

Water Quality Assessment for Tracking Water Pollution to Enhance Urban Water Environments in Jakarta and Hanoi

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Abstract. Water environment in the developing Asian cities is facing a serious pollution problem due to rapid population growth and economic development of haphazard urbanization. Water environment is directly affecting human health, social, economic, and urban sustainability. In recent decades, Asian big cities such as Hanoi, Manila, Jakarta, Kathmandu, etc. have been surfed with water pollution. In changing context, water quality modeling is aimed to track pollution for enhancing urban water environment. In this research, we identify the state of water environment conditions in Jakarta and Hanoi. In the future, we will develop a water quality model with the future climate and land use conditions, considering population growth and urban development. The new low carbon technology wastewater treatment plan will be applied to future scenarios to identify improvement of water quality.

Keywords: Water environment, Asia cities, Jakarta, Hanoi.

1. INTRODUCTION

The degradation of the water quality of rivers and other bodies of water ,due to haphazard disposal of wastewater and the associated health and livelihood consequences, have gotten inadequate attention. Wastewater management in Asian cities is limited to collection of wastewater originating from different sources through open and underground sewer lines and disposal of untreated wastewater in the rivers and other surface water bodies. The water bodies have been heavily polluted under urban development and population growth, as well as lack of wastewater treatment. Urban water pollution has broken the water environment for humans and the ecosystem.

By addressing the issue of Asian urban water environments, United Nations University - Institute for the Advanced Study of Sustainability (UNU-IAS) in association with funding from the Ministry of the Environment, Japan has launched the Water and Urban Initiative (WUI) project for enhancing urban water quality in rapidly developing Asian cities. In this research, existing water quality management frameworks and spatial relationships between land uses and urban water quality measured with biological, water chemistry and habitat indicators, will be reviewed in some representative urban watersheds. Initially, the study is planned in Manila, Jakarta, Hanoi and Kathmandu.

The main objective for this research is to take an overview of water environmental states in Jakarta and Hanoi. The result of this study can help better management decision-making to promote the quality of surface waters in the Asian cities.

2. STUDY SITES AND DATA

The purpose of water quality management of the WUI project is to maintain and improve water quality, which requires designation of water usage, establishment of criteria to protect designated uses, and development of water quality management plans. The overall objective of this research program is to enhance urban water quality by identifying drawbacks in existing water quality management frameworks and developing policy tools in developing Asian cities and, also to carry out water quality modeling for alternative urban land use development scenarios that meets both socio-economic and ecological needs.

WUI project aims to analyze existing water quality management frameworks, hydrographic, land-uses and commonly available water quality parameters from various sources to establish impacts on urban water quality. The common water quality parameters include dissolved oxygen (DO), pH, total suspended solids (TS), total dissolved solids (TDS), Nitrogen (NH₃, NO₃ and NO₂), total organic carbon (TOC), hardness, pathogens etc. These water quality variables have been selected from commonly used indicators based on the data availability in

the study areas. In this study, we have collected water quality data 3 times in 10 water sampling stations in Jakarta city (Figure 1).

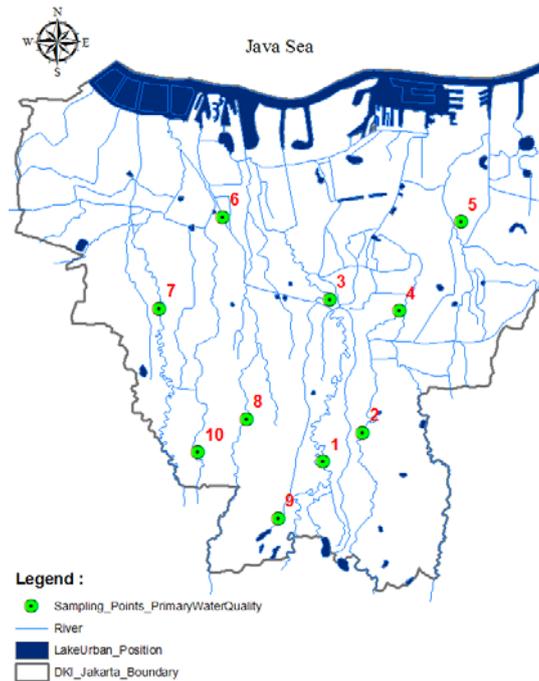


Figure 1 Water quality sampling stations of Jakarta city

3. OVERVIEW OF WATER ENVIRONMENT

With the high increase trend of population, and the rapid urban development, water resources are coming with high pressure in Asian cities. Rivers in Asian cities were fully polluted by the wastewater from domestic, agriculture and industry, due to lack of a wastewater treatment plan. In this section, we present the state of urban water quality in Jakarta and Hanoi.

The water pollution problem is become more and more serious in recent decades due to lake of sewage treatment systems. The urban sewage system only covers 1.9% of Jakarta's population (Douglass, 2010). Most residences depend on on-site sanitation. However, the on-site septic tanks and cesspits are without any sewage treatment system, and directly connected to street drainage, flowing back to the region's water system. Most industries in Jakarta city have no wastewater treatment plants. The major Ciliwung, Sunter and Krukut Rivers in Jakarta have an overall water quality of "poor to very poor" from human settlement waste and industrial pollution (Palupi, et al. 1995). Over 80 percent of groundwater in Jakarta is polluted with pathogenic, disease causing bacteria (Douglass, 2010). Industrial effluents, such as phenol, detergents and nitrate, have also been observed in shallow aquifers (The World Bank, 2003).

