

# B-DASH: Feasibility Study on the Wastewater Treatment Operations Management Support Technology Using AI

(Research for FY 2018-2019)

## 1. Purpose

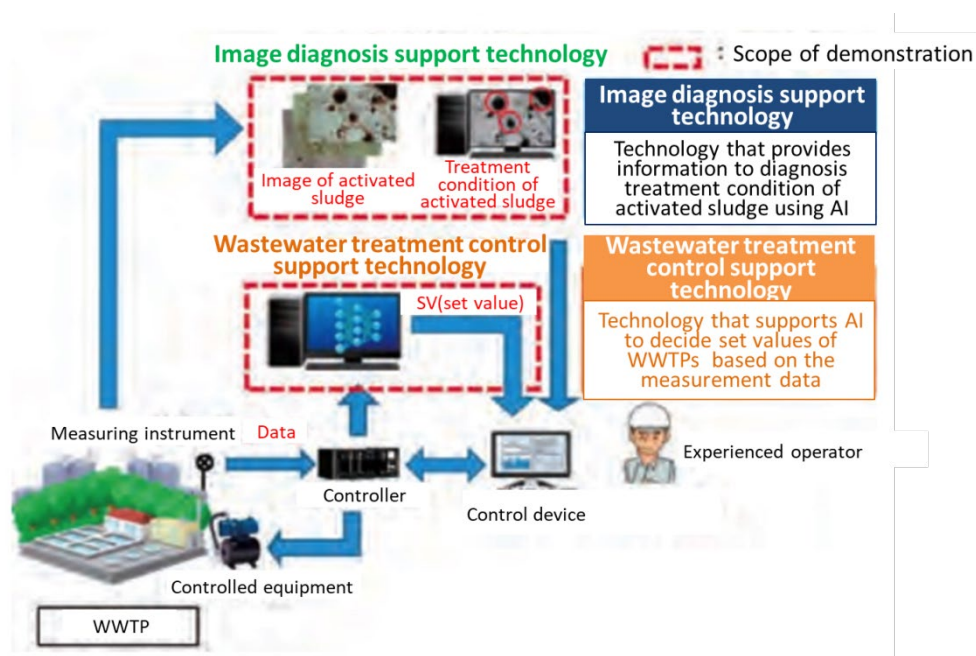


Figure 1. Image of the demonstration technology

This study aims to establish the application manner of the technology using data of the actual WWTP and verify the performance including prediction accuracy and study its applicability into WWTP and popularity.

This research is selected for B-DASH project\*<sup>1</sup> 2018 of MLIT\*<sup>2</sup>. The joint research group of Yaskawa Electric Corporation, Maezawa Industries, Inc., and Japan Sewage Works Agency (JS) conducts the feasibility study as an entrusted research project of NILIM\*<sup>3</sup>.

\*1. B-DASH Project: Breakthrough by Dynamic Approach in Sewage High Technology Project

- \*2. MLIT: Ministry of Land, Infrastructure, Transportation, and Tourism
- \*3. NILIM: National Institute for Land and Infrastructure Management

## 2. Summary of the technology

The technology supports operations management of wastewater treatment facilities by two elemental technologies using AI to enable the efficiency/labor-saving and deal with the shortage of experienced engineers (Figure 1.)

1. Wastewater treatment control support technology: Using random forest, estimate set values of operational conditions including aeration volume, withdraw amount of excess sludge, etc. and give a guidance.
2. Image diagnosis support technology: Using deep learning, make an image recognition of microscope image of activated sludge for identification and measurement of the specific microorganism.

## 3. OUTCOMES OF THIS YEAR

Researchers collected data from actual WWTP for two elemental technologies. After studying their prediction manners (model establishment manners), each prediction accuracy was verified.

- Wastewater treatment control support technology: Established a model that predicts aeration volume and withdraw amount of excess sludge using data measured at a WWTP. As a result, their annual average mean absolute percentage errors (MAPE) were 4.20% and 8.09%, respectively. Both of which satisfied the target value of 10% and less of prediction accuracy. Besides, it became clear that required item numbers for data for learning and conditions of modelization such as numbers of decision trees and numbers of hierarchies need to be individually optimized depending on the prediction subjects.
- Image diagnosis support technology: Researchers verified a recognition manner of micrometazoa, or Rotaria genus from microscope image data. As a result, the technology showed a recognition rate of 90% which satisfies the target value of 80% and more by learning 300 image data.

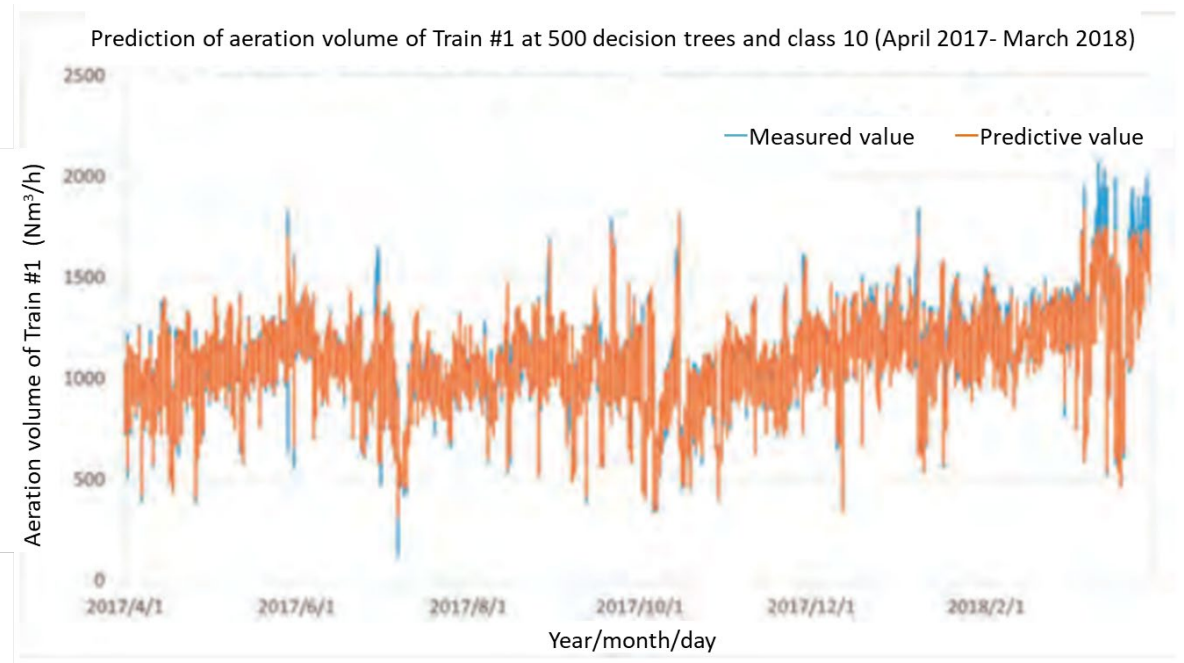


Figure 2. Study result of aeration volume by wastewater treatment control support technology (Comparison between predictive value and measured value in the annual data)

#### 4. Future plan

The study will continue next year to verify the prediction manners and its versatility of the accuracy with expanding target scope such as the numbers of WWTP, kinds of microorganisms to establish of the technology and promote its practical application.

*Keywords: Operations management support, AI, Random forest, Deep learning*