Application of Water Quality Index for Pollution Detection at Luton Hoo Lake

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***Abstract*—This study investigated contamination problems through physical and chemical surface water monitoring. The physical parameters were temperature, conductivity and turbidity while the chemical parameters were dissolved oxygen, pH and ammonium. These parameters were measured at two locations on the lake to monitor the water quality and possible sources of contamination. We evaluated the relationship of the measured parameters to contamination sources and its effect on the water quality. The collected data from the installed multi parameter sensors were analyzed to assess the difference in values at the different sensor locations based on a water quality index.**

Keywords; Water qulity index, sensors, pollution

I. INTRODUCTION

Various environmental effects are fast depleting the quality of fresh water resources, this has triggered the drive for the development of water quality monitoring programs [3, 4]. The monitoring schemes typically employ sensors for monitoring the water quality. However, there is the difficulty in evaluating and qualifying the water quality from this large amount of sensor data usually for different parameters [5].

An efficient way of handling large sensor data is mathematical computational modeling of the river. This requires knowledge of hydrodynamics and hydraulics to create an efficient model that needs an extensive validation. Water quality indices solve this problem by giving decision makers and interested parties relevant information in a summarized form on water quality to help monitor the changes and trends exhibited by the water body [5, 6]. The main aim of water quality indices is to give a single value to the water quality of a source which reduces multiple parameters into a simple and logical expression that easily interprets the monitored data. This has been proposed by so many authors in the water quality monitoring area [1, 2, 3]. Water quality index is one of the most appropriate ways to describe water quality as it considers the suitability of the water sources like lakes, rivers, ground water for human consumption [2].

This paper reviewed previous work done in water quality index (WQI) and examined their calculation methods. We discussed results from our own data analysis using the box plot analysis and WQI using the WQI minimum method.

II. PREVIOUS WORK

Horton (1965) tried to categorize water based on its purity level in United States using 10 water quality variables which are commonly used to assess water quality [1, 2]. This index was widely accepted and applied in countries within the European Union, Africa and Asia [2]. There have been many water quality indices formulated around the world which have been used to effectively judge the overall water quality in different situations [1, 2]. They are mostly based on the comparison of the parameters measured for water quality monitoring and the environmental regulatory standards available. Whilst they may consider the same physical and chemical parameters they differ in the integration and interpretation of the parameters measured [1, 3]. They included: US National Sanitation Foundation Water Quality Index (NSFWQI), Canadian Council of Ministers of Environment Water Quality Index (CCMEWQI) [13], Oregon Water Quality Index (OWQI), Weight Arithmetic water quality index (WAWQI), British Columbia Water Quality Index (BCWQI) [1]

In general, water quality indices depended on the normalization of water quality parameters based on the expected concentrations. These parameters were weighted according to their level of importance to the overall water quality while the index was calculated with regards to the observed weighted average and interpreted on a “good” to “bad” scaling [1, 4]. The parameters were transformed to a scale of 0 – 100 making 100 the best quality attainable by the parameters while 0 was the lowest quality [4].

Water quality index calculation method generally involved following three steps (a) Parameter Selection (b) Determination of Quality Function (Curve) for each parameter considered as the sub-index (c) Sub-indices Aggregation with mathematical expression [2]. Currently there is no universally accepted water quality index and interested parties still make use of the available indices with little modifications [2].

A team of 142 experts in water quality [7] based their WQI on 9 parameters that are - dissolved oxygen, fecal coliform, pH, biochemical oxygen demand, temperature, total phosphate, nitrate, turbidity and total solids. Each parameter was assigned a quality value which was then multiplied by the weighting factor of each parameter with regards to its level of importance. A summation of the weighted values was given as the WQI which showed the quality of the water and the calculation steps were as follows [7]:

1. Assigning of weights Aw_i to the parameters within a range of 1 – 4 which was based on the opinions from the experts with respect to previous research work. A value of 1 indicated the parameter is least significant while value of 4 was seen as the most significant.

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