In Figure 2, it presents the water quality conditions in Jakarta city. The value of DO in St.4 and St.5 for the 2nd and 3th sampling is almost close to 0. The TDS and TP value in St.4 and St.5 is quite higher than other stations. It means the water quality conditions are heavily polluted. The locations of St.4 and St. 5 are in the central area of Jakarta city. The extremely high value of TN is located in St.10. The DO value in St.8, St.9 and St.10 is also quite low. The whole water quality condition in Jakarta city is quite bad.

With the data on the status quo of water supply and drainage and water quality in Hanoi collected, the research has presented a panorama of the status quo of the water supply and drainage system in inner areas of old Hanoi. In addition, the research has clearly shown sources of pollution and amounts of pollutants which have direct impact on the quality of water and, through a series of data drawn from surveys on rivers, lakes, underground drainage systems, wastewater from hospitals and industrial parks. Some preliminary assessments of the quality of water in inner Hanoi have been given.

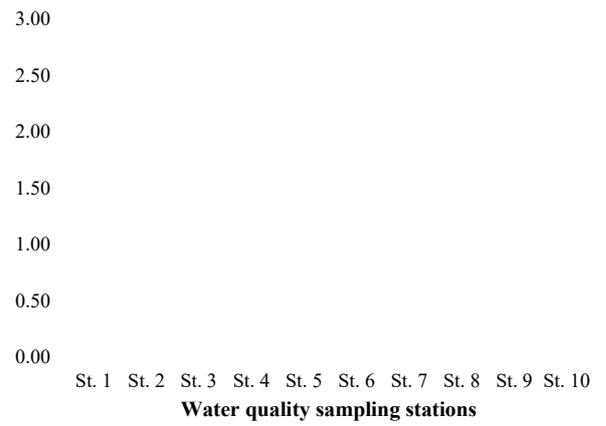
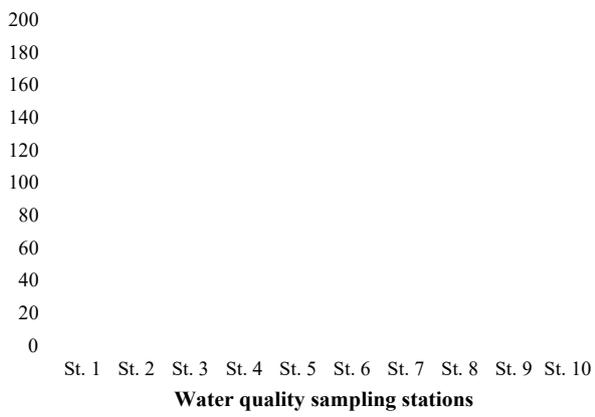
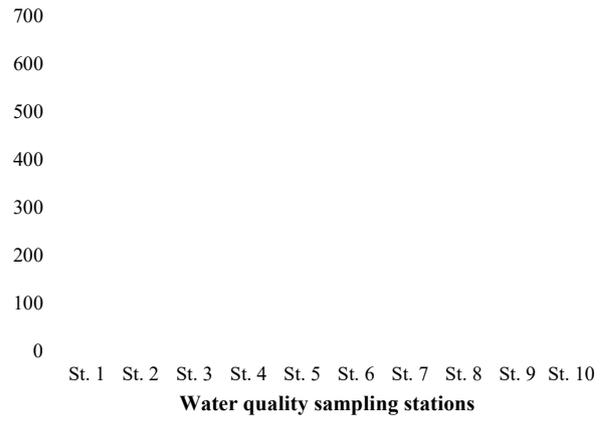
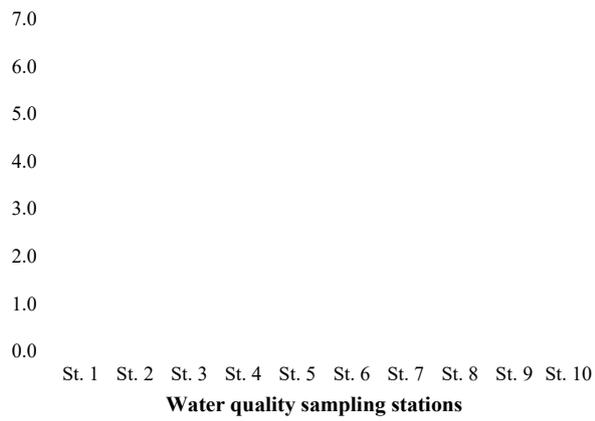


Figure 2 Water quality conditions of DO, TDS, TN and TP in Jakarta city

4. CONCLUSIONS

In this research, we have presented the basic statement of water environment in Jakarta and Hanoi city. The water environment of Jakarta and Hanoi cities has a serious pollution problem due to lack of waste water treatment and drainage systems. The urban water has been polluted due to human activities and industry waste water without treatment processes in Jakarta. The hospital waste water in Hanoi is also one of the important pollution sources to urban water. In the future, we will develop a water quality model to predict future water conditions under urban development.

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