

Hydrological modeling approach to protect biodiversity allowing environmental flows below weirs

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Reconciliation of multiple demands on stream water is yet a challenge. Long term stream flow data are not available in order to make rational decisions on the flows that can be diverted for hydro-power production without harming the downstream ecosystems and biodiversity. A hydrological study was conducted to assess the stream flow at Alupola Oya (N 06° 43.050'; E 080° 34.822') and Wewalkadura oya (Randi Oya) (N 06° 42.212; E 080° 34.697') in Alupola village in Ratnapura District, which are proposed weir sites of a mini hydropower project. A site visit to the project area was made and stream flow measurement was taken using a current meter. Other geographical data needed for model simulations, i.e. maximum and minimum elevation of the catchments, slope, length of the catchment were collected from the topographic sheets of the area. Hydrological data such as long term rainfall data from Alupola raingauge station (for 9 years from 1985-1993) and evaporation data (average monthly data from 1985-1993) were collected from the Natural Resources Management Center of the Department of Agriculture, Peradeniya, etc.

Alupola Oya (Weir 1) originates from Battaturagala mountain at an altitude of 1064 m above mean sea level (msl). Wewalkadura Oya (Weir 2) originates from Alutwelawisahena mountain at an altitude of 1213 m above msl. The catchment area with respect to the weir site 1 and 2 are 3.14 km² and 2.78 km², respectively. The catchments are in the low country wet zone (WL1a). Average annual rainfall in the catchment is 4215 mm and the number of rainy days in a year is 191.

Daily stream flows were computed using HEC-HMS model developed by the US Army Corps of Engineers. Daily stream flows generated covering 9-year period from 1985 to 1993 at the Weir-1 and it showed that mean monthly flow is approximately 1.0 m³/s in all months except in January and February. Highest flows are expected in May, June, September and October. In case of Weir-2, stream flows are more than 1 m³/s in May, June, September, October and November. Dry flows can be expected from January to March.

According to the flow duration curve for the total period of the study, 50% and 75% probability of daily discharges at Weir-1 are 1.2 m³/s and 0.93 m³/s, respectively. In Weir-2, 50% and 75% probability of daily discharges are 0.76 m³/s and 0.57 m³/s, respectively. The 100 % probability of minimum daily discharge in Weir-1 and 2 are 0.19 m³/s and 0.12 m³/s, respectively. These minimum flows have to be allowed at the weir site in order to conserve the biodiversity and make sure that minimum damage is caused to the biodiversity.