

Optimization of Sangju Weir operations to mitigate sedimentation problems

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Abstract. The Four River Restoration Project (FRRP) in Korea was completed by the Korean Government in 2013. Through this project, eight weirs were constructed along the Nakdong River, which have altered the river regime from a natural environment to post-weir conditions. The construction of the consecutive weirs and excavation along the Nakdong River changed many channel characteristics such as longitudinal slope, cross-sectional area, water stage which led to changes in erosion and sediment transport patterns. It is now necessary to assess the sedimentation problem upstream of the weirs and seek a way to mitigate the problem. Firstly, sedimentation is partly linked to the current weir operation rules. There are multiple purposes, when it comes to reservoir operations, and the various interests include: (1) flood control, (2) dredging, (3) hydropower production, (4) water supply, and (5) environment, including fish passage, recreation, tourism and downstream turbidity. Thus, introducing optimization techniques for reservoir operations is expected to mitigate sedimentation problems for complex multi-purpose weirs. The study site of Sangju Weir has been selected for this study because it is a representative site for these types of problems and because sufficiency and availability of data. The purpose of this research is to:

- (1) estimate incoming sediment yield, define the trap efficiency and estimate the reservoir filling rates using the Flow-Duration and Sediment Rating Curve (FD/SRC) method, along with the new method on the Series Expansion of the Modified Einstein Point Procedure (SEMEPP);
- (2) find the B/C ratio and break-even point between hydropower production revenues and sediment excavation costs using a Benefit and Cost Analysis (BCA);
- (3) suggest new operation rules for Sangju Weir and propose a systematic analysis procedure to find a better operation rules for mitigating sedimentation problems using the Multi-Criterion Decision Analysis (MCDA) method.

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