ENVIRONMENTAL FLOW VARIATION DUE TO MINI-HYDRO DIVERSION AT GURUGODA OYA, SRI LANKA

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ABSTRACT

Quantification of amounts of flows that could be diverted maintaining desired ecosystem conditions is difficult, and thus, water allocation among sectors including the environment, has emerged a growing concern in Sri Lanka. Therefore, this research focused on quantifying optimum flows that has to be maintained below the weir site of a mini-hydro power plant located at Morontota, Sri Lanka through Environmental Flow Assessment and to predict whether the flows of the Hungampola South/Morontota village section of Gurugoda Oya would be sufficient to sustain riverine biodiversity.

The HEC-HMS 3.5 model was calibrated and validated for the Holombuwa catchment of the Gurugoda Oya basin. The GIS layers that were needed as input data for flow simulation were prepared using Arc GIS 10.0 and the calibrated and validated model was applied to the Alapalawela sub catchment located within the Holombuwa catchment, to generate flows for the past twenty three years (1991-2013). Simulated stream flows were characterized using thirty two different hydrological parameters. The Range of Variability Approach (RVA) targets to be maintained below the weir site were calculated using flows before hydropower diversions, and the rate of non-attainment of flows were determined for past scenarios (2011-2013).

According to the RVA, Environmental Flow is not maintained at present in Gurugoda Oya below the weir. Mean rate of non-attainment of the flow of Gurugoda Oya after mini hydropower diversion is around 45% suggesting moderate level of hydrologic alteration due to impoundment. Rate of non-attainment of the indicators of hydrological alterations (IHA) group 1 parameters are in between 33% - 100%. Except for the magnitude and duration of rate of non-attainment of means of 90 day minima and all maxima values which attain a steady 0%, all other group 2 parameters vary between 33% - 67%. In the IHA group 3, timing of lower limit of annual extreme water condition could not be calculated because flow of Gurugoda Oya assumes the same minimal flow for several days, showing more than one annual minima. Annual maxima show a rate of nonattainment of 33%. Rate of non-attainment of the IHA group 4 and 5 both vary between 0% - 100%. Therefore, Hydropower diversions from Gurugoda Oya that deals with damming of the stream needs extensive analysis of environmental impacts due to changes in flow regimes. The RVA targets defined by this study could be of significance for ecosystem management and restorations plans, and could provide ecological operations for the weir.

Key words: Diversion, environmental flow, HEC-HMS, mini hydropower, modeling, Range of Variability Approach