Assessment of Suspended Sediment Loadings and their Impact on the Environmental Flows of Upper Transboundary Mara River, Kenya

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ABSTRACT

This study set out to determine the levels and constituents of the suspended sediment loading in the upper basin of the transboundary Mara River in Kenya and how they relate to the environmental flow requirements of the basin. Catchment degradation in the Upper Mara Basin is causing increased runoff, erosion, and sedimentation of the limited water resources in the basin. The Mara River is an international river shared by Kenya and Tanzania which forms part of the larger Upper Nile River Basin. The Mara River is one of the perennial rivers replenishing the waters of Lake Victoria. In this study, baseline data were collected at Nyang'ores River and Amala River, the tributaries of Mara River.

The flow and sediment data were collected over a period of six months between February and July 2007. The total suspended sediment load and corresponding turbidity in the water samples were determined in the laboratory. The concentrations of trace metals in dried sediments were identified by their spectral signatures which provide an indication of the energies based on the intensities of the emitted spectral lines. The main findings were that both tributaries had monthly sediment yields that were almost similar. Nyang'ores River and Amala River had mean sediment concentration of 95.16 mg/l and 97.43 mg/l, respectively. This sediment loading is above the allowable standards of 30 mg/l for discharge into the environment in Kenya.

The recorded levels of Iron concentration at Nyang'ores River and at Amala River were above the recommended Kenyan standards of 0.30 mg/l. Trace metals present during dry weather were the same as those present during the wet season but at higher

concentrations. It can be concluded that the increased levels of sediment and metallic pollution in the upper reach could be attributed to poor anthropogenic practices and settlement in forest catchment that resulted in soil erosion, run-off from point sources like rusted metallic articles at the shopping centres, scrap metal dump sites, sludge lagoons upstream and high organic matter in the swamps upstream.

The recommended normal year environmental flow of 1.00-2.00 m3/s in the Mara was easily met and ample water was available for consumptive use. During a drought year the recommended reserve flows were 0.30-1.00 m3/s and the environmental flow requirements were not met in most months except September. The conclusion was that land-use practices in the upper catchment may have sufficiently altered the hydrograph of the river that drought year low flows are unnaturally low.

This study recommends restoration of wetlands in the upper catchment to reinstate environmental flow. Total suspended sediment should be reduced and the water treated before consumption. There is need to stop further deforestation, settlement in the catchment and encourage soil conservation, plant environmentally friendly trees, adequately manage storm water and prohibit destruction of the river banks. There should be regular monitoring of the relationships between flow alteration and ecological response before and during environmental flow management, and refine flow provisions accordingly. There is need for further research on dissolved metal pollutants, climate change and watershed modeling to inform policy decisions, land and water development activities.