SECTION 4

PROJECT LOCATION, FACILITIES, AND OPERATIONS

SECTION 4 PROJECT LOCATION, FACILITIES, AND OPERATIONS

4.1 AUTHORIZED AGENTS OF THE APPLICANT

"The potential applicant must include in the pre-application document … [t]he exact name and business address, and telephone number of each person authorized to act as agent for the applicant." 18 CFR §5.6(d)(2)(i)

The following person is authorized to act as agent for the applicant:

Mr. Neal Suess, President/CEO
Loup Power District
PO Box 988
2404 15th Street
Columbus, NE 68602
Tel: 402-564-3171

4.2 PROJECT FACILITIES AND COMPONENTS

"The potential applicant must include in the pre-application document … [a] detailed description [including detailed maps showing all lands within the Project Boundary] of all existing and proposed project facilities and components, including [t]he physical composition, dimensions, and general configuration of any dams, spillways, penstocks, canals, powerhouses, tailraces, and other structures proposed to be included as part of the project or connected directly to it." 18 CFR §5.6(d)(2)(iii) and 18 CFR §5.6(d)(2)(iii)(A)

4.2.1 Project Description and Configuration

The Project begins at the Headworks, where a low weir is used to divert available water (up to 3,500 cubic feet per second [cfs] in accordance with the District's water right limit and the hydraulic capacity of the Loup Power Canal) from the Loup River through a gated intake structure into the 35-mile-long Loup Power Canal and generation system. The gently sloping cross-country canal segments were constructed from on-site materials and are provided with weirs and siphons as necessary. The Project includes two powerhouses (the Monroe Powerhouse and the Columbus Powerhouse) and two regulating reservoirs (Lake Babcock and Lake North). Water exiting the Project enters the Platte River east of Columbus, approximately 2 miles downstream of the confluence of the Loup and Platte rivers. The general layout of the Project is shown in Section 1, Figure 1-1, and the current Project Boundary is indicated on an aerial photography base in Figure 4-1, Sheets 1 through 14. Detailed survey mapping of the Project Boundary is available and will be submitted with the application for a new license.

This Project differs somewhat from a typical hydroelectric project in that it has no significant dam, no instream reservoir, and no project spillway (at least not in the context that these features are normally used for project operation and analyzed for safety considerations).

The Project is licensed to the District, which owns, operates, and maintains it. However, the six turbine generating units are dispatched by the Nebraska Public Power District (NPPD) in accordance with established operating agreements between the two utilities. In addition, all energy generated by the Project is sold to NPPD at the two powerhouse substations. Thus, there are no electric transmission lines associated with the Project.

The following subsections describe the principal features of the Project, generally from upstream to downstream. Unless otherwise indicated, the sources of this information are the District's 2006 *Genoa-Columbus Project (FERC Project 1256-NE) Operating Plan* and the *Final Report, Loup River Public Power District, Columbus, Nebraska* (Harza Engineering Co., February 1938).

4.2.2 Diversion Weir

The Diversion Weir is located in the Loup River approximately midway between Fullerton and Genoa. The structure is founded on the sand and silt river bed and is approximately 1,320 feet long. The Diversion Weir consists of a low concrete weir with a concrete apron stabilized with steel sheeting at its heel and toe. The fixed crest of the weir is at an elevation of 1,574 feet, and wooden flashboards (or planks) are normally maintained along the top of the weir to create an effective crest elevation of 1,576 feet. These sacrificial flashboards are designed to fail under heavy ice loads or extreme high water to prevent damage to the permanent fixed weir. The right, or south, abutment of the Diversion Weir is flanked by a dike extending approximately 3,000 feet to high ground. In mid-channel, the Diversion Weir makes an abrupt downstream turn and extends approximately 250 feet to terminate at the most riverward pier of the Sluice Gate Structure, described in Section 4.2.4, below.

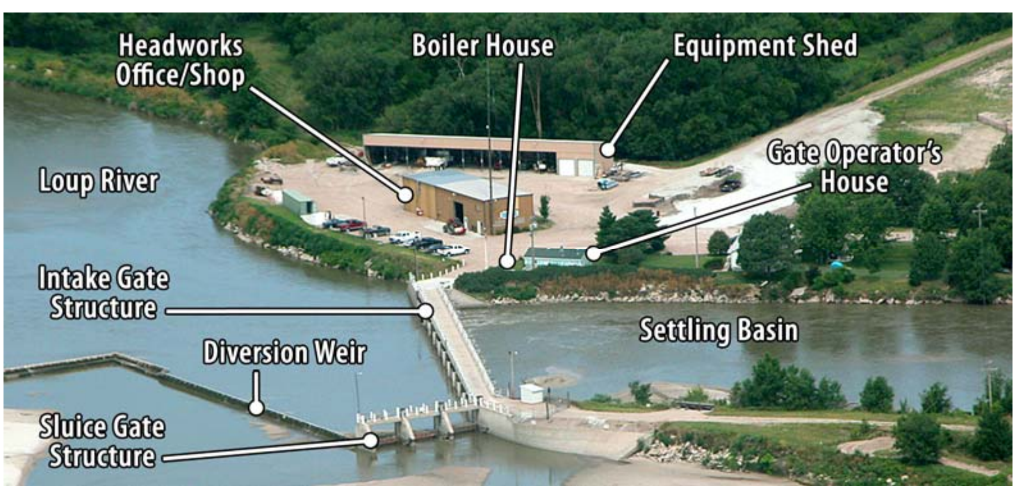

Photo 4-1. Aerial view of the Headworks.

Photo 4-2. View of the Diversion Weir from the Sluice Gate Structure.

4.2.3 Intake Gate Structure

The Intake Gate Structure is located on the north bank of the river. It is constructed of reinforced concrete and supports 11 steel radial gates that admit Loup River water into the Loup Power Canal. The elevation of the concrete gate sills is 1,569.5 feet, and each gate is 24 feet long with a maximum opening of 5 feet. Six gates are equipped with electric motors, and five gates are operated by either electric- or gasoline-powered gyros. An integral concrete service bridge spans the Settling Basin and provides for vehicle and operator access to all intake gates and utilities.

The downstream end of the Intake Gate Structure connects at a right angle with the Sluice Gate Structure, described in Section 4.2.4, below. To ensure operation of the intake and sluice gates during cold weather, a steam boiler with appropriate fixed piping and hoses is provided for ice control and thawing of all gates. The upstream end of the Intake Gate Structure is flanked by a sand-fill dike extending some 7,200 feet to high ground. Several auxiliary buildings are located north of the Intake Gate Structure, including the boiler house, gate tender's residence, maintenance shop and offices, and storage buildings.

Photo 4-3. View of the Intake Gate Structure from the Sluice Gate Structure.

Photo 4-4. Downstream face of the Intake Gate Structure.

4.2.4 Sluice Gate Structure

The Sluice Gate Structure spans the portion of river flowing between the downstream leg of the Diversion Weir and the Intake Gate Structure. This geometry promotes formation of a scour channel along the front of the Intake Gate Structure. Sediment, as well as debris and ice, then migrates directly to the sluice gates when they are opened. Periodic sluicing of sediment and debris is critical to keep the Intake Gate Structure from being obstructed by sediment.

The Sluice Gate Structure is constructed of reinforced concrete and supports three steel gates. The elevation of the sluice gate sills is 1,568 feet, and each steel gate is 20 feet long with a maximum opening of 6 feet. All three gates are equipped with electric motors and can be accessed from an integral concrete service bridge.

