

# Water & Environment



1 Panoramic view of Segami River's tsunami gate (left) and the remote monitoring system at Hitachi District Office (right)

## 1 Remote Monitoring System at Ibaraki Port Hitachi District Office

The Coast Act was amended and the Guidelines for Water Gate and Floodwall Gate Control Systems were established as measures against tsunamis and flood tides after the Great East Japan Earthquake occurred in 2011. And now, automatic closing and remote control of water gates, sluice gates and floodwall gates is being promoted across Japan with alerts from J-ALERT (nationwide instantaneous alert system) and information from seismometer observation as triggers.

Segami River's tsunami gate at the Hitachi Port was the first such gate developed in Ibaraki prefecture. This remote monitoring system consists of water gate equipment, drain pump equipment, power receiving and distribution equipment, emergency power generating equipment, observation equipment, surveillance camera equipment and remote control monitoring equipment. The developed remote monitoring system has the following features:

- (1) When an earthquake of intensity 5-upper or higher on the Japanese scale occurs or an alert for a major or regular tsunami warning is received from J-ALERT, the system automatically closes the water gate and also automatically operates the pump to prevent the water level from rising due to the closure.
- (2) The system uses the camera equipment to perform video-based monitoring to check the safety of the

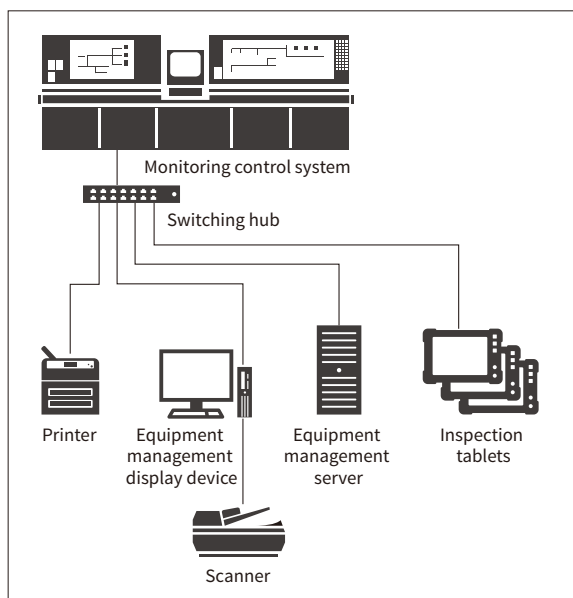
surroundings and make sure that the floodwall gate on the tide embankment is closed. It also uses speakers to alert people. Recently, the control terminals have been decentralized so that the water gate can be controlled, while camera images are viewed.

(3) Its remote control centers have been decentralized into the Hitachi District Office, Hitachi Municipal Office and Hitachi Fire Department. The transmission line system has also been made dual-redundant to improve the reliability by using a wired network as the main channel and a wireless network as the backup channel.

## 2 Equipment Management System at Waterworks Department of the Kashiwa Municipal Office

Waterworks Department of the Kashiwa Municipal Office has five facilities at sources of water supply in the city and provides stable water supply by dividing the city into five blocks for water distribution. The department has introduced an equipment management system to make a board range of management of its waterworks facilities more efficiently.

The equipment management system is used to digitize information about waterworks equipment assets, manage it as an equipment ledger in an integrated manner, associate the maintenance history, including inspections, failures and updates, with the equipment and register such information.



**2** Block diagram of the equipment management system

Recently, the equipment management system has been updated. The main features of the updated system are as follows:

- (1) A web system has been adopted to enable the management of the equipment ledger and inspections without the need to install special software to the equipment management display device.
- (2) Inspection tablet devices are used to support patrol inspections. They enable the display of inspection routes and their searches, the input of inspection results and the display of ledger information. As the tablets can also read two-dimensional codes to allow the user to select inspection locations, they are very convenient devices.
- (3) Since information about the operating time of the main pump is automatically loaded from the monitoring

