B-DASH: Demonstration of Nutrient Removal with ICT/AI Control of a Single Tank Nitrification/Denitrification Process

(Research of FY 2019-2020)

1. Purpose

This study aims to demonstrate the Nutrient Removal with ICT/AI Control of a Single Tank Nitrification/Denitrification Process
to evaluate its practicability.
The MLIT selected the research for its B-DASH Project in 2019. A joint research team of Metawater Co., Ltd, JS, and Machida city joined the demonstration as an entrusted research of the National Institute for Land and Infrastructure Management (NILIM).

2. Demonstration Technology Overview

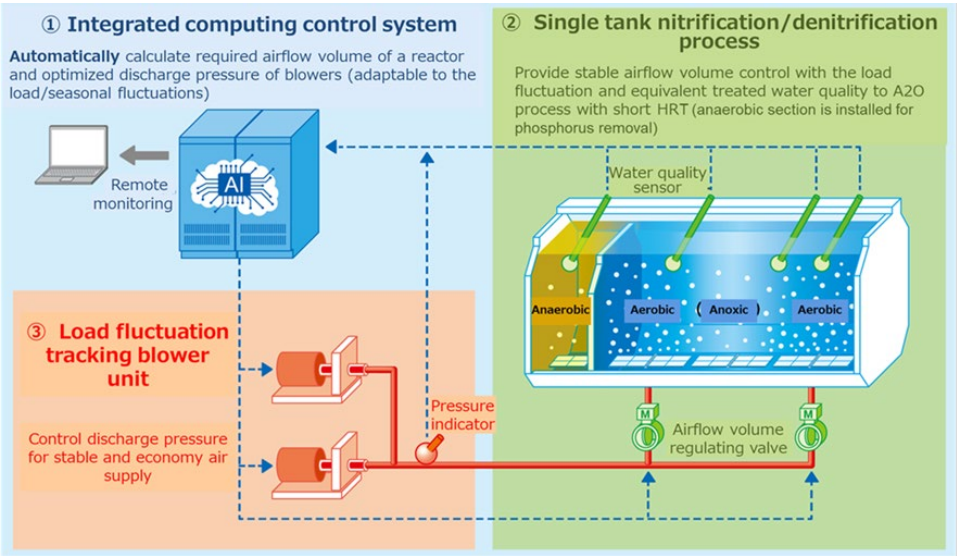

Figure 1. The schematic drawing of the demonstration technology

The demonstration process consists of the following three technologies. ICT and AI can achieve the equivalent treated water quality with shorter HRT than the existing nutrient removal process such as A2O. This process also tries to save power consumption and improve O&M performance (Figure 1).

① Integrated operation control system: The system automatically calculates the required air volume for an aeration tank and optimum exhaust pressure for a blower based on the NOx and NH_4 measuring data.

② Single tank nitrification/denitrification process: Aeration control applied to load fluctuation by the integrated operation control system can create an optimum aerobic/anoxic zone with no bulkhead to achieve equivalent treated water quality to the A2O process with short HRT.

③ Blower unit tracking load fluctuation: The unit supplies required air volume at discharge pressure according to the fluctuation to reduce power consumption for blowing compared to fixed discharge pressure control.

3. Outcomes of This Year

The research group remodeled one train of Naruse WWTP of Machida city as the demonstration facility and started a continuous experiment in January 2020.

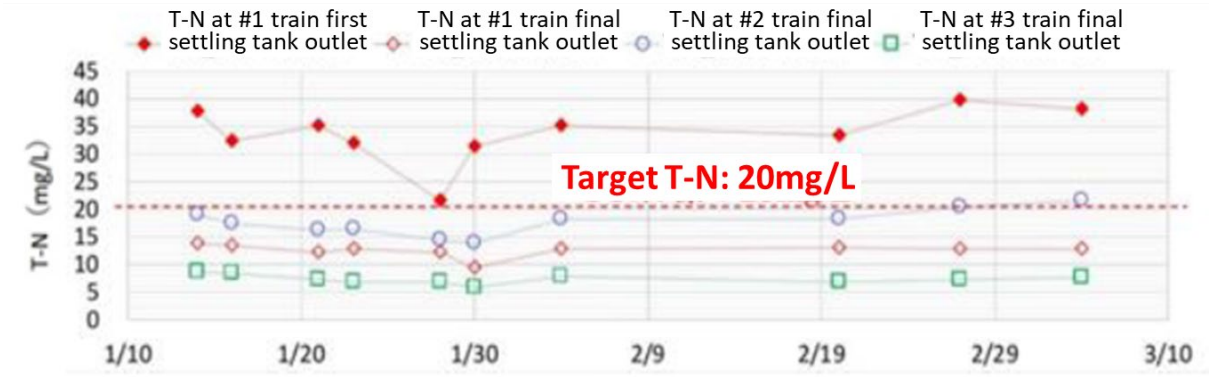

Figure 2. Transition of treated water's T-N concentration

- **Treated water quality**: The target values for treated water of T-BOD, T-N, and T-P are 15mg/L or less, 20mg/L or less, and 3mg/L or less, respectively. Each average daily water quality at the final settling tank exit satisfied the target value. Figure 2 describes the transition of

treated water's T-N concentration. The demonstration process has a 20% shorter HRT of 9.3hr than the A2O process of 12.8hr. In this HRT, the demonstration process had an average nitrogen removal rate of 63.6%, satisfying the target value, equivalent to the A2O process of 60-70%.

- Operational power consumption: The demonstration system targets a 10% or more power consumption reduction rate for the fixed control of discharge pressure. The power consumption of blower per 1Nm3 air volume achieved a reduction rate of 17%. The demonstration system targets a 20% power consumption reduction rate against the A2O process. The operational power consumption per 1m3 treated water achieved a 23% reduction rate, and each power consumption satisfied the target value.

4. Future Issues

The demonstration system achieved all target values of treated water. While nitrogen removal showed a good performance in the whole aeration tank, denitrification volume in the anoxic zone was below the expectation, which indicated denitrification progressed in the aerobic area. The research will continue in 2021 to solve this phenomenon, verify the year-round treatment performance, and evaluate the O&M performance.

Keywords: **ICT, AI, Nitrogen removal, Nitrification/Denitrification**