Photo 4-5. Upstream face of the Sluice Gate Structure.

Photo 4-6. Downstream face of the Sluice Gate Structure.

4.2.5 Settling Basin

Water diverted from the Loup River enters the Settling Basin. The Settling Basin is designed for very slow flow velocity to allow heavier sediment materials to settle out of the water before it enters the much narrower, faster flowing Upper Power Canal. Therefore, flow velocity through the Settling Basin is less than 1 foot per second. The Settling Basin is approximately 2 miles long and has a bottom width of 200 feet and a nominal depth of 16 feet. Hydraulic capacity of the basin is 3,500 cfs, and maximum basin water surface elevation is 1,572 feet.

Photo 4-7. View of the Settling Basin from the Intake Gate Structure.

Photo 4-8. View of the Settling Basin and Hydraulic Dredge from the Skimming Weir.

4.2.6 Hydraulic Dredge

A floating Hydraulic Dredge is employed to remove accumulated sediment from the Settling Basin. Without frequent dredging, the Settling Basin would quickly become choked with sand and cause the Project to shut down. The Hydraulic Dredge operates using an electrically driven 2,500-horsepower pump with 30-inch suction and 28-inch discharge lines. The crane-supported suction line is equipped with a dustpan-type suction head. This device consists of a wide shallow suction nozzle with a row of forward-facing water jets to cut into, break up, and agitate the material to be removed.

The Hydraulic Dredge is maneuvered using a system of cables wound on winches at the corners of the bow. These lines extend diagonally to snubbing posts fixed on opposite sides of the Settling Basin. Dredging is accomplished by pulling the dredge in an upstream direction by winding forward on the winches, thus forcing the suction head into the submerged sand bank. Pumps, auxiliaries, winches, and movement of the dredge are all controlled from an elevated control bridge located above the deck house.

Each year, the Hydraulic Dredge removes approximately 1 million to 1.5 million cubic yards of sediment from the Settling Basin. Sediment (in the form of silt, sand, and gravel) pumped by the dredge is carried through an articulated steel pipeline to a series of fixed steel discharge pipes spaced along both sides of the Settling Basin. These pipes lead to the North and South Sand Management Areas (SMAs), discussed in Section 4.2.7, below, on either side of the Settling Basin. Water from the North and South SMAs is routed through a series of dikes and ditches and drains back into either the Loup River or the Loup Power Canal, depending on the location of the dredge. The District has a USACE permit (Nationwide Permit 16, Return Water From Upland Contained Disposal Areas) for dredging activities at the Settling Basin, as discussed in Section 4.2.7, below.

Electric power for the dredge is provided from 5-kilovolt (kV) overhead lines along both sides of the Settling Basin. From special connectors provided at each fixed discharge pipe, electric service is carried in cables along the pipeline bridge to the Hydraulic Dredge, where all equipment is electrically operated.

Photo 4-9. The 1937 Hydraulic Dredge, “PAWNEE,” in dry dock for maintenance.

Photo 4-10. View of part of the floating dredge.

Photo 4-11. A typical dredge connection point along the Settling Basin.

Photo 4-12. Typical discharge piping and shoreline stabilization at the South Sand Management Area.

4.2.7 Sand Management Areas

The North and South Sand Management Areas (SMAs) are located on either side of the Settling Basin. The North SMA is north of the Settling Basin, away from the Loup River, and the South SMA is south of the Settling Basin, adjacent to the Loup River. Although designed for the same purpose—to receive and decant dredged material—the two areas have evolved quite differently.

In the early years of Project operation, from 1937 to 1960, all dredged material was pumped to the South SMA. The quantity dredged during that period averaged 2,631,267 cubic yards annually. In 1961, dredged material began being pumped to the North SMA as well, though it was considerably less material than was pumped to the South SMA. Beginning in 1975, the majority of the total quantity dredged was pumped to the North SMA. Total material dredged from 1961 to 2007, has averaged 1,326,850 cubic yards annually. The reason for this disparity is not clear, but it may be related to development of upstream reservoirs or other changes in the upper Loup River Basin.

At the South SMA, both the water and the solid material that are deposited eventually find their way back into the Loup River; solid material is presumably returned during high flow events. This is evidenced by the establishment of large trees and only small changes in the elevation of the site. The South SMA should be able to accept dredged material deposition indefinitely. In addition, the South SMA has unique characteristics that make it attractive for off-highway vehicle recreation, as described in Section 5.7, Recreation and Land Use.

The District has a USACE permit (Nationwide Permit 16, Return Water From Upland Contained Disposal Areas) for dredging activities at the Settling Basin that discharge to the South SMA.[1] USACE determined that a permit is not needed for discharge to the North SMA.

Since the North SMA is never scoured by high flow events, it has reached impressive proportions. The resulting sand pile covers approximately 318 acres and extends over 80 feet above natural grade. In addition, the isolation, broad expanse, and frequent wetting of the North SMA have made it a popular nesting site for the threatened piping plover (*Charadrius melodus*) and endangered interior least tern (*Sterna antillarum athalassos*), described in Section 5.6, Rare, Threatened, and Endangered Species. Since 1984, the District has voluntarily cooperated with the U.S. Fish and Wildlife Service (USFWS), Nebraska Game and Parks Commission (NGPC), and 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.

[1] The most recent permit for dredging activities was authorized on January 9, 2008, under USACE Nationwide Permit 16, permit number 207-3190-KEA.

In 2006, the District entered into an agreement with a materials processing company that wanted to purchase and remove sand from the North SMA. This was attractive to both parties because the sand had commercial value when processed and because the sand pile was becoming too large for the available storage site. Prior to finalizing this agreement, the District consulted with FERC regarding the proposed change in sand management. The District was informed that FERC had no opposition to the removal of sand for processing outside the Project Boundary provided that a Memorandum of Understanding (MOU) was developed with the key agencies responsible for protection of the threatened and endangered birds that nested on the site.

An MOU was subsequently developed between the materials processing company, Preferred Rocks of Genoa, which is operating on the North SMA; USFWS; and NGPC. The District and the Tern and Plover Conservation Partnership are cooperating parties to the MOU. The MOU includes an adaptive management plan (AMP) (discussed in Section 5.6.5, Existing or Proposed Protection, Mitigation, and Enhancement Measures, and included in Appendix G) designed to protect the birds, enhance nesting and survival opportunities, and allow removal of massive amounts of sand annually. Although the MOU has not been signed by all parties, it is being implemented informally. After two summers of experience, informal implementation of the MOU and AMP, continued deposition of dredged material, and increasing sand extraction, this unique sand management program seems to be succeeding.

Photo 4-13. Typical view of the South Sand Managment Area.

Photo 4-14. Typical view of the North Sand Management Area.

4.2.8 Skimming Weir

The Skimming Weir is located at the downstream end of the Settling Basin. Here, decanted water passes over the Skimming Weir into a narrower section of the Loup Power Canal, where the maximum flow velocity is 2.25 feet per second. This fixed-crest concrete weir has a bridge-like superstructure and is fitted with screens to collect trash and debris before they can enter the Upper Power Canal. The crest elevation of the Skimming Weir is 1,568.2 feet. Overflow depth varies from 1.6 feet at 800 cfs to 4.2 feet at 3,500 cfs. The water level in the Settling Basin (and the depth of the basin) will vary with the amount of water passing over the Skimming Weir. Just upstream of the Skimming Weir, a stream gage, USGS Gage 06792500, Loup River Power Canal near Genoa, NE, records water flow entering the Upper Power Canal.

