



302/C

**Defining sustainable limits to surface water storage development in river basins**

N Eriyagama<sup>1\*</sup>, V Smakhtin<sup>2</sup> and L Udamulla<sup>3</sup>

<sup>1</sup> *International Water Management Institute, P.O. Box 2075, Colombo, Sri Lanka*

<sup>2</sup> *UNU Institute for Water Environment and Health, 204 – 175, Longwood Road South, Hamilton, Ontario, Canada, L8P 0A1*

<sup>3</sup> *Department of Civil Engineering, Open University of Sri Lanka, Nawala, Sri Lanka*

Storage of water is widely regarded as a form of insurance against rainfall variability. Current rainfall variability is expected to exacerbate with anthropogenic climatic changes resulting in increased frequency of floods and droughts. Consequently, storage of water will continue to remain a key intervention in guaranteeing an adequate supply of water as well as detaining excess flood water. Out of the many diverse options available for water storage, historically, the “natural” first choice among water planners and managers has been surface storage development. This is evidenced by the ancient tank irrigation systems that existed in Sri Lanka from around 300 B.C. as well as multiple large dams that were constructed all over the world, during the latter half of the twentieth century. It is likely that impounding surface water will remain a popular choice for managing basin water resources in the immediate future too. However, creation of surface storage generally results in environmental consequences which may endanger the functions of natural river ecosystems, and in turn ecosystem services to humans. A question that has not been well answered yet is, the optimal (sustainable) upper limit (tipping point) to surface water storage development within a basin, which maximizes benefits from storage, and ensures the sustainability of both the benefits as well as the aquatic ecosystems that originally depended on the impounded water. This paper presents a possible approach to identify such a limit by studying the conjunctive behaviour of a set of indicators defining both water resources sustainability and ecological sustainability under different storage capacities and reservoir network configurations. The suggested indicators include, among others, safe yield, hydrologic sustainability, environmental flows and river fragmentation. The aim of the exercise is to identify an optimal suite of options, which maximises reservoir yield, hydrologic sustainability, and environmental flows, while minimising river fragmentation impacts in individual river basins, by studying the conjunctive behaviour of these indicators under different storage capacities and reservoir network configurations.