ASSESSMENT OF SURFACE WATER QUALITY VARIATION OF THE CANALS ASSOCIATED WITH PARLIAMENT LAKE, SRI LANKA

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ABSTRACT

Water quality of urban water bodies is critically important because it is one of the most essential resources for human existence and settlement. Water quality of urban water bodies are being changed over the time due to both anthropogenic and natural reasons. Therefore, it has become a needy requirement to identify level and trends of the deterioration of the water quality of the water bodies in the Colombo catchment and this study is focused on the water quality of Parliament Lake and associated two canals. The results of this Study revealed that the water quality of selected canals is in deteriorated condition. The quality of water in most of the areas along these canals are influenced by both point and non-point sources.

***Key words*:** water quality, pollution, urban waterways

1. INTRODUCTION

Clean, safe, and adequate freshwater is vital to the survival of all living organisms and the smooth functioning of ecosystems, communities, and economies. However, the quality of the world's water is increasingly threatened as human population grows, industrial and agricultural activities expand, and as climate, change causes major alterations of the hydrologic cycle. Inferior water quality affects the health of people and ecosystems, reduces the availability of safe water for drinking and other uses, and limits economic productivity and development opportunities [1] .

Likewise, pollution is extensive within the surface water bodies of the Colombo Metropolitan Region of Sri Lanka (CMR). When considered against the standards within the European Union's Water Framework Directive [2], approximately 50% of the drainage network of CMR is represented by water of very bad quality and less than a fifth of the surface drainage system can be considered to be in good ecological status. While there are some signs of localized improvement in water quality since 2014, overall the trend is a steady deterioration over time with an increase in rates of deterioration since 2010 [3]. Moreover, the canal system, which is in and around Colombo-Sri Jayewardenepura area, is in such an environmentally deteriorated condition due to rapid development and urbanization of the area [4].

In this context, it is imperative to assess the variation of water quality of the selected waterways over the past few years to identify the trends of water quality changes in order to develop a proper water quality management strategy.

The objective of the research is to determine the trends in water quality changes of two inlets and outlet of Parliament Lake, and selected two canals over the period of ten years from 2005 to 2014.

2. METHODOLOGY

2.1 Study Area

The study area is confined to two water inlets and outlet of the Parliament Lake and surroundings. The sampling locations were selected with the aim to assess the trend of water quality changes with the time and distance and thereby to identify the potential pollution sources, which affect the water quality of water bodies, mainly the Parliament Lake. In this study, water samples were collected at five locations i.e. Location 1: Kimbulawala Madiwela, Location 2: Battaramulla South-Pelawatte, Location 3: Battaramulla North Diyawanna Oya Outlet, Location 4: Mahawatte Canal, Kotte road bridge Rajagiriya and Location 5: Kirulapone Canal, near Open University Bridge.

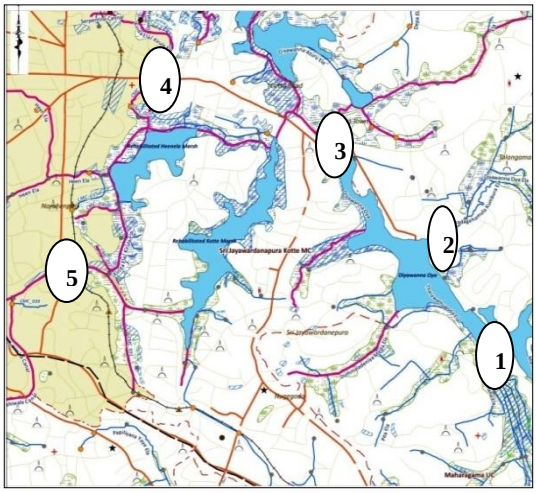

Figure 1: A map of water quality monitoring locations

2.2 Data Collection and Analysis

Data for this study were collected through a comprehensive literature survey, secondary data collection and field visits to the study area. The monthly water quality data for a period of ten years from 2005-2014 available at Sri Lanka Land Reclamation and Development Corporation (SLLRDC) were used for the study. The water quality parameters considered for the study are pH, Turbidity, Electrical Conductivity (EC), Dissolved Oxygen (DO) and Nitrate (V)-N.

Furthermore, monthly rainfall data of Colombo Meteorological Station for the period of 2005-2014 and land-use maps were used in the study. Field visits were made along identified canals and around the Lake in order to identify potential point and non-point pollution sources of the area, which will directly or indirectly impact on the water quality of the canals.

The fluctuation of selected parameters during the period of ten years from 2005-2014 and spatial variation of selected parameters over the ten year period were analyzed using MS Excel and MiniTab packages. The fluctuations of the water quality parameters were compared with the available national water quality guidelines.

