INFLUENCE OF SLUDGE ON WATER QUALITY OF HORI RIVER DUE TO THE TIDAL BEHAVIOUR

○Ugendra REGMI[1], Makoto TAKEDA[2] and Naoki Matsuo[3]
[1]Student member of JSCE, PhD student, Chubu University
[2]Member of JSCE, Associate Professor, Chubu University
[3]Fellow member of JSCE, Professor, Chubu University

1. INTRODUCTION

Urbanization with the rapid development of Nagoya city economy in 1960s had result many problems of river-environment, especially deterioration of water quality in many rivers of Japan. Hori River is one of the examples of that, which flows from north to south part through the downtown of Nagoya city, Japan. This river is the manmade river and it was built for the purpose of transporting goods and materials during the construction of Nagoya castle about 400 years ago. On the other hand, the water quality and the river environment were improved by waste water regulations, sludge dredging, and the construction of sewer systems. However, due to a number of reasons, a radical improvement in water quality has thus far been elusive. For example, the Hori River lacks its own water source (instead relying on wastewater processed by sewage treatment plants), and so the water tends to stagnate. Therefore, there is still strong public demand for further improvements of water quality, foul odors and garbage in the river. The aim of the study is finally to create and restore a sustainable water system of the Hori River for the better inhabitant for fishes and other living organisms and enabling better environment around the Nagoya city. Therefore intensively observation and experiment have been done for the study of impact of sludge on water quality of Hori River around matsusige lock gate areas,

The longitudinal profile of Hori River can be seen in **Fig.1**. Moreover, in the past, Takeda et al (2008)[1)] has also reported the study on the transport characteristics of floating garbage around Matsusige water area resulting in the status of water pollution in Hori River. The combined effects of transport characteristics of float and accumulation of sludge have adversely affected the water quality of Hori River at Matsusige lock gate water area.[2)] Therefore, the uncontrolled deposition of sludge (which are highly influenced during the cycles of tide) have led to its environmental being seriously degrades.

2. MATERIAL AND METHODS

The field study at matsusige Bridge was carried out on 21st December 2010, which corresponded to spring tide. Surface, middle and bottom (0m,1m,2m and 3m) water samples were collected under the matsusige Bridge every 1h from 9 a.m. to 16 p.m. shown in **Fig. 2**. In **Fig. 2**, the blue colour indicates the 24-h tidal cycle of Nagoya port while the red colour indicates the observed tidal cycle.

Samples were dilution in the laboratory due to the influence of sea water. ION-ANALYZER (IA-300, TOA-DKK) was used for the analysis of NO_3-N, NO_2-N, and PO_4-P while TNP-10 (TOA-DKK) meter was used for NH_4-N and TP. Then the inorganic TN can be analysis by the sum of total Nitrate (NO_3-N), Nitrite (NO_2-N) and Ammonia (NH_4-N) concentration, measured in milligrams per liter (mg/l).

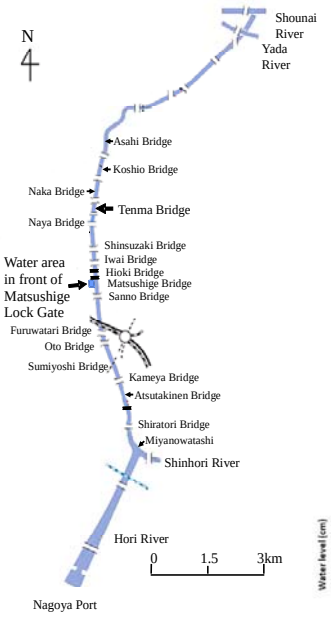

Fig. 1 Longitudinal profile of Hori River

Matsusige lock gate water area

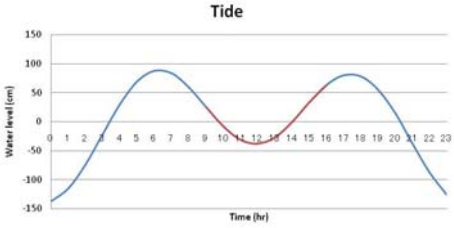

Fig. 2 Tidal cycle of Nagoya port

Key Words: Sludge, water quality, Hori River, spring tide, wave action, sea water
Address: Chubu University, Faculty of Engineering, Matsumoto-cho 1200, Kasugai, Aichi, 487-8501, Japan.

