program administered by the U.S. Bureau of Reclamation (2008).

**Table 3-1. Loup River Basin Storage and Diversion Dams**

Project Name	Dam Location (river or stream)	Drainage Area (mi <sup>2</sup> )	Surface Area (acres) <sup>1</sup>	Total Reservoir Storage (acre-ft) <sup>a</sup>
Virginia Smith Dam and Calamus Lake	Calamus River	1,036	5,190	177,623
Sherman Dam and Reservoir	Oak Creek	37	2,868	125,477
Davis Creek Dam and Reservoir	Tributary of Davis Creek	6.3	1,145	46,179
Kent Diversion Dam	North Loup River	240	N/A	N/A
Milburn Diversion Dam	Middle Loup River	Not Available	N/A	N/A
Arcadia Diversion Dam	Middle Loup River	Not Available	N/A	N/A

Sources: NDNR, 2008a, "Databank," *Nebraska Department of Natural Resources*, retrieved on July 18, 2008, <http://www.dnr.state.ne.us/databank/dbindex.html>;  
U.S. Bureau of Reclamation, 2008, "Dataweb," *U.S. Bureau of Reclamation*, retrieved on July 18, 2008, <http://www.usbr.gov/dataweb/>.

Note:

<sup>a</sup> N/A = not applicable.

### 3.7 PROJECT RETURN FLOW

Flow released from the Columbus Powerhouse is returned to the Platte River approximately 2 miles downstream of the confluence of the Loup and Platte rivers. The drainage area of the Lower Platte River downstream of the Project return flow point is approximately 26,000 square miles (U.S. Geological Survey [USGS], 2008). Major tributaries of the Lower Platte River include the Elkhorn River and Salt Creek (see Figure 3-1).

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