DEVELOPMENT OF A DRINKING WATER QUALITY INDEX FOR DRY ZONE OF SRI LANKA: APPLICATION TO KALA-OYA BASIN

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Degree of Master of Science

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Environmental Engineering and Management

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DECLARATION

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Dr. J.M.A. Manatunge

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Dr. B.C.L. Athapattu

ABSTRACT

Water Quality Indices have been developed to assess the suitability of water sources for its intended uses which give the status of water quality in water sources. Over past few decades, deterioration of water sources in Sri Lanka is getting critical. Ground water plays a significant role as a drinking water source in rural communities of dry zone while surface water is not that vital. In such circumstances, feasibility of use of water from traditional village irrigation tanks for drinking is utmost importance. To assess the surface water in dry zone, Drinking Water Quality Index was developed following four steps; (1) Selection of parameters considering their importance to the assessment study and availability of data. (2) Development of sub-indices by converting different units and rangers of water quality measurements for selected parameters into common scale, (3) Assigning weighting to the selected parameters considering their contribution to final index, (4) Aggregation of sub-indices and weightings using aggregation equations producing final index. Drinking Water Quality Index was then applied to Kala-oya basin in order to characterize the spatial and temporal variability of surface water quality in the basin. Kala-oya basin, located in the north-western dry zone of Sri Lanka is irrigational watershed which supplies water to agriculture, recreation and domestic purposes including drinking. Drinking Water Quality Index was calculated from ten physicochemical parameters; pH, Conductivity, Total Dissolved Solids, Turbidity, Hardness, Nitrate, Phosphate, Sulfate, Fluoride, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Coliform and Faecal Coliform periodically measured at 16 sampling sites in three reservoirs in Kala-oya basin; Kalawewa, Dambulu-oya and Bowathenna, from January to December 2014. The results revealed that Drinking Water Quality Index scores varied between 38 to 80 indicating deterioration of water quality. It was observed that surface water samples from 78% of sampling locations were categorized as 'Marginal' water quality. Results of remaining locations showed 'Fair' and 'Poor' water quality. In none of the locations, the score of the DWQI was determined as 'Good' or 'Very Poor'. Water quality analysis done for assessing the level of treatment showed all the locations need advanced water treatment. The Drinking Water Quality Index shows an overall suitability of water bodies for drinking with level of treatments. Proposed Drinking Water Quality Index can be applied for watersheds in other parts of the country.

Key Words: Drinking Water Quality Index, Water Quality, Water Quality Parameters, Kala-oya basin

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LIST OF ABBREVIATIONS

BOD_5	Biochemical Oxygen Demand
CCME WQI	Canadian Council of Ministers of the Environment Water Quality Index
CKDu	Chronic Kidney Disease of unknown etiology
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DWQI	Drinking Water Quality Index
MASL	Mahaweli Authority of Sri Lanka
NSF WQI	National Science Foundation Water Quality Index
OWQI	Oregon Water Quality Index
TDS	Total Dissolved Solids
WHO	World Health Organization
WQI	Water Quality Index
WQIs	Water Quality Indices
SLS	Sri Lankan Standards