3. RESULTS AND DISCUSSIONS

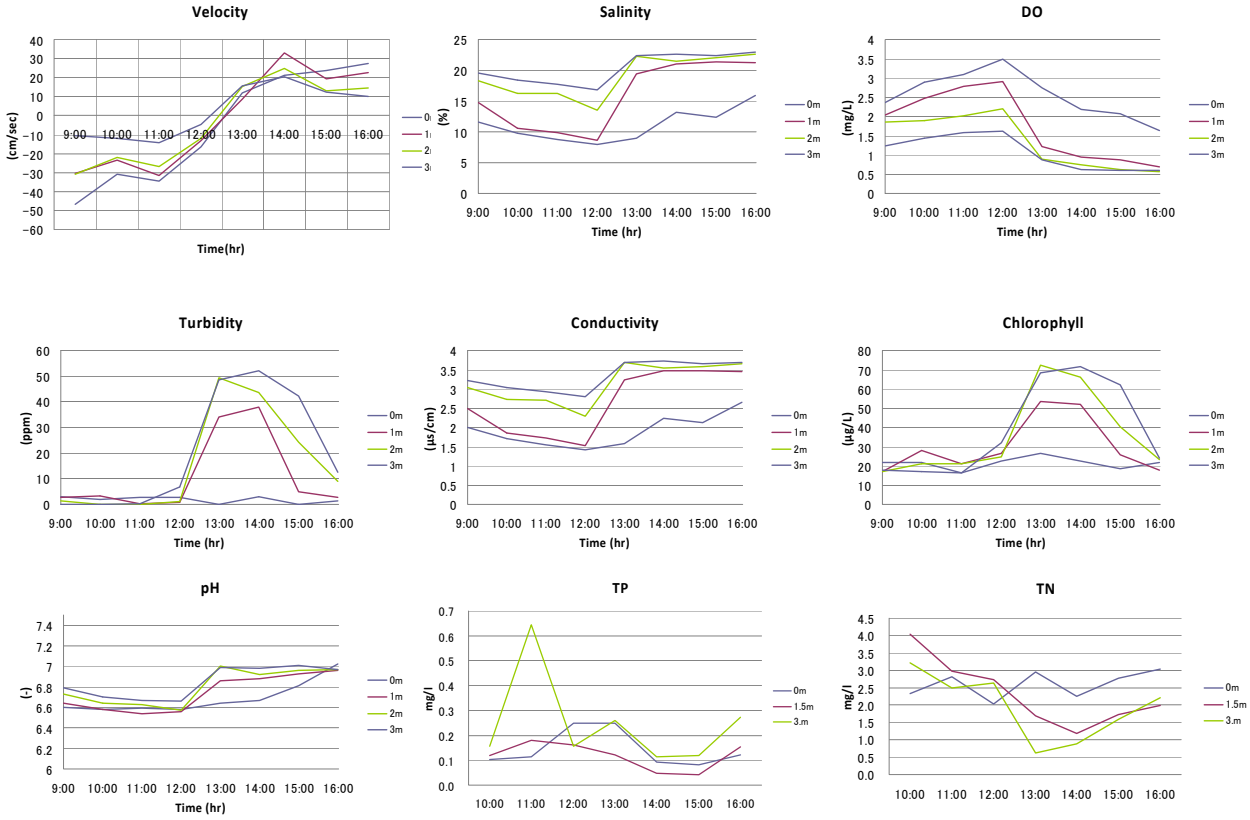

Fig. 3 Distribution of water quality parameters

From the distributions of different parameter of water quality shown in **Fig. 3** at matsusige bridge, we can clearly seen that the parametes are strongly influenced during the ending of low tide and starting of flood tide i.e. in between 12 and 1o`clock. From **Fig. 3**, the middle and bottom layers velocities in the flood tide are higher, causing the sludge exposed for resuspend. Also due to the high seawater intrusion during the flood tide, salinity and pH are high as shown in **Fig. 3**. Turbidity and chlorophyll values were high due to tidal mixing wave action where the bottom sludge was exposed for resuspend. The dissolved oxygen during flood tide was low due to the effect of sea water and high turbid water. On the other hand, the phosphate and nitrogen levels, though not were very high for water pollution.

4. CONCLUSIONS

This study indicated that the water quality of matsusige bridge has highly influenced by sludge as evidenced by physical and chemical characteristics. The cause can be traced to the behaviors of tidal phenomenon as well as the deposition of sludge inside the river. Especially at flood tide, during the high velocity of water, the sludge is back-washed into the river. The extremely high levels of turbidity and low value of dissolved oxygen give an indication of the extent of pollutant introduced into the river. However, total phosphorus and nitrogen has not a negative impact. The implication is that although the sludge has an adverse impact on water quality, this impact can be significantly reduced by applying restoration works e.g. dredging of sludge around the Matsusige water area. These processes are important for living organisms inside the river and water quality for Hori River.

Reference

1) Takeda Makoto and Matsuo Naoki: Study on the transport characteristics of floating garbage in Hori River, Annual Journal of Hydraulic Engineering, JSCE, Vol. 52, pp.1111-1116. 2008

2) Takeda Makoto, Regmi Ugendra and Matsuo Naoki: The relationship between transport characteristics of float and accumulation of sludge in Hori River, Annual Journal of Hydraulic Engineering, JSCE, Vol. 54, pp. 2010