

## Overview

# Hitachi's Water Infrastructure Solutions and Examples of Collaborative Creation Projects

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## 1. Introduction

Water is one of the most important circulating resources on a global scale and is also a key part of the social infrastructure that is indispensable for sustaining human life. However, the world is faced with various issues such as uneven distribution of water resources, droughts, floods, and water pollution. In Japan, water supply and sewage facilities and pipes are deteriorating with age, the fiscal budgets available for maintaining and managing them are tight, and measures are required for ever more severe disasters. The United Nations has set up “Goal 6: Ensure the availability and sustainable management of water and sanitation for all” in its Sustainable Development Goals (SDGs)<sup>(1)</sup> and has set other water-related targets to be achieved by 2030.

Against this backdrop, the Hitachi Group announced its new Mid-term Management Plan 2024 in April 2022 in which Hitachi will support the planetary boundaries, which protect the Earth and sustains society, and well-being, a society in which each individual is comfortable playing an active role, through Green, Digital, Innovation and Lumada<sup>\*</sup> initiatives. Specifically, Hitachi intends to continue to accelerate and develop its Social Innovation Business to innovate the urban and industrial sectors. This article presents the products, systems, and services (water infrastructure solutions) that support the water infrastructure sector, which plays a key role in this effort.

\* The general term for Hitachi's advanced digital solutions, services, and technologies that utilize advanced digital technologies to create value from data and accelerate digital innovation.

## 2. Trends in the Water Infrastructure Market in Japan and Overseas

The amount of freshwater that people can use for drinking and daily life is thought to be 0.01% of the total water on the Earth, which is unevenly distributed on a global scale, and floods and droughts, which are thought to be the effects of climate change, occur frequently. The Ministry of Economy, Trade and Industry prepared a report on the 10-year review of overseas development measures for the water business and the direction of future development, and published it in March 2021<sup>(2)</sup>. The market size of the water business is expected to exceed JPY110 trillion by 2030, but the market is expanding and diversifying, and the report stated that public-private cooperation and the use of partnerships are needed in order to prepare projects in partner countries.

In Japan, on the other hand, the percentage of the population with access to drinking water will reach 98.1% by the end of FY2020, and the population with access to sewage treatment (sewage system, agricultural community drainage facilities, septic tanks, etc.) will reach 92.1%<sup>(3),(4)</sup>, and at the same time, the market for water supply and sewage facilities is shifting from new construction to updates. However, administrators are facing many issues, such as tight budgets for local governments, fewer available skilled staff, and a drop in water demand due to a shrinking population.

In response, the Ministry of Health, Labour and Welfare (MHLW) presented its New Water Supply Vision in 2013 and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) presented its New Sewerage Vision in 2014. Also, in October 2019, the revised Water Supply Act

came into effect, which includes the implementation of wide-area cooperation in waterworks infrastructure projects, appropriate asset management, public-private partnerships, and the obligation to create a record of waterworks facilities<sup>(5)</sup>. Furthermore, following an organizational review of the MHLW, it was announced that the administration of waterworks infrastructure development and management would be transferred to the MLIT and the Ministry of the Environment in September 2022. This is the first major change in jurisdiction in 65 years, and observers will watch closely for any changes in trends from 2024.

### 3. Overview and Direction of Water Infrastructure Solutions

Hitachi Group has long been working to solve problems in various water infrastructure sectors, including the conservation of water resources, flood control and water use, municipal and industrial water supply, sewage and industrial wastewater treatment, and water production and recycling. It intends to contribute to comprehensive problem solving and overall optimization not only through its individual

**Figure 1 — Main Technologies, Products, Systems, and Services Supporting Water Infrastructure Solutions**

Since there is no single way to resolve water infrastructure issues, Hitachi will contribute to solving these problems by linking various technologies, systems, and services for the conservation of water resources, flood control, and water use, municipal and industrial water supply, sewage and industrial wastewater treatment, and water production and recycling.

