

**Action:** Run-of-River Operation Plan

**Prerequisite Actions:** none

**Action Description:**

Determine any changes needed to maintain and comply with run-of-river operations, especially during low flow conditions.

**Applicable Hydro Projects/Developments:**

Bryson(2601), Dillsboro(2602), Franklin(2603), Mission(2619)

## I. Objective

The objective is to analyze the operation of the run-of-river plants and determine the effectiveness of current control systems to maintain operational reservoir levels and minimum flow requirements.

## II. Basis

- At the run-of-river plants, daily inflows into the reservoir should equal daily outflows from the reservoir. However, due to control system logic, equipment failures, or extreme weather conditions, there may be some variance in a continuous “inflow equal outflow” operation.
- Relates to FERC license Form L-12 Article 6 as to sufficient stream gage equipment.
- Relates to FERC license Form L-12 Article 9 as to amount of water releases.

## III. Geographic and Temporal Scope

Since the water releases are controlled at the dams of each facility, the study areas are at the reservoir and the river area below the dams.

## IV. Approach and Analysis

The run of river plants (Franklin, Bryson, Mission, Dillsboro) have float control systems that have been in place for over fifty years. These systems are used to control reservoir levels by controlling loading on the generators and operation of the spill gates. These float systems have been a dependable means of reservoir control most of the time. There have been times over the years when a float would ‘hang’ or one of the float cam motors would fail and cause the lake level to change drastically.

When using a float system, generator load control is done by an iterative search process. The unit will increase and decrease load in progressively smaller incremental steps until the reservoir level becomes stable. Tainter gate operation is done the same way except the tainter gate operating motors are much larger than the unit load control motors and are much more difficult to fine tune. At each plant there are several float systems. Each unit has its own float control and so does each tainter gate. All these float systems are adjusted relative to each other. For example, unit float controls will cause the units to be at full load before the tainter gate float control operates. There are very few replacement parts for these systems. When something breaks or wears out, a new part has to be made at a machine shop.

Another problem arises during low stream flow conditions. When there is not enough water to run a unit, we shut the unit down and allow the tainter gate float control system to regulate reservoir level. These tainter gate control systems are not sensitive enough for close reservoir level control. At Franklin plant we have seen reservoir fluctuations of 0.2 to 0.3 feet.

It has been decided that these float control systems will be replaced. A programmable logic controller (PLC) will be installed at Franklin, Bryson, and Mission plants. Two pressure transducers will be used to measure reservoir level. The PLC will monitor the signals from the pressure transducers. Through program logic, decisions will be made to either open or close the tainter gates. Reservoir variance of less than 0.1 ft. should be realized on tainter gate operations. After acceptable tainter gate control is established, the PLC will be programmed for unit control. Also, by using a PLC for reservoir level control our minimum flow requirement will be easier to implement during a power failure.

The Franklin plant PLC will maintain the reservoir level at 90.0. This elevation corresponds to a full pond. There are three free flowing or overtopping spillways at Franklin at elevation 90.0. By maintaining reservoir level at 90.0 almost no flow interruption would occur in case of any power failure or loss of gate control. Operation logic is similar at Bryson where the top of the open spillway sections are 135.0. At Mission, the PLC will continue to control the gates since Mission has a backup generator. At all three plants the float control systems will be readjusted to provide backup control in case of a PLC failure.

It is not planned to add a PLC control system at the Dillsboro plant. There are two small generating units at Dillsboro. During low streamflow periods, one or both of the units are shut down, allowing the flow to pass over the twelve feet high dam. We must develop an operating procedure so the operators will know at what flow level to shut down these units.

## **V. Schedules and Required Conditions**

All PLC control systems with the tainter gate control option will be operational by September, 2001. The Franklin plant control is in place now for one tainter gate. This will be upgraded for all three gates by September. Unit control option will be in place at all plants by December 2001.

## **VI. Results**

## VII. Participants

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## VIII. Expected Benefits

Installation of a PLC control system that maintains and complies with run-of-river operations, especially during low flow conditions.