Evaluation of pollutants removal efficiency to achieve successful urban river restoration

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ABSTRACT

Greater efforts to provide alternative scenarios are key to successful urban stream restoration planning. In this study, we discuss two different aspects of water quality management schemes, biodegradation and human health, which are incorporated in the restoration project of original, pristine condition of urban stream at the Gwangju (GJ) Stream, Korea. For this study, monthly monitoring of biochemical oxygen demand (BOD_5) and fecal indicator bacteria (FIB) data were obtained from 2003 to 2008 and for 2008, respectively, and these were evaluated to explore pollutant magnitude and variation with respect to space and time window. Ideal scenarios to reduce target pollutants were determined based on their seasonal characteristics and correlations between the concentrations at a water intake and discharge point, where we suggested an increase of environmental flow and wetland as pollutants reduction drawing for BOD_5 and FIB, respectively. The scenarios were separately examined by the Qual2E model and hypothetically (but planned) constructed wetland, respectively. The results revealed that while controlling of the water quality at the intake point guaranteed the lower pollution level of BOD_5 in the GJ Stream, a wetland constructed at the discharge point may be a promising strategy to mitigate mass loads of FIB. Overall, this study suggests that a combination of the two can be plausible scenarios not only to support sustainable urban water resources management, but to enhance a quality of urban stream restoration assignment.

Key words | environmental impacts, river restoration, urban stream, water resources management

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INTRODUCTION

Attempts to understand in detail the physical, chemical, and biological processes in water systems are of great research merits in order to improve public health and flourishing biodiversity. However, recent high-level environmental modifications (e.g., alteration of land cover and stream channel) at or adjacent to rivers or streams often disturbed this effort, while preventing an attempt to reinstate greater harmony with their natural or pre-step conditions. In particular, urban streams are known to be highly vulnerable to these external stresses, representing various degree of urban stream syndrome today (Walsh *et al.* 2005). This was mainly attributed to large mass flux from dense and complex infrastructure in relatively small catchment area (Walsh *et al.* 2005; Nakano & Nakamura 2006), which resulted in chronic ecological degradation problems in the urban streams. One of the remarkable examples at the streams is a dramatic change of hydrograph, followed by an increase of pollutants loads during rainfall event as well as a decrease of water quantity during dry weather season (Paul & Meyer 2001; Sudduth & Meyer 2006).

Studies have been conducted mostly to assess the current condition of the environment (or the ecosystem)

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