3. RESULTS

The results indicated that the mean pH values of Location 1-Location 5 for the period of 2005-2014 are varied from (5.6 - 7.6), (5.5 - 7.5), (5.8 - 7.5), (5.8 - 7.4) and (6.5 - 7.7) respectively as shown in Figure 2.

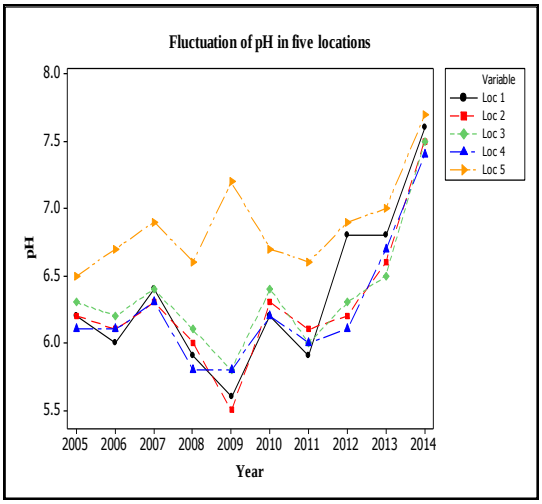

Figure 2: Fluctuation of mean pH in five locations during the period of 2005 - 2014

A decreasing trend of mean pH values of four locations, except Location 5 towards 2009 could be identified. The lowest mean pH value recorded during the study period of 2005-2014 is in 2009 corresponding to Location 2 (pH=5.5). It is noted that in all the locations the mean pH values from 2013 show a significant improvement towards basicity, which makes the water more suitable for aquatic life. Some areas of these canals are covered with floating and submerged aquatic plants like *Eichhornia crassipes*, *Hydrilla* sp. and *Salvinia* sp. and decomposition of these plant materials and organic materials could lower the pH by releasing carbon dioxide into water.

The mean EC values of Location 1-Location 5 for the period of 2005-2014 are varied from (0.15 - 0.27) mS/cm, (0.15 - 0.24) mS/cm, (0.13 - 0.30) mS/cm, (0.25 - 1.08) mS/cm and (0.19 - 0.98) mS/cm respectively (Figure 3).

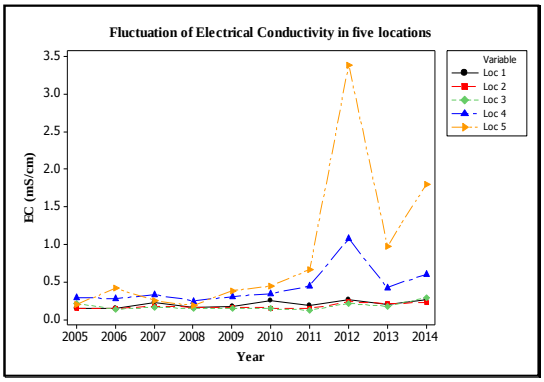

Figure 3: Fluctuation of mean EC in five locations during the period of 2005 - 2014

The mean EC values recorded in the Location 4 and Location 5 for the period of 2005-2014 are comparatively high. In 2012, the highest mean EC value of 3.3 mS/cm was recorded in Location 5. Location 4 is the Mahawatte canal near Kotta road bridge Rajagiriya whereas Location 5 is the Kirulapone Canal near Open University Bridge, which are closer to the sea. As recorded by Bergstrom (2002), EC is a good measure of salinity in water. Therefore, the increment of EC could be due to the salinity intrusion along the Kirulapone canal.

As illustrated in Figure 4, the mean Turbidity values of Location 1 - Location 5 for the period of 2005-2014 are varied from (3.93 - 32.36) NTU, (7.22 - 71.99) NTU, (8.70 - 34.55) NTU, (10.60 - 66.70) NTU and (6.49 - 38.53) NTU respectively.

The turbidity levels of waterways could be increased due to both natural and anthropogenic activities. The turbidity levels could be increased due to rapid development activities, dredging of the lakes and canal rehabilitation and urban runoff in the study area.

