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DETERMINING THE EFFECTS OF VARIOUS LAND USES WITHIN MICHIGAN STATE UNIVERSITY'S WATERSHED ON WATER QUALITY IN THE RED CEDAR RIVER

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EXTENDED ABSTRACT

Traditionally, the influence of land use on the quality of surface and subsurface water is evaluated through studies of sub-watersheds or source sheds at the regional scale. These source sheds are typically quite heterogeneous, with wide variability in hydrologic characteristics, in land use activities, in the pollutant loads generated, and in the impacts on water quality. As a result, these large-scale watersheds require the use of broadly averaged hydrologic and chemical loading parameters. Thus, it is difficult to delineate specific cause-and-effect relationships necessary to efficiently achieve specific water quality goals through land-use management strategies. This problem becomes particularly acute in urban and suburban environments because of the very high density and wide diversity of small-scale land uses (e.g., roads, parking lots, buildings, landscaped zones and natural areas).

Working within the Michigan State University Red Cedar River Project (MSU Water http://www.hydra.iwr.msu.edu/msu_ws/) we have developed an approach for understanding how specific land uses affect water quality using the MSU campus as a pilot study area. The foundation of our approach is to understand how water and chemicals are transported throughout the campus land area using a combination of deterministic and stochastic methods. Creating mathematical models of the hydrology present within the MSU campus involves delineating micro-watersheds, defined by topography and the storm sewer collection system, modeling the complex network of storm drains and outfalls, and accurately portraying the physical characteristics of the Red Cedar River (RCR). Once these models adequately describe water flow from the MSU campus and within the RCR, then chemical transport and transformations can be added to fully depict how chemical inputs from different land uses affect water quality.

Initial results of hydrologic dynamics and chemical sampling suggest detailed modeling and intensive sampling are required to accurately characterize this complex watershed. Ultimately, results from this project will aid in current and future land use planning issues, locally and regionally; provide a framework for designing watershed management plans, locally and nationally; and assist regulatory agencies to clarify and prioritize monitoring requirements aimed at improving watershed conditions.

Key words: Urban storm water, land use, modeling, watersheds.