Photo 4-15. View of the Skimming Weir from upstream.

Photo 4-16. View of flow exiting the Skimming Weir.

4.2.9 Upper Power Canal

The Upper Power Canal parallels the south side of the Nebraska Central Railroad (formerly Union Pacific Railroad) from the Settling Basin to Genoa, where it dips under Beaver Creek through an inverted siphon. The 10-mile canal segment then skirts along the south side of Genoa until it dips under the railroad in another siphon. The Upper Power Canal continues along the north side of the Loup River Valley, crosses under Looking Glass Creek in a third siphon, and continues to the Monroe Powerhouse. All three siphons are three-barrel concrete structures designed as rigid boxes and are capable of passing the maximum canal flow of 3,500 cfs at a velocity of 5.22 feet per second.

From the Settling Basin to the Looking Glass Creek Siphon, the Upper Power Canal has a bottom width of 73 feet and a normal water depth of 14.3 feet. Freeboard is 5 feet, and the design velocity is 2.25 feet per second. Much of this upstream canal segment is constructed in sand. From the Looking Glass Creek Siphon to the Monroe Powerhouse, the Upper Power Canal has a bottom width of 39 feet and a normal water depth of 19.5 feet. The canal bottom profile slopes only 3 inches per mile.

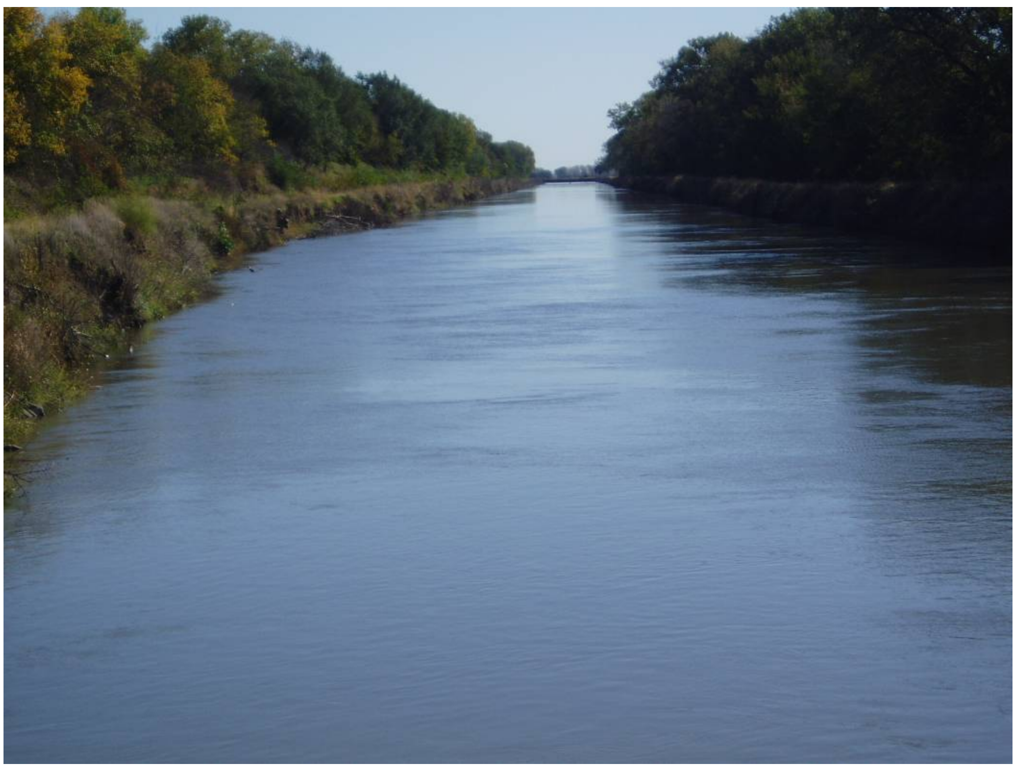

Photo 4-17. Typical view of the Upper Power Canal.

Photo 4-18. View of the Upper Power Canal in Genoa.

Photo 4-19. View of the approach to the Railroad Siphon at Genoa.

Photo 4-20. View of the Railroad Siphon exit.

4.2.10 Monroe Powerhouse

The Monroe Powerhouse is located 0.75 mile north of Monroe. It is a reinforced concrete structure that is 129 feet long, 39 feet wide, and 87 feet high. The station intake and powerhouse were built as one structure, with the scroll cases formed in concrete. The Monroe Powerhouse spans the canal and functions as an energy-producing canal drop structure.

The plant was designed for a normal gross head of 32 feet. It contains three 2,600-horsepower, vertical axis Francis turbines directly connected to generators rated at 2,750 kilovolt-amperes (kVA) at a 0.95 power factor. At full load, each turbine generating unit can pass 1,000 cfs. All three units were sequentially rehabilitated and modernized from 2004 to 2007. Power is generated at 6.9 kV and stepped up to 34.5 kV at the substation located at the north end of the powerhouse.

Six electrically operated vertical head gates (two to each turbine generating unit) provide for closing off the turbine intake flumes. A 25-ton bridge crane provides for equipment handling and maintenance in the Monroe Powerhouse.

In the event of a total plant shutdown, a single automated radial bypass gate will quickly redirect the canal flow around the Monroe Powerhouse. The 15-foot-4-inch-wide gate is fully enclosed from the elements at the north end of the powerhouse. It is operated by means of a 5-ton electrically powered hoist equipped with a solenoid brake. A 9-ton counterweight is used to lift the gate. When the solenoid is released, a centrifugal fan brake automatically comes into operation. Precise discharge control is accomplished by means of floats and relay control of the radial bypass gate.

Photo 4-21. View of the upstream face of the Monroe Powerhouse.

Photo 4-22. View of the downstream face of the Monroe Powerhouse.

4.2.11 Lower Power Canal

The Lower Power Canal extends approximately 13 miles from the Monroe Power House to Lake Babcock, a regulating reservoir, and has a bottom width of 39 feet and a water depth of 19.5 feet. The Lower Power Canal dips under two siphons, the Dry/Cherry Creek Siphon and the Oconee Siphon (at the Union Pacific Railroad). These siphons, like those on the Upper Power Canal, are three-barrel concrete structures designed as rigid boxes. Additionally, the 916 Siphon carries Lost Creek under the Lower Power Canal.

Photo 4-23. Typical view of the Lower Power Canal.

Photo 4-24. View of the Lower Power Canal at the Oconee Siphon.

4.2.12 Sawtooth Weir

An unusual concrete weir structure, called the Sawtooth Weir, is located where the Lower Power Canal enters Lake Babcock. Its purpose is to control the depth of water in the Lower Power Canal and to prevent Lake Babcock from back-flowing in the event of a canal breach. When this weir is viewed from above, it has a sawtooth or zigzag shape. This design geometry was used to obtain a greater crest length (and overflow capacity) for the distance available between abutments. Head loss at this structure is approximately 0.40 feet at maximum canal flow.

Photo 4-25. Unique turbulence created by the submerged Sawtooth Weir.

Photo 4-26. Lake Babcock entrance channel from the Sawtooth Weir.