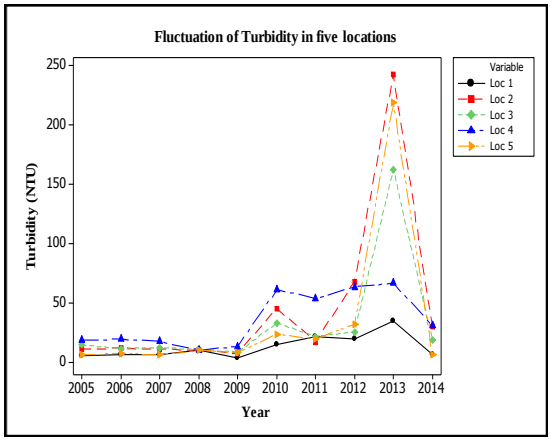

Figure 4: Fluctuation of mean turbidity in five locations during the period of 2005 – 2014

The mean DO levels of Location 1-Location 5 for the period of 2005-2014 are varied from (4.97 - 6.58) mg/l, (2.57 - 5.69) mg/l, (4.37 - 5.58) mg/l, (0.74 - 2.48) mg/l and (3.65 - 5.60) mg/l respectively (Figure 5).

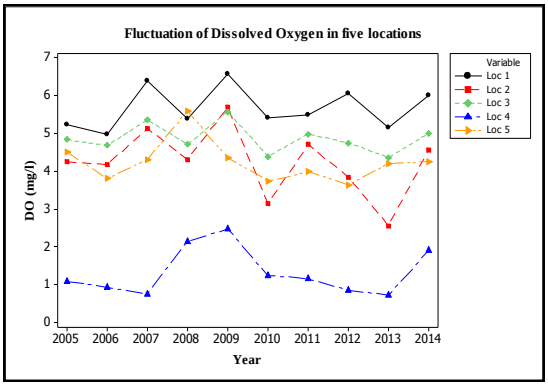

Figure 5: Fluctuation of mean DO in five locations during the period of 2005 - 2014

Except in 2008, 2009 and 2014, the mean DO level of Location 4 has depleted below 3.9 mg/l, which is considered as level under which the organisms are stressed. In addition, in Location 2, the mean DO level has depleted below 3.9 mg/l in 2010, 2012 and 2013. In Location 5, the mean DO level has depleted below 3.9 mg/l in 2006, 2010 and 2012. The mean DO levels in the Location 4 have depleted below 2.0mg/l. The mean DO levels of location 4-Mahawatte canal is comparatively low due to stagnant water in the canal, and higher pollution load add into the canal from households, small scale industries and vehicle service areas along the canal.DO is an important indicator of the water quality and health of the ecosystem. Low DO levels as recorded at Location 4, indicates the necessity to locate the sources of depleting material in the respective sensitive areas of the catchment of these waterways for conservation measures.

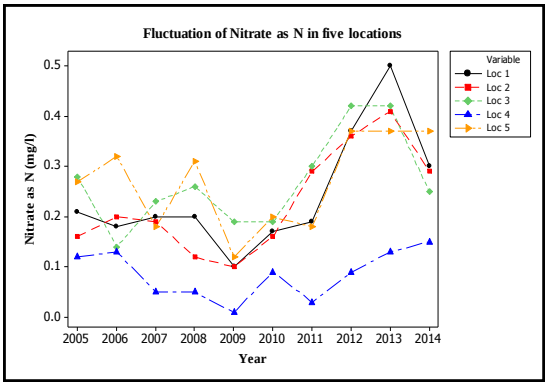

Figure 6: Fluctuation of mean Nitrate (V) - N in five locations during the period of 2005 – 2014

The mean Nitrate (V)-N values of Location 1-Location 5 for the period of 2005-2014 are varied from (0.10 - 0.50) mg/l, (0.10 - 0.41) mg/l, (0.14 - 0.42) mg/l, (0.01 - 0.15) mg/l and

(0.12 - 0.37) mg/l respectively (Figure 6).

Due to surface runoff from respective catchments, large quantities of nutrients could have entered to the inlet canals from catchments thus elevating the Nitrates in the canals and Parliament Lake contributing towards eutrophication. The potential sources of Nitrate pollution in the inlet canals of Parliament Lake (i.e. Location 1 and Location 2) could be fertilizer applications in the neighboring paddy fields, and due to human activities. The drainage systems, which intersect paddy lands, drain into these canals.

4. CONCLUSION

The results of this Study revealed that the water quality of selected canals for the Study i.e two inlets (Location 1: Kimbulawala Madiwela, Location 2: Battaramulla South-Pelawatte) and outlet of Parliament Lake (Location 3: Battaramulla North), Mahawatte canal near Kotte road bridge Rajagiriya (Location 4) and Kirulapone Canal near Open University Bridge (Location 5) are currently in an environmentally deteriorated condition.

Based on the findings of this study it is recommended to conduct further studies on the water quality changes of the waterways in Colombo catchment. Monitoring of all chemical, physical and biological parameters of water quality is important and the impact of changing water quality on the urban natural ecosystems, physical environment as well impact on human should be assessed in order to have proper policy implications.

5. REFERENCES

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