Water infrastructure					
	Conservation of water resources, flood control, and water use	Municipal and industrial water supply	Sewage and industrial wastewater	Water production and recycling	
Hitachi's water infrastructure solutions	Public-private partnerships for infrastructure operation (water and sewage O&M, PPP projects, etc.)				
	Planning and engineering (wide-area coordination, support for infrastructure consolidation, etc.)				
	Planning and operations support systems	Operational planning support (water demand predictions, earthquake damage estimation, planning and management of water safety)		Disaster management support	Support for water recycling
		Water quality simulation (flushing out of pollutants, water quality and pollution prediction)		Sewage simulation (flooding and overflows, rainwater inflow prediction, sewage water quality)	
		Water supply quality simulation (quality of intake and treated water, residual chlorine, etc.)			
	Maintenance support systems	Anomaly warnings (use of AI and ART)			
		Management support (equipment inspection, monitoring, and maintenance; crisis management; EAM; portable devices and databases for maintaining equipment records, etc.)			
		Support for skills transfer			
	Monitoring and control systems	Monitoring and management (water level meters using image processing, river flow information)	Water pipe network management (management of network drawings, leak detection, etc.)	Sewage pipe network management (multi-sensing using optic fiber, internal-flood prevention during rainstorms, etc.)	
			Fault diagnosis		
Wide-area operation monitoring and control (centralized management of multiple water purification plants, etc.)			Control of sewage treatment (reduce environmental impact, improve energy efficiency, prevention of overflows during rainstorms, etc.)		
Water treatment processes		Monitoring and control of water treatment (control of flocculant dosage, control of membrane filtering, etc.)			
		Monitoring and control of water distribution (water supply, water distribution, etc.)			
		Membrane-based water treatment systems	Integrated system of seawater desalination and sewage treatment		
Plants and equipment			MBR system		
			Advanced nitrogen treatment process using microbial immobilization	Membrane-based RO system	
	Electrical equipment (monitoring and control, power receiving and transforming, on-site generation, operator controls, instrumentation)				
	Mechanical equipment (advanced water treatment processes, pumps for water conveyance and distribution, pumps for rain and waste water, blowers)				
	Mechanical equipment (sand filter tanks, sedimentation tanks, temporary water treatment, etc.)				

O&M: operation and maintenance PPP: public private partnership AI: artificial intelligence ART: adaptive resonance theory EAM: enterprise asset management  
 MBR: membrane bioreactor RO: reverse osmosis

products and services, but also by proposing water infrastructure solutions that link them all together.

In recent years, digital technology has been increasingly used in the water infrastructure sector, and Hitachi Group has been implementing the use and application of information and control technology in the water infrastructure sector. For example, it continues to provide simulation technology to support planning and management and to provide maintenance, monitoring, and control systems for water treatment facilities and pipes. In the process of proposing various solutions, the digital technology that has been developed in the water sector is increasingly being applied to other infrastructures and vice versa. **Figure 1** shows the main technologies, products, systems, and services that support solution proposals by sector.

## 4. Latest Examples of Hitachi Water Infrastructure Solutions

### 4.1 Recent Initiatives in the Water Supply Sector

Japan’s water utilities are facing a number of challenges, including a shortage of human resources, declining water demand, and fee revenues due to a shrinking population, increasing demand for replacement of aging water supply facilities, a review of plant operations to take into account the effects of climate change, and the need to become carbon neutral. To assist in overcoming these challenges, Hitachi, Ltd. has developed digital transformation (DX) solutions for water utilities (see **Figure 2**). This section presents the digital technologies and public-private solutions for the water operation and maintenance (O&M), water

supply operation support technology using artificial intelligence (AI), and Hitachi Group’s latest initiatives in the maintenance and management of water pipes.

(1) O&M digital technology and solutions based on public-private partnerships

Some measures being used to address the challenges faced by Japan’s water utilities include public-private partnerships and wide-area implementation. One effective way to enhance the operational infrastructure of water and sewage utilities is to provide high-quality services and to reduce costs by leveraging the technical capabilities and expertise of private companies. Hitachi Group is focusing on digital solutions and is working to improve technology at contracted sites, such as the Hakodate City (Hokkaido) design build operation (DBO) project and full-service outsourcing for the Nakagawa Water Purification Plant (Ibaraki Prefecture Public Enterprise Bureau).