4.2.13 Lake Babcock

Lake Babcock, the original regulating reservoir, is located 3 miles north of Columbus. Its purpose is to temporarily pond water for later release through the Columbus Powerhouse during peak load periods. Lake Babcock was created in a natural depression by building compacted earth embankments on the north, east, and south sides. The lake covers 760 acres at its full pool elevation of 1,531 feet. The original storage capacity of 11,000 acre-feet was drastically reduced by sediment deposition during the first 25 years of Project operation, prior to the construction of Lake North, discussed in Section 4.2.14, below. When Lake North was opened, it was estimated that Lake Babcock had a storage capacity of 2,400 acre-feet at an elevation of 1,531 feet and 1,050 acre-feet at an elevation of 1,529 feet. In 1995, when the lake was last surveyed, these values had dropped to approximately 2,270 acre-feet and 730 acre-feet, respectively. Daily fluctuation of the reservoir surface averages about 2 feet; however, in certain circumstances, it can be as much as 3 feet.

The open water portion of the lake experiences substantial wave buildup on windy days. Therefore, much of the shore is protected with riprap. In addition, a substantial reach of embankment near the outlet and bordering Lake North is protected with a concave seawall constructed of concrete.

Photo 4-27. Shallow water plant growth in Lake Babcock as seen from the west dike.

Photo 4-28. View of Lake Babcock from the south dike at the outlet.

4.2.14 Lake North

After 25 years of Project operation, sediment accumulation in Lake Babcock had substantially reduced its ponding capacity. The District determined that the best solution to the problem was to build a second regulating reservoir adjacent to and connected with Lake Babcock. This new regulating reservoir, named Lake North, was completed in 1962. It was constructed by adding new compacted earth embankments to the north and east and using existing Lake Babcock embankments to the south and west. Lake North covers 200 acres at an elevation of 1,531 feet, providing 2,080 acre-feet of storage.

A concrete control structure in the south dike links the two regulating reservoirs. The control structure is located such that Lake North does not experience the rapid sedimentation that occurred in Lake Babcock; therefore, Lake North is a major recreation feature of the Project. A set of steel stoplogs are stored at the control structure, and they can be installed to isolate the regulating reservoirs as necessary for maintenance or emergency purposes.

To control erosion, much of the Lake North shoreline has been lined with steel sheet pile protection and concrete riprap.

Photo 4-29. View of Lake North from the boat launch area in the northeast corner.

Photo 4-30. View from Lake Babcock to Lake North showing the dike that divides the two regulating reservoirs and the control structure that connects them.

4.2.15 Intake Canal

Water exiting Lake Babcock flows 1.5 miles through the Intake Canal to the Columbus Powerhouse. The Intake Canal was designed for a capacity of 4,800 cfs, which is the hydraulic capacity of the turbine generating units in the Columbus Powerhouse. The bottom width of the Intake Canal is 108 feet when it leaves Lake Babcock. This width reduces to 94 feet as the Intake Canal approaches the Powerhouse Inlet Structure. The embankments for the Intake Canal were constructed of compacted earth fill, similar to the reservoir dikes. Intake Canal water depth varies from 17.2 to 22.2 feet, depending on the reservoir stage and rate of flow. The slope of the canal profile is 3 inches per mile. Flow velocity in the canal varies from 1.4 to 2.0 feet per second.

Photo 4-31. View of the Intake Canal as it exits Lake Babcock.

Photo 4-32. View of the Intake Canal from the Powerhouse Inlet Structure.

4.2.16 Powerhouse Inlet Structure

The Intake Canal terminates at the Powerhouse Inlet Structure. This three-bay reinforced concrete structure is 60 feet long, 104 feet wide, and 40 feet high. A concrete tower structure for the gate hoists extends an additional 34 feet above the deck of the Powerhouse Inlet Structure. Approaching canal flow is smoothly routed through vertical steel trash rack panels that are designed to exclude large items that could harm the turbines or mechanical equipment at the Columbus Powerhouse, and a large mechanical trash rake is mounted on rails to traverse the inlet width and clean the trash racks.

Behind the trash racks, each inlet bay is provided with a steel inlet gate that can be lowered to stop the flow to the Penstocks for maintenance or emergency purposes. Each gate weighs 26,500 pounds and is designed to close off the passage under maximum flow conditions. The ability to quickly and dependably shut down the flow is critical because there is no spillway or flow bypass device at the Columbus Powerhouse. In an emergency, any two turbine generating units can pass up to 4,100 cfs, which is 600 cfs more than the maximum system inflow diverted at the Headworks.

Photo 4-33. Upstream face of the Powerhouse Inlet Structure.

Photo 4-34. Operating deck of the Powerhouse Inlet Structure.

4.2.17 Penstocks

Three steel Penstocks connect the Powerhouse Inlet Structure with the Columbus Powerhouse. Each penstock is 20 feet in diameter and 385 feet in length. Thickness of the riveted steel sections increases from 3/8 inch at the top to 7/8 inch at the bottom, where hydraulic pressure is greatest. The Penstocks are supported on a gravel base that extends up to the spring line of the pipe. Flow velocity in the Penstocks is approximately 5.1 feet per second. The Penstocks were designed for a low velocity to eliminate the need for a surge tank.

Photo 4-35. View of the Penstocks from the Columbus Powerhouse.

4.2.18 Columbus Powerhouse

The Columbus Powerhouse is located 2.5 miles northeast of Columbus and is the primary power-generating element of the Project. It has 3.5 times the head and 1.4 times the flow capacity of the Monroe Powerhouse. In addition, and with several limitations, the regulating reservoirs allow the Columbus Powerhouse to use its daily measure of water to produce electricity when it is of greatest value to the regional electric system.

The Columbus Powerhouse is a reinforced concrete structure that is 180 feet long, 57 feet wide, and 115 feet high. It was designed for a normal head of 115 feet, and it contains three 19,140-horsepower, vertical axis Francis turbines directly connected to generators rated at 16,000 kVA at a 0.95 power factor. At full gate, each turbine generating unit can pass 2,060 cfs. However, total plant generation is limited by the 4,800-cfs hydraulic capacity of the Intake Canal. The turbine generating units normally operate at about 1,600 cfs for the most efficient use of water. All three units were sequentially rehabilitated and modernized from 2004 to 2007. A 75-ton bridge crane provides for equipment handling and maintenance in the Columbus Powerhouse. The crane also has a 15-ton auxiliary hook. Power is generated at 13,800 volts and stepped up to 115,000 volts by District-owned step-up transformers as it enters the NPPD-owned transmission facilities located at the east end of the Columbus Powerhouse.

Photo 4-36. View of the Columbus Powerhouse from the Powerhouse Inlet Structure.

Photo 4-37. View of the Columbus Powerhouse from the Tailrace Canal.

4.2.19 Tailrace Canal

After passing through the Columbus Powerhouse, water is discharged to the Tailrace Canal for its return to the river basin. The Tailrace Canal is approximately 5.5 miles long and has a bottom width of 42 feet and a normal water depth of about 19 feet. This canal was designed to carry a nominal 4,800 cfs at a velocity of 3 feet per second. The Tailrace Canal was excavated along its entire length, and the slope of the hydraulic gradient is 0.0007 foot/foot.

An interesting feature of the Tailrace Canal is the unique form of shore protection installed during the 1950s and 1960s. It consists of hundreds of junked automobiles lined side by side along the embankment waterline. This Detroit riprap, as it is known locally, has done an effective job of bank stabilization and has become so entrenched in the soil and plant material as to be scarcely identifiable.

In the tailrace area just downstream of the Columbus Powerhouse, there are two structures of note, the Lost Creek Flood Control Channel spillway and the Lost Creek Siphon. After many years of flooding problems in Columbus related to Lost Creek, USACE constructed the Lost Creek Flood Control Project in 1983. This USACE project included construction of a concrete spillway structure on the west bank of the Tailrace Canal that discharges overflow water from the Lost Creek Flood Control Channel into the canal immediately downstream of the Columbus Powerhouse.

