

Project Title: Unit 5 Upper Bearing Bracket Repair

Dam and Reservoir Project: Little Goose

Estimated Total Costs: Greater than \$3 million but less than \$7 million

Estimated Schedule for Completion of the Project: FY 2021

Current Status as of February 5, 2019: In construction as to previously authorized Hydropower Maintenance Project or Activity expenditures

Summary Little Goose dam and reservoir project's hydropower generating Unit 5 requires significant repairs and replacements to safely place the unit back into service. Unit 5 was taken out of service on April 21, 2017 because several components were in a degraded condition due to excessive vibration, cracking in the upper bearing bracket, and cracking in the rotor spider arms. The first crack in the rotor spider arms was discovered in 2002, and since that time additional cracks have been discovered and have been growing over time. The rotor is the spinning element of the generator and supports the rotor poles, which are magnetized to induce the electric current. The rotor spider refers to the radial structural elements that connect the hub to the rim, where the rotor poles are mounted. The spider supports the weight of the generator and turbine. When the cracks were initially discovered, the Corps placed operational limitations on the unit, and based upon the advice from the Corps' Hydroelectric Design Center (HDC), Unit 5 was operating as the last unit turned on to generate and the first turned off ("last on, first off") operational status, before it was finally taken out of service.

The initial scope of work for this project anticipated that Unit 5 could be returned to service with extensive weld repair, which would be classified as a maintenance project under accounting policies. However, as Phase 2 construction progressed, the Corps identified significant deficiencies in the original design, and several structural modifications or additions were required to upgrade the turbine support structure and address alignment problems, including air-gap and unbalanced magnetic pull. Operating the units with known alignment problems can result in accelerated degradation of the generator's mechanical components as evidenced by vibration and other dynamic (air-gap) measurements. In addition, inspections revealed that the cracks had continued to propagate through the full depth of the weld, and into the base material of the upper bearing bracket flanges. The contractor attempted to excavate these cracks, but found that the cracks continued deeper into the flange material than excavation could address and raising the probability that new cracks would occur. Therefore, the lower hub flange was determined unrepairable and a replacement of the upper bearing bracket is required. Under accounting policies, this type of replacement requires accounting for the project as a capital investment (i.e., it meets capitalization criteria based on accounting policies).

Upgrading the rotor spider arms and upper bearing bracket, replacing the guide bearings, installing vibration monitoring equipment, and fixing failed welds on Unit 5 is necessary for safe dam operations because Unit 5 serves as the backup station service unit for the project. Unit 5 is the only main unit that can provide station service to the project when transmission lines T1 and T2 are de-energized. Therefore, the current absence of backup station service creates substantial risk to the project. Station service is power that is required to operate the electrical components of the dam and reservoir project, including the spillway, some fish passage equipment, the power

drainage system, unwatering pump system, and critical control systems necessary to prevent potential flooding of the powerhouse. Furthermore, Unit 5 is needed for hydropower generation to avoid additional total dissolved gas in the river during high flows throughout spring runoff.