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Master of Science in Environmental Science

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An Assessment of Channel Change Effects on Flood Stages in Marikina River, Philippines

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ABSTRACT

The Marikina River has perennially experienced flood and recent extreme flood events exemplified magnitudes which are not only disruptive but destructive as well. While weather events are the main driving force of flood hazards, other changes in the environment influence the magnitude of floods, such as changes in the river morphology. The Marikina River is situated within a watershed that has rapidly changed within the past century, and within the river, structures have encroached, further reducing its capacity to convey flow at some segments. This study aims to assess the effects of constrictions and other morphological changes in the channel to local flood stages in a segment of the Marikina River using scenario-based hydraulic modelling. An integrated bathymetric and LiDAR data was used to create hydraulic and morphodynamic models in HEC-RAS and CAESAR-Lisflood, respectively. The 1-D HEC-RAS hydraulic model was then calibrated, validated, and used as the base model from which scenario models were generated. The 2D CAESAR-Lisflood model, on the other hand, was calibrated for flow and was used to assess possible effects on channel morphodynamics following a sensitivity analysis. Results show that constrictions generally increase flood stages depending on the magnitude of discharge. Recent constrictions could increase maximum flood stage in an event like Tropical Storm Ondoy by as much as 26.21 cm while the removal of existing constrictions on the other hand could decrease stage by as much as 48.86 cm in the same event. In an event like the 2012 enhanced southwest monsoon, recent constrictions could increase the maximum flood stage by as much as 35.30 cm and the removal of constrictions could decrease it by 56.36 cm. Morphodynamic scenario modelling for both flood events also show shifts in depositional areas towards areas where the channel capacity is increased and specific to large scale dredging scenarios, results show dredged areas acting as better sinks to sediments which are expected to eventually fill up. Such results indicate that there is a large benefit in the removal of constrictions as compared with a few widening and excavation options.