The Lost Creek Siphon was constructed with the original Project to carry Lost Creek under the Tailrace Canal. The siphon consists of a 60-inch-diameter, west-to-east-flowing pipe that drops approximately 20 feet below Lost Creek to pass under the Tailrace Canal. The pipe then rises approximately 16 feet to discharge into re-aligned Lost Creek on the east side of the Tailrace Canal. Because of the intermittent flow and high sediment characteristics of Lost Creek, it is necessary to prevent the siphon invert from becoming blocked with sediment. This is accomplished by providing for flow through the siphon using water from the Tailrace Canal. A 24-inch by 45-inch adjustable sluice gate was installed in the west canal embankment. This gate opens to a 24-inch-diameter culvert that passes through the embankment and discharges into the west entrance of the Lost Creek Siphon. At full gate opening and normal canal level, this sluiceway can maintain a flushing flow of 20 cfs from the Tailrace Canal to the Lost Creek Siphon. As partial compensation for dredging and re-aligning Lost Creek across private lands when the Project was constructed, the District entered into an agreement with landowners to provide water in Lost Creek at such times as the landowners may desire water. This includes landowners east of the Tailrace Canal whose lands are traversed by Lost Creek.

Photo 4-38. View of the Tailrace Canal from the Columbus Powerhouse.

Photo 4-39. View of the Lost Creek Flood Control Channel spillway.

Photo 4-40. View of the unique shoreline stabilization along the Tailrace Canal.

4.2.20 Outlet Weir

The Outlet Weir, also called the Tailrace Weir, is located at the confluence of the Tailrace Canal and the Platte River. It is east of Columbus and approximately 2 miles downstream of the confluence of the Loup River with the Platte River. An important function of the Outlet Weir is to maintain sufficient submergence of the draft tubes at the Columbus Powerhouse. This concrete overflow weir has a straight 700-foot-long crest. The transition from canal section to this width is 550 feet long. The weir crest was originally built at an elevation of 1,413 feet. Sometime later, it was lowered approximately 18 inches, presumably to obtain more net head at the Columbus Powerhouse.

The flow characteristics and accessibility of the Outlet Weir make this a popular fishing, viewing, and recreation area.

Photo 4-41. View of the Outlet Weir from the west bank.

4.2.21 Transmission Lines

All power produced at the Monroe and Columbus powerhouses is sold at the on-site substations to NPPD. For this reason, no overhead transmission voltage lines are associated with the Project license. The District does own and maintain extensive overhead distribution voltage lines to serve customers throughout its four-county service area. However, none of these lines are directly associated with the Project.

4.3 CURRENT AND PROPOSED PROJECT OPERATION

4.3.1 Reservoir Storage

"The normal maximum water surface area and normal maximum water surface elevation (mean sea level), gross storage capacity of any impoundments." 18 CFR §5.6(d)(2)(iii)(B)

As discussed in Section 4.2.13, above, Lake Babcock was the original regulating reservoir for the Project. When sedimentation substantially reduced its ponding capacity, an adjacent regulating reservoir, Lake North, was constructed in 1962. Together, these two interconnected reservoirs form the current regulating reservoir for the Project, which has a normal maximum surface area of 960 acres at an elevation of 1,531 feet. The gross capacity of this two-reservoir impoundment, including sediment and dead storage, is approximately 13,000 acre-feet.

The regulating reservoirs are normally operated between elevations of 1,529 and 1,531 feet. Usable ponding capacity between these elevations is estimated to be approximately 1,740 acre-feet. This volume is about equal to 13 hours of average inflow from the Lower Power Canal. The regulating reservoirs were not designed to store a large volume of water for use during dry periods. Instead, they allow for daily regulation of inflow: ponding of water during low electrical demand hours of the day and release of water during high electrical demand hours of the day.

During low electrical demand hours of the day, flow through Columbus Powerhouse normally drops to zero to maximize ponding. Conversely, powerhouse discharge can increase to 4,800 cfs during hours of peak electrical demand. The lowest practical discharge from a single turbine generating unit at the Columbus Powerhouse is 1,000 cfs. The Intake Canal, Columbus Powerhouse, and Tailrace Canal are all designed for the zero-to-4,800-cfs flow variation of hydrocycling[2] operation.

4.3.2 River Flows

"A description of the current … and proposed operation of the project, including … daily or seasonal ramping rates, flushing flows, reservoir operations, and flood control operations." 18 CFR §5.6(d)(2)(iv)

As discussed in Section 3, General Description of the River Basin, the Loup River rises in the Nebraska Sandhills ecoregion. It has a fairly stable base flow largely composed of sustained groundwater discharges. This base flow is increased by precipitation events and runoff in the Loup River Basin. The Loup River carries a substantial sediment load with its water. Managing this high sediment content complicates the water diversion and canal flow aspects of the Project.

Project operation is heavily dependent on flow conditions in the Loup River. There have been many changes to the flow regime of the river in the 7 decades since the Project was constructed. Storage reservoirs and diversion dams have been constructed in the headwater streams, and hundreds of water appropriations and consumptive use permits have been issued for domestic, agricultural, and industrial depletions of the natural river flow. Seasonal crop irrigation has the most noticeable impact on flow depletion at the point of diversion for the Project.

The quantity of flow diverted for power generation is dependent on river flow and sediment conditions at the Project Headworks. Diverted flow is measured and recorded at USGS Gage 06792500, Loup River Power Canal near Genoa, NE, at the outlet of the Settling Basin. The flow rate ranges from a low of 0 cfs to a maximum of 3,500 cfs. The average diversion rate, as measured at the USGS gage, is 1,610 cfs

[2] Hydrocycling refers to the method of producing hydroelectricity "on-demand" by temporarily ponding water in a regulating reservoir until the water is needed to produce electricity, typically within the same 24-hour period.

(based on USGS data from 1937 through 2007). The Project operates on a run-of-river basis from the Headworks to the regulating reservoirs.

Using the ponding capacity provided in the regulating reservoirs, the Columbus Powerhouse is operated in response to NPPD's need for power on a daily basis. Typically, power is generated for one, or sometimes two, periods of several hours during the day; the amount and duration of power production varies each day according to both electrical demand and available water. This on-and-off method of operation is known as hydrocycling. The accompanying opening and closing of turbine gates creates flow pulses in the Tailrace Canal that then translate 5.5 miles downstream and influence discharge into the Platte River at the Outlet Weir.

Substantial flow changes can be made at the Columbus Powerhouse in a matter of minutes, but these ramp-up and ramp-down pulses are attenuated as they move down the Tailrace Canal. According to 15-minute increment flow records on the Tailrace Canal at the 8^{th} Street bridge in Columbus (NDNR Gage 00082100), it typically takes between 15 and 120 minutes (ignoring canal travel time) for the resulting pulse to fully rise or fall as it enters the Platte River. Hydrocycling pulses are further attenuated as they travel downstream in the Platte River.

Occasionally (less than annually), the District drops the pool elevation at the regulating reservoirs and performs flushing of the canal and reservoir system to control sediment accumulation. However, these flows are limited to the design flow of the system—3,500 cfs upstream of the Sawtooth Weir and 4,800 cfs downstream of the Sawtooth Weir. Operation during high flow events is discussed in Section 4.3.6, below.

