Reese Creek Flume Calibration Study

Brian A. Smith, Christopher I. Thornton and Michael D. Robeson
Civil Engineering Department, Colorado State University

Abstract

Reese Creek is located along the northern boundary of Yellowstone National Park and flows into the Yellowstone River downstream of Gardiner, Montana. The United States is party to a complex water rights agreement involving the waters of Reese Creek. An agreement was signed in July 1990 distributing the waters of Reese Creek among four users, including the United States. As part of this agreement, the National Park Service (NPS) is obligated to construct and install water measurement structures at appropriate points along Reese Creek.

One of these structures is a Parshall Flume with a five-foot throat width. NPS hydrologists have since discovered that the computed discharge values for given gage heights within the flume do not agree with manual discharge measurements taken over a range of flows. After a field visit involving Colorado State University, Engineering Research Center staff, it was determined that the flow entering the flume was in a supercritical regime. As Parshall flumes are designed to measure subcritical approach flow, utilizing the published rating equation would provide inaccurate estimates of in-channel flow.

Colorado State University has been contracted to investigate the possibility of determining a calibration equation for a Parshall flume installed in a supercritical flow regime. A three (3) phase research plan has therefore been formulated. Phase 1 provided a review of the available literature in an effort to determine if Parshall flumes had previously been calibrated for supercritical flow regimes. Phase 2 consisted of a series of physical tests at a reduced scale to determine the practicability of calibrating a Parshall flume for supercritical flow regimes and to examine the sensitivity of a calibration to estimations of channel slope and roughness. Phase 3 would encompass full scale testing to provide a verification of the results obtained during Phase 2. Results of the Phase 1 review and Phase 2 testing are presented.