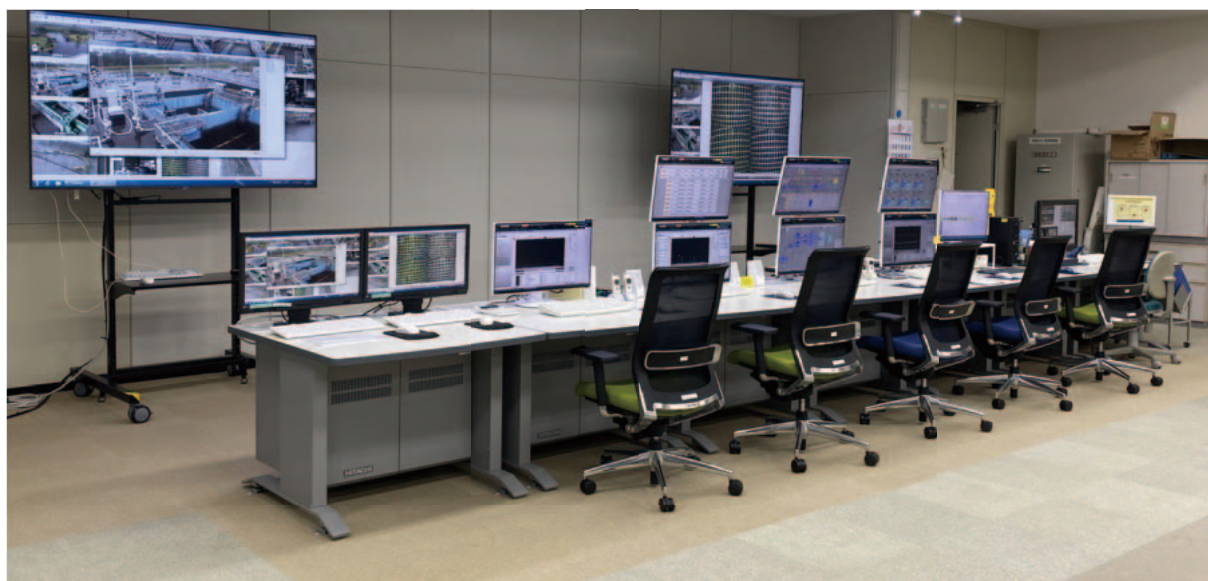
control system, the operating time of each pump can be examined in comparison with other pumps. Notifications are also issued to urge the operator to consider an overhaul or equipment update according to the time elapsed.

### 3 Monitoring Control System at Prefectural Central Second Water Supply Office, the Public Enterprise Bureau of Gunma Prefectural Government

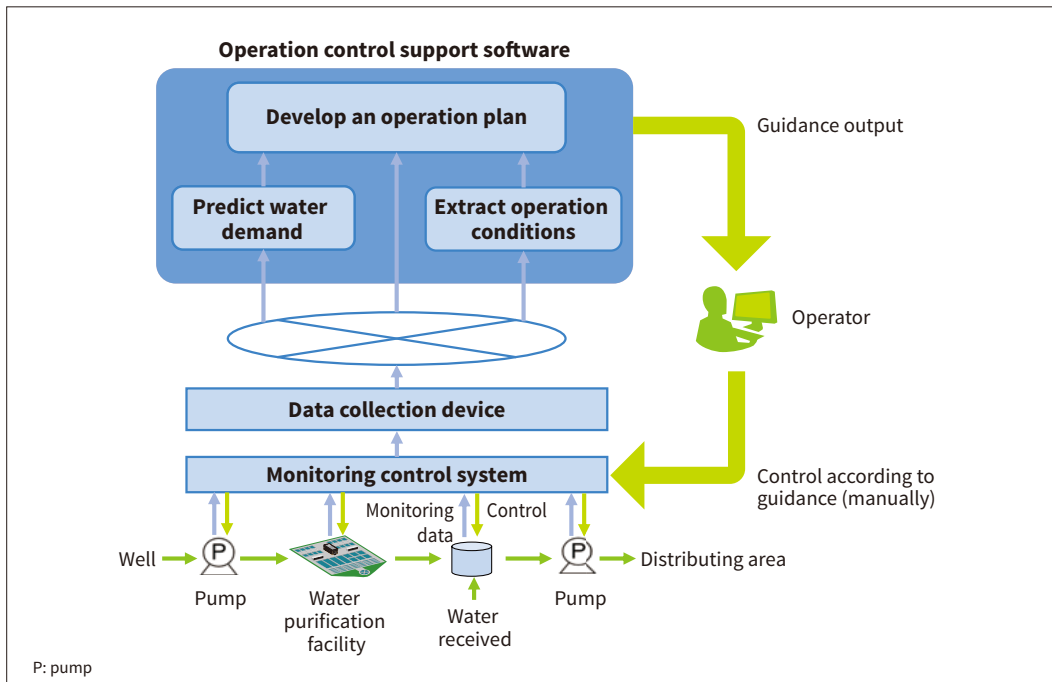
Prefectural Central Second Water Supply Office of Gunma prefectural government uses the surface water of the Tone River as its source of water supply and it came into service in June 1998. Recently, the existing monitoring control system has been overhauled due to its deterioration in order to improve the reliability of the system and make monitoring of its operation more efficient.