4.3.3 Power Generation

"The number, type, and minimum and maximum hydraulic capacity and installed (rated) capacity of any proposed turbines or generators to be included as part of the project." 18 CFR §5.6(d)(2)(iii)(C)

"An estimate of the dependable capacity, average annual, and average monthly energy production in kilowatt hours (or mechanical equivalent)." 18 CFR §5.6(d)(2)(iii)(E)

Power is generated by the turbine units in the Monroe and Columbus powerhouses. Rating and descriptive data for the existing turbine units are provided in Table 4-1.

Table 4-1. Project Turbines

Item	Monroe Powerhouse[a]	Columbus Powerhouse[a]
Number of Vertical Axis Francis Turbines	3	3
Manufacturer	James Leffel/American Hydro	I.P. Morris/American Hydro
Rotational Speed	112 rpm	150 rpm
Maximum Hydraulic Capacity	1,000 cfs	2,060 cfs[b]
Minimum Hydraulic Capacity	300 cfs	1,000 cfs
Rated Turbine Capacity	2,600 hp	19,140 hp
Rated Net Head	28.6 feet	113.5 feet

Notes:

[a] rpm = revolutions per minute
cfs = cubic feet per second
hp = horsepower

[b] This source of this data is Acoustic Technologies, July 15, 2005, “Loup Power District, Columbus Powerhouse Unit 1 Performance Test,” Wareham, MA.

Rating and descriptive data for the existing generator units in the Monroe and Columbus powerhouses are provided in Table 4-2.

Table 4-2. Project Generators

Item	Monroe Powerhouse[a]	Columbus Powerhouse[a]
Number of Synchronous Generators	3	3
Manufacturer	Westinghouse/Woods Group	Allis Chalmers/Woods Group
Rotational Speed	112 rpm	150 rpm
Rated Generator Capacity	2,750 kVA	16,000 kVA
Frequency	60 Hz, 3-Phase	60 Hz, 3-Phase
Voltage	6,900	13,800
Power Factor	0.95	0.95

Note:

[a] rpm = revolutions per minute
kVA = kilovolt-amperes
Hz = hertz

The dependable capacity of the Project is 45 MW based on the NPPD Columbus hydro accreditation, which includes all Monroe and Columbus powerhouse generating units.

Data for the average monthly energy and average annual energy produced at the Project from 1938 through 2005 are provided in Table 4-3.

Table 4-3. Average Project Energy Production

Period	Average Energy (kWh)[a]
January	8,036,000
February	9,719,000
March	12,860,000
April	14,573,000
May	14,160,000
June	13,052,000
July	9,190,000
August	8,487,000
September	10,694,000
October	13,844,000
November	12,761,000
December	6,817,000
Annual	134,192,000

Note:
[a] kWh = kilowatt hour

4.3.4 Normal Project Operations

Normal Project operating conditions are associated with Loup River flows below 10,000 cfs. All river flow above 3,500 cfs must be bypassed as this is the District's water right limit and the hydraulic capacity of the Loup Power Canal. During normal operation, the Headworks are operated to divert the maximum practical amount of flow (and the least amount of sediment) from the Loup River into the Settling Basin. The amount of flow that can be diverted at any given time is a function of Loup River stage and flow, sediment accumulation in front of the Intake Gate Structure, settings of the 11 fully adjustable gates comprising the Intake Gate Structure, Settling Basin stage, and the sediment situation in the Settling Basin on that particular day. These continuously variable factors make it difficult for operators to deliver a pre-selected rate of diverted flow. There is no automation at the Headworks; intake gates and sluice gates must be manually adjusted frequently in order to keep water flow and sediment movement within acceptable ranges.

The long-term average for diverted flow is 1,610 cfs, or 3,180 acre-feet per day. This volume represents 69 percent of the total Loup River flow at the point of diversion. The District's water right limit and the hydraulic capacity of the Loup Power Canal is 3,500 cfs, or 6,930 acre-feet per day. In actuality, it is possible to divert the maximum flow rate only about 10 days each year, when conditions are just right.

The Monroe Powerhouse operates in a traditional run-of-river mode based on the water coming to it in the Upper Power Canal. Level sensors at the station intake maintain a constant canal elevation by making minor adjustments to the turbine wicket gates. Control of the Monroe Powerhouse turbine generating units is normally dispatched remotely by the Columbus Powerhouse operator. Generation of each unit is determined by water levels and the wicket gate settings on the unit. The radial bypass gate at the Monroe Powerhouse can be operated in manual or automatic mode. This gate will open to a pre-determined position to pass any flow that exceeds the capacity of the turbine generating units on-line. Operation with water level control maintains a steady headwater level at the Monroe Powerhouse.

Water exiting the Monroe Powerhouse flows freely down the Lower Power Canal. Level control is provided by the Sawtooth Weir located at the entrance to Lake Babcock. Water level in the regulating reservoirs is controlled by adjusting canal flow or turbine releases at the Columbus Powerhouse.

Project generation is dispatched from the NPPD Control Center in Doniphan, Nebraska. The NPPD Dispatcher will request that generation be brought on- or off-line as system demand changes. When the NPPD Dispatcher issues an order, the Columbus Powerhouse Operator makes wicket gate adjustments, brings turbine generating units on-line, or takes turbine generating units off-line, depending on the order.

The dispatch order must account for the available storage in and elevation of the regulating reservoirs, the water available for diversion at the Headworks, and current headwater and tailwater levels at the two powerhouses. The turbines are capable of operating in four modes: 1) flow control, where the flow through the unit remains constant; 2) level control, where the headwater elevation is maintained within a narrow band by adjusting turbine gates; 3) power control, where the flow is adjusted to maintain a steady generation rate; or 4) gate control, where wicket gates are adjusted to maintain a specified headwater and/or tailwater elevation.

The Columbus Powerhouse is generally operated as a hydrocycling plant by the dispatcher. This involves ponding some of the canal inflow in the regulating reservoirs and then pulling the level of the reservoirs down a couple of feet during certain times of the day for generating at peak demand. In the evening hours, when there is less electrical demand, the turbine generating units are shut down and the regulating reservoirs are allowed to refill.

The controls at both the Monroe and Columbus powerhouses are interfaced electronically to provide optimum control of all water elevations during Project operation. This control, in turn, produces optimum generation from the available flow.

4.3.5 Cold Weather Operations

In early winter, slush begins to form in the Loup River and the Settling Basin, generally in the early morning hours. A small amount of slush can normally be diverted into the Settling Basin without causing problems. As the season progresses and temperatures drop, the slush forms earlier in the evening and in heavier concentrations. At this point, the slush must be bypassed down the Loup River. If too much heavy slush is diverted from the Loup River into the much slower flowing Settling Basin, a "plug" can form in the basin. If this should happen, there can be no further flow diversion until the ice plug melts or dissipates. It could remain in place for the remainder of the winter.

As air temperature gets colder, an ice cap forms both on the Loup River and in the Loup Power Canal. Once a solid ice cap exists, a steady winter diversion rate of about 2,000 cfs can be established. This rate can be maintained fairly well through the season provided that the ice cap remains intact. Abrupt flow increases must be avoided when there is an ice cap in the canal. Ice adheres to bridge pilings and could loosen or damage them if it rises. If a diversion increase is needed, all ice formed around the bridge pilings must first be manually removed.

During periods of extreme cold, the steel gates at the Intake Gate Structure and Sluice Gate Structure will freeze in place. Steam produced by an on-site boiler is used to deice the gates and keep the Headworks operable. Heavy ice also accumulates on the Diversion Weir flashboards, which cannot be reached with steam. Pressure from ice and river flows can tip the flashboards. Rising water, moving ice, and debris during spring runoff usually destroy a portion of the boards. Therefore, the flashboards are replaced each spring.