(2) Water supply operation support technology using AI

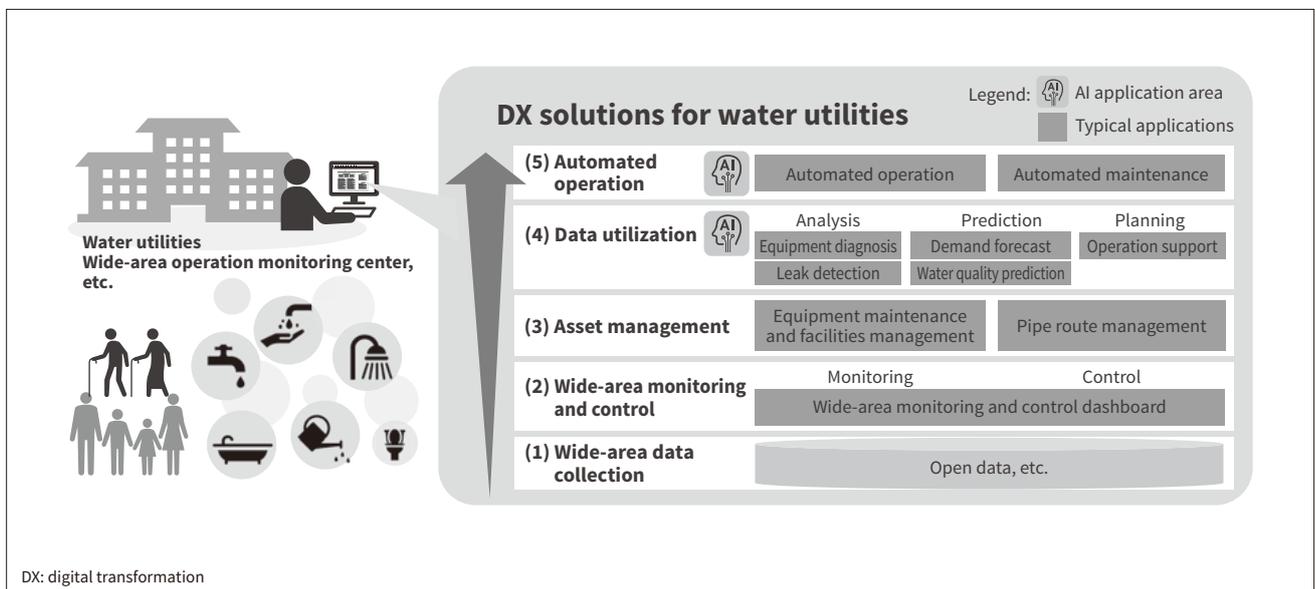
The Water Supply Act, which was revised in 2019, stipulates that water utilities must perform systematic renewal of water supply facilities from a long-term perspective and clarifies the importance of facility consolidation and reallocation. Hitachi Group is working on operation support technology for facilities and equipment and on digital technology that replaces the five senses and experience of operators with the Internet of Things (IoT) and AI, and is conducting joint research with the Osaka City Waterworks Bureau and with the Saitama Prefectural Public Enterprise Bureau.

(3) Maintenance and management of water pipes

Pipes account for about 70% of water supply assets, and this is an area where the management burden on water utilities is high. Hitachi Group’s pipe management support

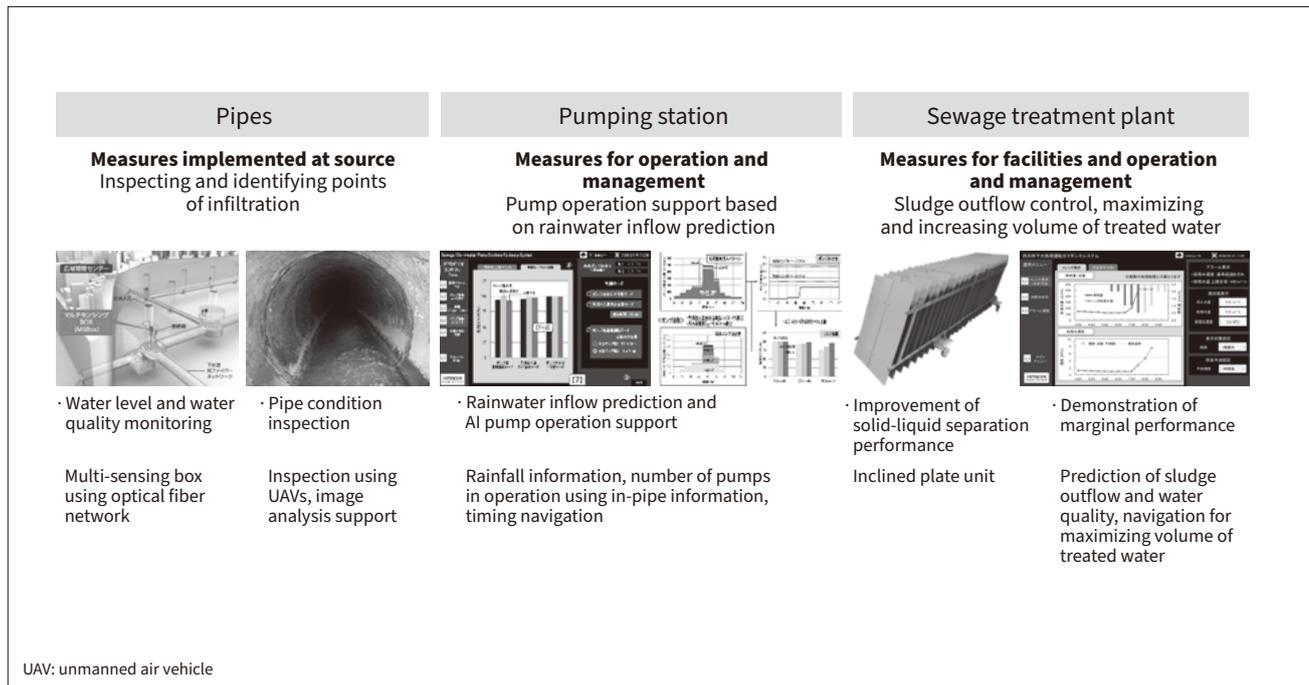
**Figure 2 — Available DX Solutions for Water Utilities**

