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A CASE STUDY OF WATER QUALITY MODELLING IN URBAN STREAMS

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Urban streams receive more and more wastewater with the population growth, urban migration, industrial development and this results in the decrease of the environmental quality of the aquatic environment at an alarming rate specially in developing counties like Sri Lanka. Thus, maintaining water quality of urban streams to the desired standards is essential for health, bio-diversity preservation etc. through controlling waste water inflows with an understanding of the waste water assimilative capacity of the stream. A water quality model which describes the water quality parameters quantitatively along a stream is therefore an important tool in the planning of stream restoration schemes and also in the assessment of the influence of water quality changes brought by siting a new wastewater source.

The present study has developed a one-dimensional, computational water quality model applicable for un-eutropic streams. The governing equations for the steady, stream water quality model are mass balance equation coupled with single-first order kinetic equation,

$0 = -U\frac{dL}{dx} - KL$, for contaminant (N, P, BOD) concentrations and

$0 = -U\frac{dc}{dx} - K_d L_{BOD} \exp(-K_r \frac{x}{U}) + K_a(c_s - c)$, for dissolved oxygen concentration

Where K_N, K_P, K_{BOD} are decay rates, K_a, K_r, K_d are aeration, total loss and deoxygenating rates. U is the stream velocity, c_s is the saturated DO concentration and x is measured from the upstream.

The model was applied to the Meda-Ela (Mid Canal) which originates from the Kandy Lake and falls into the Mahaweli River at Getambe to assess the influence of alternate restoration proposals. By a field survey, wastewater sources were identified and pollutant loads received by this highly polluted canal along its path of about 4 km were quantified. It receives pollutants directly from restaurants, open markets of vegetables, fish, meat in the town, railway and bus stations, garages, slaughter houses, laundries, industries, treatment plant of the hospital, kitchens, some overflowing septic tanks and indirectly through subsurface migration from many septic tanks at the vicinity of the canal. Inflows were modelled as point sources at 50m intervals. The model predictions was verified with the field measurements of N,P,DO and BOD concentrations along the canal reported elsewhere as at present during dry weather period. The model was then applied to assess the influence of two different restoration proposals on the water quality along the canal: Phase I - direct inflows and 30% of septic tanks are absent and PhaseII - Phase I with another 60% of septic tanks are absent. Predictions show that the canal could be restored to an environmentally acceptable level by Phase I which requires only the community participation and only a little capital investment. Phase II will bring the canal to much better level though it require a considerable capital investment.