Winter operation at the Monroe Powerhouse involves monitoring water temperature and watching for the formation of frazil ice. If frazil ice begins to form, diversion is quickly halted at the Headworks. Frazil ice could quickly plug the trash racks and starve the turbines for water. Depending on conditions, this could lead to overtopping of the Upper Power Canal. The radial bypass gate at the Monroe Powerhouse must be kept unfrozen and operable at all times; therefore, the gate and its hoist are enclosed in a heated structure. However, the operator must ensure that the gate seals are not frozen to the sill or sides of the gate bay. The operator must thaw them as necessary and remain vigilant in keeping them from refreezing.

Winter operation at the Columbus Powerhouse also involves monitoring water temperature and responding rapidly to the formation of frazil ice. Conditions suitable for frazil ice formation can occur at either one or both powerhouse locations. At the Columbus Powerhouse, declining pressure readings in the Penstocks indicate that frazil ice is forming on the trash racks. The Columbus Powerhouse Operator may reduce flow through the plant or take the turbine generating units off-line to inhibit additional icing and potential plugging of the trash racks. The Columbus Powerhouse has no bypass gate; therefore, when the powerhouse is taken off-line and the regulating reservoirs reach a certain elevation, flow diversion must be stopped to allow for water already in the system.

The Headworks Supervisor, Canal Foreman, Monroe Powerhouse Operator, and Columbus Powerhouse Operator must remain in close communication as winter conditions change along the Loup Power Canal from the Headworks to the Tailrace Canal and Outlet Weir. The entire 35-mile length of the Project must be monitored for heavy slush, frazil ice formation, ice floes, and ice jams. Any of these conditions may create an emergency situation where flow diversion must be quickly adjusted or curtailed completely.

4.3.6 High Flow Operations

Abnormally high flows in the Loup Power Canal could be produced by two scenarios: 1) high flows in the Loup River at the Headworks, and 2) excessive precipitation runoff into the Loup Power Canal from local drainage areas. High flows (10,000 cfs and greater) have historically occurred in the Loup River during the spring freshet (that is, the sudden high flow resulting from a thaw). However, high flows can and do occur whenever there is a major precipitation event in the Loup River Basin.

Much of the work to address high flows in the Loup River must be completed before the high flow event occurs. Dikes that connect the Diversion Weir and Intake Gate Structure with high ground on either bank must be maintained in good repair at all times. These dikes contain the river channel and prevent shoreline erosion. In addition, the floodplain located immediately downstream of the Diversion Weir must be kept clear of trees and brush that could inhibit or obstruct passage of high flows.

When high flow events occur, the Loup River carries large amounts of trash, debris, and occasionally ice. These materials must be passed down the river and not diverted into the Loup Power Canal. Most of the unwanted material will simply pass over the submerged Diversion Weir; the remainder can be passed downstream using the Sluice Gate Structure. Occasionally, stranded trees or logs must be cut into more manageable sizes with chainsaws. The Headgate Operator resides on site and monitors both weather and river flow conditions. To protect the Project, the Headgate Operator will reduce or curtail flow diversion as necessary prior to or during a high flow event.

The Project was designed to handle normal storm runoff entering the Loup Power Canal from adjacent areas. Operation and maintenance of 37 miles of ditches located along the Project prevents the Loup Power Canal from being inundated by runoff from normal precipitation events. However, during extreme precipitation events, some storm runoff will enter the Loup Power Canal. To manage such events, the Headgate Operator can reduce diversion at the Headworks prior to an event to provide additional freeboard in the canal segments. If an event occurs with little or no warning, the Headgate Operator can cease diversion. The Headgate Operator can also call for over-generation at both the Monroe and Columbus powerhouses as well as for opening the radial bypass gate at the Monroe Powerhouse. These actions will move the high inflows through the Project at a much higher rate.

The only over-topping event ever to occur at the Project happened in August 1966. A large and very intense precipitation event over much of the Loup River Basin resulted in a 500-year flood event on the Loup River at the Headworks. The peak flow was estimated by USGS to be 123,000 cfs. This was an exceedingly serious and damaging event that overtopped the Headworks, breached the Upper Power Canal in several places, and returned the flow to the Loup River downstream of the Project.

There is no cost-effective way to prevent substantial damage to the Project from such a rare high flow event. However, the District has a state-of-the-art Emergency Action Plan (EAP) for the Project. The FERC-approved EAP is designed to prevent loss of life, minimize property damage, and minimize interruption of Project operations if a high flow event or other type of emergency should occur. The EAP is reviewed and updated annually, or more often as appropriate. Every 5 years, in conjunction with the FERC Part 12 dam safety inspection, the District conducts a formal Functional Exercise to test its EAP procedures against an assumed emergency scenario.

4.3.7 Low Flow Operations

Low flow conditions can occur at any time. However, on the Loup River, they generally occur during the hot summer months when river flow is often impacted by upstream irrigation withdrawals. During these periods, the Project continues to operate normally, albeit with reduced flow available for diversion and generation. According to USGS gage records and observations, the minimum leakage rate at the Diversion Weir and Sluice Gate Structure is about 50 cfs. This value represents the minimum flow in the Loup River bypass reach downstream of the Headworks.

The primary Project operating response to hot weather conditions has been to allow for a flow of 50 to 75 cfs in the Loup River bypass reach when conditions warrant. This has been done voluntarily by the District (in accordance with mutual understandings and informal letter agreements with NGPC) to prevent temperature-related fish mortality from occurring in the Loup River bypass reach. The Headworks Supervisor monitored ambient temperatures and initiated the reduced flow diversion when air temperature reached 98° Fahrenheit. This District-imposed system has been effective in preventing fish kills in the Loup River bypass reach since it was adopted in 1995. 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.

A second operating consideration in low flow, hot weather conditions was adopted by the District in 2005. Experience has shown that dissolved oxygen levels can drop to dangerously low levels for fish in the Loup Power Canal if there is insufficient flow of water during hot weather. Therefore, during high temperature periods, the District defers non-emergency maintenance procedures that require substantial curtailment of Loup Power Canal flows.

4.3.7 Monitoring

Monitoring of the Headworks is done remotely, but the Headgate Operator lives on site, and the operator or a rotating assistant is on duty 24 hours per day, 7 days per week when conditions warrant. The Headgate Operator's primary function is operation of the Intake Gate Structure and Sluice Gate Structure. However, the Headgate Operator performs routine maintenance, observation, and equipment checks as well.

The Monroe Powerhouse is designed to be remotely operated from the Columbus Powerhouse. However, the Monroe Powerhouse Operator lives on site, normally tends the powerhouse during a daylight shift (8 hours per day, 5 days per week), and is on call 24 hours per day, 7 days per week when conditions warrant.

The Columbus Powerhouse is staffed 24 hours per day, 7 days per week by an operator working a 12-hour shift, rotating at 6:00 a.m. and 6:00 p.m. Five additional District staff are on duty to perform normal maintenance and equipment checks at the Columbus Powerhouse from 8:00 a.m. to 5:00 p.m. during the normal 5-day workweek. The Columbus Powerhouse Operator is the primary lead in normal operation of the Project. There are five qualified, full-time powerhouse operators for the Columbus Powerhouse.

The entire Project is operated, monitored, and controlled by a supervisory control and data acquisition (SCADA) system. This system includes remote sensors at the Headworks, Monroe Powerhouse, and Columbus Powerhouse. Operation of turbine generating units in both powerhouses can be fully controlled through the SCADA system at the Columbus Powerhouse. In addition, each turbine generating unit has a manual interface for local control.