The main features of the updated system are as follows:

- (1) A client server method has been adopted to make the server dual-redundant to improve the reliability of the whole system.
- (2) The controller has been made dual-redundant to improve the reliability of the automatic control.
- (3) A touch panel has been introduced to the controller board to enable the monitoring control of the equipment at the work site and improve the maintainability in case of an accident or during inspection.
- (4) A whitelist-based security system has been built to block attacks from unknown malware.



**3** Central monitoring control room in Prefectural Central Second Water Supply Office, the Public Enterprise Bureau of Gunma prefectural government



4 Overview of the pump operation support system at a water purification plant

#### 4 Water Supply and Sewerage Department of Toda Municipal Government: Demonstration of Pump Operation Support Using Expert Know-how

Water and sewer services are facing major issues such as a shortage of expert engineers and effective transfer of their technical know-how to the next generation due to the depopulation. Hitachi Group develops and applies diversified solutions leveraging digitization and artificial intelligence (AI) technologies to solve such issues.

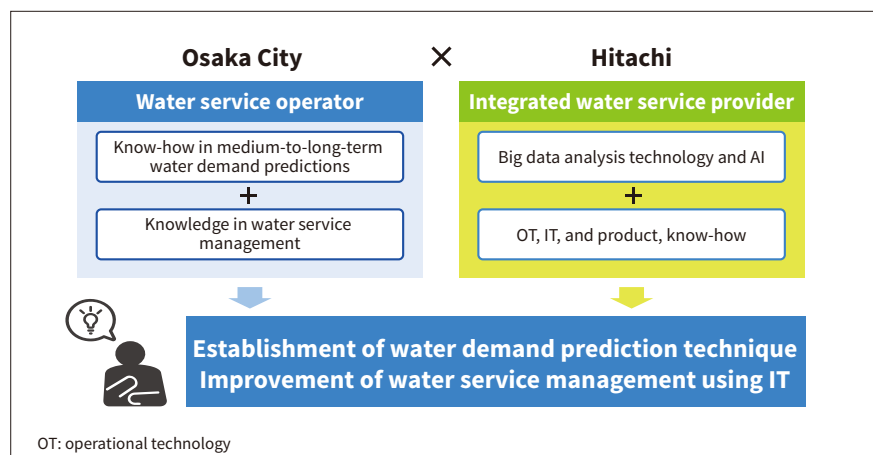
The water distribution system of Toda City provides stable water supply to the entire city from three water purification plants and its pump operation control requires expert skills. In order to enable the pump operation to be controlled appropriately at all times, even when no expert engineer is available, Hitachi has developed a pump operation support system that uses AI to learn past water demand values and experts' operation control data and provides appropriate control guidance at appropriate timings.

Recently, an operator demonstrated the control of the actual system according to its guidance. And the demonstration confirmed

that the water level of each distributing reservoir was maintained at a sufficient accuracy enough to satisfy experts' expectations during the normal operation and water continued to be supplied to the entire city in a stable manner. Hitachi will check the safety of the system under various conditions to achieve its commercial operation.

#### 5 Osaka Municipal Waterworks Bureau: Long-term Water Demand Predictions Based on AI and Big Data

In recent years, it has been difficult for water service providers to predict medium-to-long-term changes in the water demand due to a decline in water usage caused by increasing environmental awareness and lifestyle changes



5 Establishment of a water demand prediction technique in collaborative creation with customers

as well as the impact of the spread of COVID-19 infections on social and economic activities.

To address this issue, Osaka Municipal Waterworks Bureau is striving to improve the accuracy of water demand predictions to achieve stable supply of safe and secure water for the future. The Bureau is also committed to the management that can contribute to future urban development. In this effort, the Bureau with know-how in water demand predictions and Hitachi with experiences and know-how in waterworks systems have collaborated to conduct a joint research on use of big data for water demand predictions and established a new technique for analyzing various data based on AI and big data analytical technologies.

Through a case study conducted based on this technique, the research team successfully examined the water demand for next 20 years or so, which will form the basic information to be used to forecast future profits from the water supply service and consider the scale of waterworks facilities for the future. In addition to the water demand solution, Hitachi is also going to strengthen the development of solutions that will improve the management of waterworks services.

sewage amount that increases during rain, enable stable treatment, reduce the discharge pollution load and make the operation more efficient.

In response, Hitachi are developing technologies for improving the final settling tank performance by combining a tilted plate unit (developed by Hitachi Plant Services Co., Ltd.) that can improve the solid-liquid separation performance with respect to the outflow of sludge from the final settling tank, which is a concern about sewage treatment in rainy weather, through minor modification as the hardware feature, with an operation support system that displays alerts and guidance based on a sludge outflow prediction model as the software feature.