The system collects operational data (water volume, water level, water quality, etc.) and inspection data from each water purification plant owned by the utility and also shares the solutions with them for enabling wide-area implementation by water utilities.



**Figure 3 — Hitachi’s Rainwater Solutions for Sewage Systems (Including Those under Development and Verification)**

Hitachi provides a wide range of rainwater solutions to reduce rainwater risks in sewers.



service helps water utilities achieve their goals of providing safe and reliable water now and into the future by linking the services and functions they provide for leak detection and pipe update planning.

#### 4.2

### Recent Initiatives in the Sewage Sector

The sewage business, like the water supply business, is facing declining revenues, aging facilities and pipes, and a reduced number of skilled operators. At the same time, the FY2022 revision of the MLIT’s “New Sewerage Vision Acceleration Strategy” sets forth the implementation of decarbonization and water infrastructure management as new points of focus and expresses its commitment to prevent and mitigate disasters by expanding efforts based on DX, asset management, climate change, and other factors. To address these issues, Hitachi Group will present its latest efforts in the maintenance and management of pipes using digital technology and the latest technologies to revolutionize sewage treatment (see **Figure 3**).

#### (1) Maintenance and management of pipes using digital technology

Improving the efficiency of pipe maintenance and management is an issue common to a wide range of utilities. Hitachi Group is working to develop effective solutions for pipe maintenance and management by combining digital technology and products. A sewer pipe inspection solution using unmanned air vehicles (UAVs) is a method that enables safe and efficient inspections without requiring workers to enter pipes, and it is being developed under joint research with the Bureau of Sewerage Tokyo Metropolitan

Government and the Tokyo Metropolitan Sewerage Service Corporation. An optical fiber multi-sensing system is used to enable continuous sensing of the inside of sewer pipes by using the sewer optical fiber as a power source through power-over-fiber (PoF) technology. For pumping stations in combined sewerage systems, Hitachi is developing a rainwater pump operation support system that uses AI to propose appropriate start-up and shutdown plans.

#### (2) Latest technologies revolutionizing sewage treatment

Hitachi Group is working to find solutions to issues in sewage treatment technology from various perspectives based on digital technologies, including the coordination of software and hardware, AI, and sensing. For stormwater solutions at sewage treatment plants, in addition to hardware measures that require only minor modifications, the company is developing an operation support technology that uses software-based modeling and AI from operation management innovations to reduce the discharge load due to simplified treatment. AI sewage treatment support technology is an operation support system that combines human knowledge and AI to achieve energy-saving operation within a range that does not adversely affect water quality, and Hitachi is participating in a joint research project with the Saitama Sewerage Systems Agency for the practical use of AI sewage treatment and is currently verifying the effectiveness of the system. In the area of sludge treatment operation support technology, Hitachi is developing a solution to optimize the dewatering process and reduce sludge disposal costs by using AI image analysis and operational guidance based on new sensors.

## 4.3

## Other Recent Initiatives

Hitachi Group is also proposing a variety of solutions in business areas surrounding water infrastructure. For example, port terminals in Japan and overseas, which are social infrastructure that have an impact on trade and economic activities and serve as a nexus for marine and land transport, face a variety of issues, and the company is working to upgrade their functions to resolve these issues.

Furthermore, the transition to a sustainable society, including decarbonization, water resource use, and resource recycling, requires the cooperation and collaboration of stakeholders across industries, including technology, operation, certification, and financial support. Hitachi Group has begun to build a trust-based platform concept that links these stakeholders.

## 5. Conclusions

This article presents various trends related to water infrastructure, an overview of the Hitachi Group's water infrastructure solutions, and recent examples of collaborative creation projects. The company will work together to solve the various issues faced by its customers by adding the latest digital technology to the technologies, products, systems, and services that it has developed over many years. Hitachi is committed to continue contributing to a sound water infrastructure in Japan and overseas and to attaining the SDGs.

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