The Columbus Powerhouse Operator can monitor the status of all turbine-generator operations, river flow, diversion rate, reservoir elevation, turbine generating unit performance, and other information associated with Project operations.

River flow and diverted flow are continuously monitored by sensors located at the Headworks. Critical inflow information is monitored by USGS Gage 06792500, Loup River Power Canal near Genoa, NE, at the Skimming Weir and backed up by independent sensors at the Headworks.

Water elevation is monitored at three key Project locations: the Headworks, Monroe Powerhouse, and Columbus Powerhouse. Each of these locations has redundant, independent monitors. Project alarms are triggered if any sensor detects water at pre-set elevations.

The SCADA system will automatically initiate a normal or emergency shutdown as required when a turbine generating unit goes off-line. Should this occur, the Columbus Powerhouse Operator immediately contacts the Headgate Operator to adjust diversion accordingly and the NPPD Dispatcher to alert him/her of the change in generation. When a shutdown occurs, turbine controls are locked out, and the turbine generating unit must be restarted manually from its powerhouse.

4.3.8 Communications

The Columbus Powerhouse Operator is the primary contact for the NPPD Dispatcher and the Headgate Operator for planning long-term diversion and other operational issues that may affect flow diversion and bypass. The Columbus Powerhouse Operator on duty will confirm the operating parameters with the NPPD Dispatcher and Headgate Operator at the beginning of each day, and the Headgate Operator will contact the Columbus Powerhouse Operator each day at 8:00 a.m. and 4:00 p.m. to report diversion and bypass flows.

Routine daily communication between the Columbus Powerhouse Operator and the Headgate Operator includes a discussion on available diversion for the day so that the Columbus Powerhouse Operator can relay estimated generation for the day to the NPPD Dispatcher. The Columbus Powerhouse Operator must also review the current operating parameters with his/her relief operator at each shift change.

Part of routine communications between the Columbus Powerhouse Operator, the Monroe Powerhouse Operator, the Supervisor of Powerhouse Maintenance, and the Hydro Superintendent is discussion of any planned maintenance activity that may involve dewatering of penstocks or turbines or may otherwise cause turbine generating unit outages or impact generation. Scheduled outages and major maintenance are planned to minimize impact on generation, such as during low flow periods.

During high flow conditions, the Columbus Powerhouse Operator and the Headgate Operator communicate more frequently. The Headgate Operator must be available at all times to adjust diversion. The Columbus Powerhouse Operator will contact both the NPPD Dispatcher and the Headgate Operator when both powerhouses reach their full discharge capacity.

During winter operations, there is a similar need for more frequent communication between the Columbus Powerhouse Operator and the Headgate Operator for safe operation of the system. As stated in Section 4.3.5, above, the Headworks Supervisor, Canal Foreman, Monroe Powerhouse Operator, and Columbus Powerhouse Operator must remain in close contact as conditions change along the entire system.

All of the District personnel discussed above have four avenues of communication available: a cell phone, a land-line phone, e-mail, and a business band radio.

4.4 EXISTING LICENSE

4.4.1 Existing License Requirements

"A complete description of the current license requirements; i.e., the requirements of the original license as amended during the license term." 18 CFR §5.6(d)(2)(v)(A)

A copy of the current license for the Project is included in Appendix B. The various requirements of the license are clearly stated in the Standard Articles and Special Articles of the license.

4.4.2 5-Year Project Generation and Outflow Summary

"A summary of project generation and outflow records for the five years preceding filing of the pre-application document." 18 CFR §5.6(d)(2)(v)(B)

Water diverted for the Project is monitored and recorded at USGS Gage 06792500, Loup River Power Canal near Genoa, NE, at the Skimming Weir. Project power generation is monitored and recorded daily for the individual turbine generating units at both the Monroe and Columbus powerhouses. With few exceptions, all flow diverted is used for generation at both powerhouses. Less than 1 percent of annual flow diverted is extracted from the Loup Power Canal for irrigation. Project outflow is monitored and recorded every 15 minutes at NDNR Gage 00082100, Loup River Power Canal Return at Columbus, NE, located on the Tailrace Canal at the 8th Street bridge in Columbus. This information for the past 5 water years is summarized in Table 4-4.

Table 4-4. Annual Project Generation and Average Outflow[a]

Water Year	Total Generation (kWh)	Diverted Flow at Headworks (acre-feet)	Tailrace Canal Flow (acre-feet)
2003	130,133,000	1,110,000	1,140,000
2004	111,458,000	970,000	980,000
2005	126,297,000	1,060,000	1,080,000
2006	134,649,000	1,060,000	1,070,000
2007	161,118,000	1,280,000	1,270,000

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.

4.4.3 Current Net Investment

"Current net investment." 18 CFR §5.6(d)(2)(v)(C)

The total investment in the Project is $30,130,593.95 with a depreciation of $8,481,716.15, resulting in a net investment of $21,648,877.80 as of August 30, 2008.

4.4.4 Compliance History

"A summary of the compliance history of the project, if applicable, including a description of any recurring situations of non-compliance." 18 CFR §5.6(d)(2)(v)(D)

The District has established a positive compliance history with respect to operation and maintenance of the Project. As of August 2008, FERC's files indicate no instances of non-compliance with any of the terms and conditions of the current Project license (FERC, August 5, 2008).

4.5 PROPOSED FACILITIES AND OPERATIONAL CHANGES

"A description of any new facilities or components to be constructed, plans for future development or rehabilitation of the project, and changes in project operation." 18 CFR §5.6(d)(2)(vi)

The Project is considered to be fully developed and capable of efficiently generating electrical power using all of the water available under its established Nebraska water right. No significant power generation facilities have been added since the Project was last relicensed in 1984. Furthermore, the District has no plans for future generation capacity development or other material expansion of the Project.

Each of the six turbine generating units associated with the Project was rehabilitated and modernized from 2004 to 2007. This $18 million initiative substantially improved overall Project efficiency and made the turbine generating units viable for at least another 50 years of renewable energy operation.

The District intends to continue its established program of maintenance, rehabilitation, and replacement of critical Project components. Examples of anticipated future program elements include replacement of the Monroe Powerhouse roof, replacement of the original Project dredge, and removal/replacement of canal bridges.

In addition, the District intends to continue its ongoing program of adding enhancements for safety, environmental protection, and public recreation at the Project. The specific elements and timing of these improvements will be largely based on the outcome of the relicensing process.

The District currently has no plans to make any substantive changes in its operation of the Project. The Headworks will continue to divert available water up to 3,500 cfs in accordance with the District's water right limit and the hydraulic capacity of the Loup Power Canal. Sand and sediment will continue to be dredged from the Settling Basin. The Monroe Powerhouse will continue to operate in a run-of-river mode, utilizing whatever flow comes down the Upper Power Canal. Flow exiting the Monroe Powerhouse to the Lower Power Canal will continue flowing to Lake Babcock. Lake Babcock and Lake North will continue to function as interconnected regulating reservoirs, providing daily ponding for use in load following and peak demand period generation at the Columbus Powerhouse. The Columbus Powerhouse will continue to be dispatched for optimum utility system benefit by NPPD, with discharge flows ranging from a low of near zero to a maximum rate of 4,800 cfs. Flow exiting the Columbus Powerhouse will continue to be released to the Tailrace Canal and overflow the Outlet Weir into the Platte River.

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