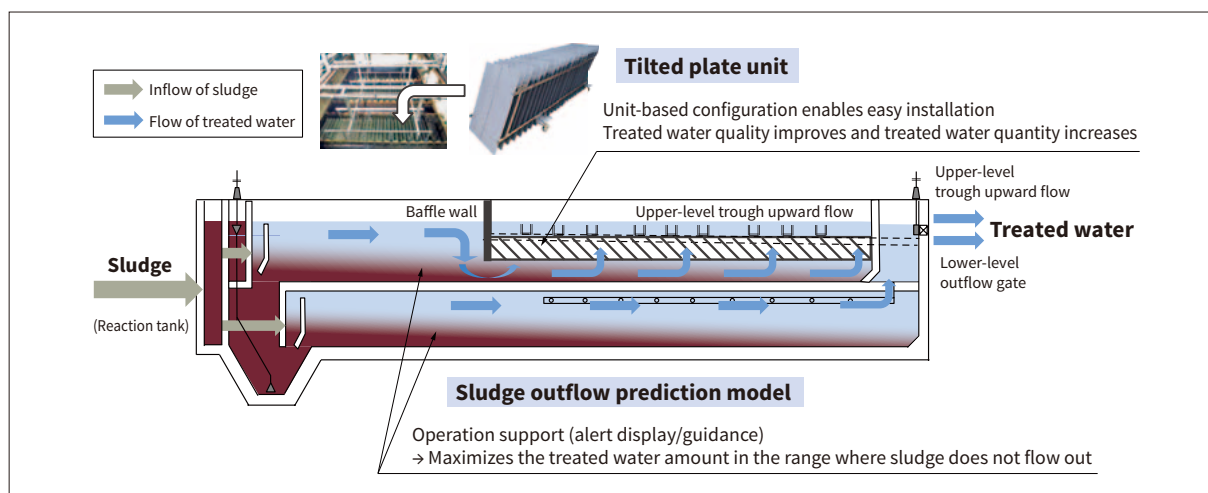
These technologies are being verified in a corporate application-based joint research with Public Works Bureau of Osaka City to assess the quality improvement of the water treated by the tilted plate unit and the feasibility of an operation support system based on a sludge outflow prediction model. The establishment of these technologies will help reduce the discharge pollution load, conserve the environment and make the sewage treatment in rainy weather more efficient.

## 6 Technologies for Improving the Final Settling Tank Performance in Sewage Treatment in Rainy Weather

Due to the recent climate change, which is causing unexpectedly strong rain frequently, for instance, a sewerage plant based on a combined sewerage system, which uses the same culvert to remove rain water and sewage, requires technologies that can respond to the in-flow

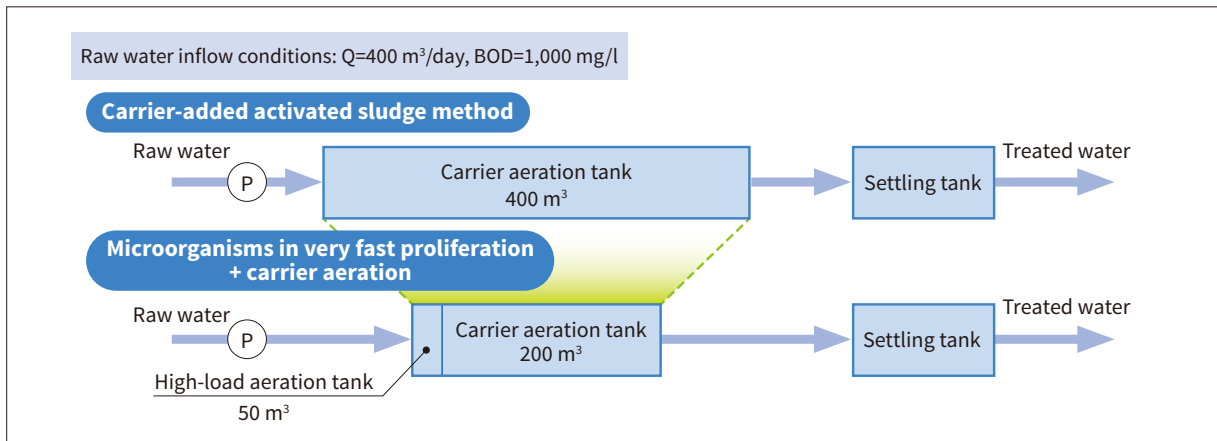
### 7 High-load BOD Drainage Treatment Technology Using Microorganisms in Very Fast Proliferation

As a carrier-added activated sludge method (hereinafter “carrier method”) can respond to a higher design load than the standard activated sludge method, it is an effective treatment method for removing organic matters from industrial drainage. For drainage that has rapid load fluctuation in a short period of time, there are some issues



6 Technologies for improving the final settling tank performance, which help reduce the discharge pollution load and make the operation more efficient





**7 Example of application comparison**

in terms of securing the site by combining a flow control tank, for example. Therefore, a treatment method that can respond to an even higher load is required.

