The Spatial Model for Water Quality Changes in Upper Stream of the Polgolla Reservoir Catchment

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DECLARATION OF THE CANDIDATE

I do hereby declare that work described in this thesis was carried out by me under the supervision of Prof. (Mr) G.M. Bandaranayake and Mr. Prabath Malavige and report on this thesis has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma.

Date 2016/08/20 .....

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ABBREVIATION

PRC	- Polgolla Reservoir Catchment
GIS	- Geographical Information System
GPS	- Global Portioning System
IDW	- Invers Distance Waited
pH	- Potential of Hydrogen
EC	- Electrical Conductivity
DO	- Dissolved Oxygen
ESRI	- Environmental Systems Research Institute
WHO	- World Health Organization
INWQS	- Interim National Water Quality Standard
IT	- Information Technology
UN	- United Nation
MASL	- Mahaweli Authority of Sri Lanka
EFCD	- Environment and Forest Conservation Division
NWSDB	- National Water Sappy and Drainage Bode
DoM	- Department of Meteorology
DEM	- Digital Elevation Model
TIN	- Triangular Irregular Network
DSD	- Divisional Secretariat Division
GND	- Grama Niladhari Division
WQ	- Water Quality
ICRISAT	- International Crops Research Institute for the Semi-Arid Tropics
BOD	- Biological Oxygen Demand
IOC	- Inorganic Chemical
KY	- Kandy
NE	- Nuwara Eliya

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A Spatial Model for Water Quality Changes in Upper Stream of the Polgolla Reservoir Catchment

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ABSTRACT

Polgolla Reservoir Catchment (PRC) is distributed in the Upper Mahaweli River Basin, Central Province in Sri Lanka. Such catchments in Sri Lanka is being polluted due to various aspects namely, rapid urbanization, higher growth of population, unplanned industrialization, unauthorized, utilization of fertilizer. The main objective of this study was to determine the plausible and complex of water Quality changes in different areas along the main stream of the Polgolla Reservoir Catchment using Geospatial technology. Developing of a Geospatial model to resolve the changes in water of streams using water quality parameters is another objective. The study identified polluted areas in the sub catchments. The study was carried out in the period of January to December 2013. The water quality data (pH, Electrical Conductivity, Dissolved Oxygen, Nitrate, Ammonia, Phosphate, Total Hardness and Total Iron) were collected eleven sites in Upper stream of PRC. The qualitative data collected was analyzed using IDW and weighted overlay tools using Arc GIS model builder.

The spatial variation maps of water quality parameters, Land Use, Population, Rainfall, were prepared using ArcGIS spatial analysis. These maps were weighted overlay through the spatial model, Mada Ela Sub catchment was recoded as high risk water quality changes in the PRC.

Key words- PRC, Water quality, Spatial, Stream, GIS

1. INTRODUCTION

1.1 Background of the study

Water is vital for all known forms of Life. It covers 71% of the Earth's surface. The major source for discard the Garbage in the Worlds is Water Body. In Sri Lanka also can be seen this situation. Mainly there are hundred and three main river basins can be identified around this Island. Mahaweli River is the most influential surface water body in there. That has significantly contributed to shape the economy, society and environment in Sri Lanka. The river basin covers 10,670 Km^2 area and mean annual flow of the Mahaweli River are approximately 8.3 billion m^3 (Gauging records 1950–1977 at Manampitiya). Fresh water has become a scarce commodity due to over exploitation and pollution of water. The possibility of contamination of river water is due to the mixing of toxic chemicals, fertilizers and improper disposal of liquid wastes from the industries. In the absence of appropriate waste management strategies, many human activities and their by-products have the potential to pollute surface and subsurface water. Acute short fall of monsoon rains, poor watershed management, lavish use of water for domestic and agricultural purposes have led to the over exploitation of the surface water sources especially from the river bodies. On the other hand, surface water bodies become the dumping source for industrial effluent and domestic wastes. As a result, the naturally existing dynamic equilibrium among the environmental segments get affected leading to the state of polluted rivers. Hence monitoring of surface water quality has become Indispensable. Surface water quality depends on various parameters such as Potential of Hydrogen (pH), Electrical Conductivity (EC), Dissolved Oxygen (DO), and Total Hardness, Ammonia, Nitrate, Phosphate and Iron.

This study attempts to map the spatial variation of surface water quality parameters in Polgolla Reservoir Catchment of Upper Mahaweli River Basin, Central Province in Sri Lanka Using Geographical Information System (GIS) and Mathematical analysis. GIS is an effective tool for water quality mapping and essential for monitoring the

environmental change detection. The water samples will be collected from 11 Locations in the study Area. The physiochemical parameters are namely pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Total hardness, Ammonia etc.

This study attempts to map the spatial variation of surface water quality parameters in Polgolla Reservoir Catchment of Upper Mahaweli River Basin, Central Province in Sri Lanka. Geographic Information System (GIS) is an effective tool for capture, store, manipulate, analyze, manage, and present all type of spatial or geographical data (ArcGIS, ESRI). In ArcGIS there is a special tool for hydrology analysis and another tools and extension are available for analysis with ArcGIS model. Therefore this tool directly can be used for water quality mapping and essential for monitoring the environmental change detection. Finally Geospatial analysis Methods will be used to assess the existing condition of surface water quality and the contaminated areas identified for further monitoring and management.

1.2. Research Problems

Currently Rapid Population growth, urbanization, industrialization and unplanned land use Pattern are increasing rapidly in Mahaweli river catchment. As a result, various pollutants are reserved to this river. There for, water quality may be changed in the Mahaweli river catchment from time to time. It will help to make various threats in these environs. However several institutes have collected water quality data in the Mahaweli river; although adequate data recording water quality, there is no Proper spatial analysis Models, water quality Databases or Management plans to identify the quality of water in Mahaweli River.

There are many type of software can be identify to solve these type problem. Geographical Information System (GIS) Techniques is most effective and efficiency method to solve spatial water quality changes.