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Harriman Dam is a 217.5 foot high earthen hydropower dam which was built in 1924 and has since been raised three times. Excess inflows to the dam are discharged through a morning glory spillway with an outside diameter of approximately 160 feet transitioning into a 22.5 foot diameter drop shaft and discharge tunnel.

Following recent high flows produced by Hurricane Irene, questions were raised regarding the discharge capacity of the morning glory spillway. Prior to construction, the hydraulic capacity of the spillway design had been evaluated through a theoretical analysis and a series of scale model tests performed at the Alden Hydraulic Laboratory and at a rebuilt crib dam on Sadawga Brook, near the dam site. The scaling and design of morning glory spillways was novel at the time resulting in the 1924 ASCE Journal Article (paper 1551). In the current study, Gomez and Sullivan Engineers performed an updated theoretical analysis of the spillway capacity, including development of a tailwater rating curve for evaluating tailwater impacts on discharge capacity. A detailed three dimensional computation fluid dynamics (CFD) model was also developed by Gomez and Sullivan, for analysis of the spillway capacity, with a peer review performed by Alden Research Laboratory.

Analysis of the Harriman spillway revealed a number of unique characteristics of the hydraulic response. The Harriman spillway was found to transition directly from weir control at the crest to full pipe flow, without an orifice condition occurring in the inlet throat. Additionally, the spillway was found to exhibit sub-atmospheric pressures within the drop shaft under high flow conditions, leading to a siphon-like condition in the spillway.

This presentation will discuss the evolution (1924 to 2017) of the hydraulic analyses of the spillway capacity identifying similarities and differences between the resulting rating curves. One area of focus will be the presence of sub-atmospheric pressures within the drop shaft and the implications on computed capacity. The advantages and disadvantages of physical and computer based models will also be discussed in the context of the study.