Recently, Hitachi has updated and delivered drainage treatment equipment for a chemical plant with large load fluctuation. As this plant manufactures a large number of product types, the drainage load greatly fluctuates daily. Due to its site limitation for the update, the carrier method alone was not enough to respond to the load. For that reason, a technology based on microorganisms in very fast proliferation is now used and a high-load aeration tank, which demonstrates a high treatment load (about  $3 \text{ kg-BOD}^*/\text{m}^3 \cdot \text{day}$ ), is incorporated into the front part of the carrier aeration tank. This enables

stable treatment against the load fluctuation and can also reduce the required site by 30% (in Hitachi's comparison).

Hitachi is going to apply this technology to drainage conditions that have both high load and large fluctuation to meet the need for treatment stability and space-saving. (Hitachi Plant Services Co., Ltd.)

\* BOD: biochemical oxygen demand

**8 Opening of Center for Environmental Innovation**

In August 2020, Hitachi Plant Services opened the Center for Environmental Innovation as a base for

Item	Overview
Name	Center for Environmental Innovation
Address	2-5-12 Higashisakashita, Itabashi-ku, Tokyo
Site	1,357 m <sup>2</sup>
Total floor space	2,637 m <sup>2</sup> (steel construction of four floors) 〔 1F: 687 m <sup>2</sup> , 2F: 650 m <sup>2</sup> , 3F: 650 m <sup>2</sup> , 4F: 650 m <sup>2</sup> 〕

Center for Environmental Innovation

**8 Overview of Center for Environmental Innovation**

collaborative creation with customers, technology development and analysis. The Center has a biopharmaceutical plant room (equipped with micro-reactor equipment), where the advanced technology leading the pharmaceutical manufacturing sector can be experienced, a biological clean room, which can verify decontamination at a cleanliness level of class 5 to 7 defined by International Organization for Standardization (ISO), an air-conditioned environmental laboratory, where optical tests can be performed in an environment that is controlled at a temperature of the  $\pm 1/1000^{\circ}\text{C}$  level with no fluctuation, and a verification facility for the data center air-conditioning system that is both energy and space saving. The Center also has a verification area for digital construction to achieve more efficient, labor-saving construction sites and enables experiences in virtual reality (VR) contents to share facility plans with customers.

With the Center as the core, Hitachi Plant Services is going to promote the optimal use of air, water, and energy for environmental harmony and the establishment of efficient process technologies. Hitachi Plant Services is also going to use the Center as a place for sharing customers' issues, making efforts in solving them by linking technology and know-how, and creating new values. (Hitachi Plant Services Co., Ltd.)

## 9 Promotion of Circular Economy to Achieve SDGs

Of the Sustainable Development Goals (SDGs) defined by the United Nations, Hitachi Group also focuses on

Goal 12 “Responsible consumption and production” to recycle products and make effective use of resources that are drying up (resource circulation) in terms of corporate social responsibility. The target products include home appliances, IT equipment such as automated teller machines (ATMs) and medical equipment such as magnetic resonance imaging (MRI).

These activities feature the development of schemes and technologies that focus on shifting from the conventional linear economy to circular economy. Hitachi has been promoting the resource circulation of rare-earth magnet, which used to be regarded as difficult, in collaboration with the Ministry of Economy, Trade and Industry (METI), the New Energy and Industrial Technology Development Organization (NEDO) and other organizations.

As these efforts were recognized, Hitachi Industrial Equipment Nakajo Engineering Co., Ltd. and Tokyo Eco Recycle Co., Ltd. jointly received the METI Minister's Prize category of the 3Rs (Reduce, Reuse, and Recycle) Promotion Merit Awards in 2018. And in 2019, Tokyo Eco Recycle, Nichiwa Service, Ltd. and NEOMAX Engineering Co., Ltd. jointly received the METI Minister's Award of the Resources Recirculation Technologies and Systems.

As both waste matters and resource procurement risks are expected to continue to increase due to an increase in the global population and economic expansion, Hitachi is going to promote the circular use of resources.



9 Award ceremony for Award of the Resources Recirculation Technologies and Systems