

Study No. 4

Reliability of Transmission Lines and Feasibility of Eliminating Redundant Line

Mystic Lake Hydroelectric Project FERC No. 2301

Mystic Lake, Montana

PPL Montana

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Background

The U.S. Forest Service (USFS) has expressed concern over the visual and environmental impact of the Mystic Lake Project transmission line (T-line) connection to the Line Creek Substation. A T-line study for the Mystic Lake Integrated Licensing Process was proposed by the USFS. A preliminary search for data has shown that data collection for this study may be very labor intensive. GEI Consultants, Inc. evaluated the existing situation and available data to satisfy the question of why the two lines exist and why PPL Montana prefers a continuation of the existing configuration.

The electrical connection of Mystic Lake Powerhouse to the Line Creek Substation consists of two separate and redundant lines, named A and B (Figures 1 – 4). Both carry power continuously and join the grid at the Line Creek Substation, approximately 5 miles from the powerhouse along West Rosebud Road. Individually each has capacity to carry the full load of Mystic Lake Powerhouse should one line encounter an outage. This redundancy was built into the system early in the history of the project because outages were common. The transmission line can be interrupted by severe weather, snow avalanches, lightning strikes and shorts due to trees, physical deterioration, or other unpredictable events. A complete outage has two severe consequences: (1) loss of energy from Mystic Lake with a series of emergency actions that must take place and (2) destabilization of the power supply to the Stillwater Mine, an important electricity customer that relies on the reliability provided by the A and B lines at Line Creek Substation.

Consequences of T-Line Outages

Several things happen if power is interrupted to the Line Creek Substation. Power is cut off from the substation and the electrical grid. Thus, there is interruption in power supply to the electrical grid and consequential financial losses. The hydropower turbines at Mystic Lake Powerhouse largely shut down and significantly reduce tailrace flows. If Mystic Lake is full, the reservoir will begin spilling water equivalent to the project inflows and raise the level of the bypass flows temporarily until power is restored. PPL Montana crews would be dispatched to investigate and begin restoring the outage. If the interruption occurs during nighttime hours, emergency crews would be called out. Other power must be called up from other power plants on the grid to replace the lost energy. And, possibly most importantly, the loss of voltage at the Line Creek Substation destabilizes a section of the grid that supplies power at the Stillwater Mine. Stillwater Mine draws large amounts of current to run large motors there to maintain mining operations. These demands rely on voltage stability provided

by Line Creek operations. Thus the mine would be subject to unplanned outages that would interrupt their operations similar to when lights go out in a section of a home if the circuit is interrupted. Unplanned electrical outages at the mine also have significant financial costs in addition to the avoidable energy losses to the power company.

SECTION 2

Current Operations

PPL Montana is in the process of upgrading the oldest section of the T-Line connection (A Line), which is over 80 years old. In 2004 PPL Montana replaced 35 poles, cross members and insulators at a cost of \$150,000. They have planned for similar upgrades to the remaining 77 poles in 2005. In future years they are planning for similar budgeting and unit costs until all poles in the A Line are replaced. Subsequently, the B Line will need similar attention as its age is approaching 70 years. It is PPL Montana's intention to upgrade both the A and B lines to modern condition.

PPL Montana can document the outages that have historically occurred. However, this will be a laborious task as the outages are recorded manually in daily log books and are not available in machine readable or summary form. Efforts continue to locate summary data. Regardless of how many outages have occurred, even one is unacceptable because of the consequences described above. Engineers of the Mystic Lake Project and appurtenant electrical system would not have invested hundreds of thousands of dollars to build, operate, and maintain the extra B line if it was not critical to electrical service and stability.

The current two-line (A & B) system is 5.3 miles long and passes in tandem from the powerhouse to the Line Creek Substation along a route mostly parallel and in line of sight to the access road Figure 1. Near the powerhouse, the lines pass through lodgepole pine forest, each in a 50-foot wide T-Line ROW Corridor. This corridor is actually not sufficiently wide to prevent tree strikes from shorting the electrical lines and causing outages. Previous requests from PPL Montana to widen the ROW corridor to reduce tree impacts have met with reluctance by USFS for environmental reasons (personal communications, PPL Montana).

PPL Montana has considered combining the two lines into a single pole system. Such a system would require higher poles, wider stance and a more complex structure to contain the six wires and static line ground protection and meet both safety and raptor protection standards. PPL Montana electrical engineers estimate this configuration would stand at least ten feet higher than the existing power pole and be more visible because of multiple cross arms. It would require a wider ROW corridor. The cost of such a system would also be considerably higher than the planned investment costs to rehabilitate the existing A and B lines which are already in progress.

PPL Montana understands USFS interest in maintaining a visually pleasing environment and the need to protect fish and wildlife in the area. PPL Montana also must retain reliability according to NERC (North American Electrical Reliability Council cf. www.nerc.org)

standards. It will not be possible to retain that reliability by simply removing either one of the A or B lines. Steve Hocking has indicated FERC will not approve any new design that will compromise reliability; that would include voltage stability as well as interrupting the power supply. From PPL Montana's perspective, to maintain reliability, a single line will cost significantly more than the rehabilitation of the existing A and B lines. A new single line with similar reliability will likely create a larger visual impact due to the larger poles and greater structural stability needed to support the redundant A and B systems. It will require a larger ROW width to ensure reliability from interference with trees.

Thus, PPL Montana believes it is in both the utility's interests and the USFS goals to retain the A and B lines.

SECTION 3

Photos



Figure 1. Mystic Lake Transmission Line near the West Rosebud Road.



Figure 2. Shows the A and B lines.



Figure 3. Line Creek Substation



Figure 4. Another view of the A and B lines.