

Improvement of Water Purification Facilities

Planning of projects

Water intake, purification, and distribution facilities in Osaka City have been brought up to certain standards of facility safety and reliability through nine water works expansion projects that have been implemented since the establishment of waterworks and four projects for improvement of water purification facilities that have been promoted since fiscal 1979. In line with the advancement of these facility improvement projects, measures for the earthquake resistance of waterworks has also been effectively implemented.

The Second Water Purification Facility Improvement Project, which began in 1992, was aimed at revitalizing water purification plants through the introduction of an advanced water purification system to supply safer and higher-quality water as part of the efforts to contribute to the realization of a society in which people can enjoy a rich lifestyle. At the same time, the Project improved the comprehensive standards of water intake, purification, and distribution plants to serve as a core lifeline toward the 21st Century.

After the Great Hanshin-Awaji Earthquake, Osaka City examined the state of waterworks facilities from the perspective of earthquake resistance and formulated the Osaka City Waterworks and Earthquake-resistance Measures Reinforcement Plan 21 (Basic Concept) in March 1996 as Osaka's basic long-term concept to be promoted with sights set on the 21st century. And the City was faced with the urgent task of implementing earthquake countermeasures based on the Plan.

Thus, the City reviewed the Second Water Purification Facility Improvement Project and launched the Third Water Purification Facility Improvement Project for ten years from 1997 to 2006 to expand and reinforce earthquake resistance measures with a total project budget of 97 billion yen.

In the third and fourth Water Purification Facility Improvement Projects, the City, while continuing to implement the basic measures of the Second Water Purification Facility Improvement Project, worked to establish a highly reliable water supply system by implementing various earthquake-related measures from a long-term and strategic point of view, such as reinforcing earthquake resistance of key facilities, improving water supply and distribution bases through the enhancement, etc., of water distribution plants, and enhancing measures against power failures, in line with the principles of the Osaka City Waterworks and Earthquake-resistance Measures Reinforcement Plan 21 (Basic Concept) and the Osaka City Waterworks Grand Design.

However, the environment surrounding the water supply business has been increasingly severe. While demand for water has been declining, it is urgently necessary to implement measures against a great Nankai Trough earthquake and other disasters. Fundamental measures are also required to respond to the declining population, abnormalities in water quality that require renewed action, and a rise in needs for technological support from other municipalities.

The New Water Supply Vision compiled by the Ministry of Health, Labour and Welfare in March 2013 shows an ideal image of water supply focusing on three viewpoints: "resilience" to ensure a stable supply of water through earthquake-proofing, etc. of facilities, "safety" to ensure safety of tap water through enhancing the water purification/treatment and water quality management technologies, and "sustainability" to ensure a sustainable supply system through strict asset management, etc.

In view of these challenges and the vision of the national government, Osaka City launched in fiscal 2018 the Water Purification and Distribution Facilities Enhancement Plan, a 10-year project with a total budget of 70 billion yen. The Plan focuses on the water supply infrastructure and is aimed at enhancing the target facilities determined through selection and concentration.

■ Figure: Earthquake-proofing of Toyono Purification Plant (coagulation and sedimentation basin)



Project details (Water Purification and Distribution Facilities Enhancement Plan)

(1) Enhancing resilience of key facilities

Promote measures against power failures by reinforcing earthquake-resistance of purification plants and other key facilities along with the installation of in-house power generation systems for the facilities. Also install the system connecting pipes in order to facilitate the mutual water supply, with a view to enhancing the water conveyance and distribution networks.

(2) Enhancing the system to supply safe and high-quality water

Implement facility improvement measures that can contribute to the enhancement of monitoring capabilities, such as the installation of granular active carbon injection equipment or other improved water treatment equipment in preparation for water source water quality accidents, etc., and the advancement of the purification and distribution management systems.

(3) Maintaining and improving facility functions

From the perspective of asset management, properly identify the state of each piece of equipment and set the appropriate renewal cycle for each piece of equipment, thereby implementing efficient updating and maintenance. At the same time, promote initiatives to make the facilities friendly to the global environment, such as the introduction of rotation speed control equipment capable of reducing power consumption by controlling pump operation and small hydroelectric power equipment capable of making effective use of water pressure energy in distribution pipes.

■ Figure: Granular active carbon injection equipment (Kuzuha Water Intake Facility)



■ Figure: Hydroelectric power generation system (Nagai Distribution Plant)



History of water purification facility improvement projects

Project Item	First Water Purification Facility Improvement Project	Second Water Purification Facility Improvement Project	Third Water Purification Facility Improvement Project	Fourth Water Purification Facility Improvement Project	Water Purification and Distribution Facilities Enhancement Plan
Business year	1979 - 1991	1992 - 1996	1997 - 2006	2007 - 2017	2018 - 2027
Project cost	32.3 billion yen	34.4 billion yen	76.1 billion yen	49.4 billion yen	70.0 billion yen
Project contents	<ul style="list-style-type: none"> Measures for aging and deteriorating facilities Measures to modernize facilities Disaster and security measures Measures for monitoring of water quality <p>By promoting the above measures, ensure the safety and reliability of water purification and distribution plants and facilities as a whole.</p>	<ul style="list-style-type: none"> Planned renewal of aging equipment Reinforcing backup functions for an emergency Introducing advanced water purification management systems Improving water purification facilities Reinforcing water quality monitoring systems <p>By promoting the above basic measures, and in relation to the reform of the water purification and treatment systems associated with the introduction of the advanced water treatment system, improve and stabilize the entire water intake, purification and distribution systems toward the next generation.</p>	<p>To establish highly reliable water intake, purification, and distribution systems by improving the facility standards through expanding and enhancing earthquake-proofing measures, while continuing to follow the principles of the Second Water Purification Facility Improvement Project</p> <ul style="list-style-type: none"> Planned renewal of aging equipment Reinforcement of the earthquake resistance of key facilities Reinforcing backup functions, along with the ensuring of water supply and distribution bases Introducing advanced water purification and distribution management systems Modernization of water purification facilities Reinforcement of water quality monitoring systems 	<p>In line with the principles of the Osaka City Waterworks Grand Design, develop medium-to-long-term scenarios, taking into consideration various reform factors, and implement efficient renewal and earthquake resistance reinforcement of water purification facilities by employing waterworks asset management that takes advantage of the characteristics of multiple systematization. Also, effectively reinforce system functions by introducing cutting-edge technologies in view of the next-generation waterworks systems, and establish highly reliable water purification and distribution systems that will achieve goals such as low-cost risk management.</p> <ul style="list-style-type: none"> Reform and improvement of aging facilities based on asset management Reinforcement of the earthquake resistance of key facilities Expansion and reinforcement of life-spot functions Establishing next-generation water purification and distribution management systems Sophistication of water purification and water quality management 	<p>Keeping in mind "resilience," "safety" and "sustainability," the principles of the New Water Supply Vision, enhance the infrastructure of waterworks business.</p> <ul style="list-style-type: none"> Enhancing resilience of key facilities Enhancing the system to supply safe and high-quality water Maintaining and improving facility functions
Project effects	<ul style="list-style-type: none"> Water purification and distribution reservoirs (43,000 m³) secured [2.43 million m³/day base] Sufficient for 5.4 hours → 1.8 hours Reinforcement of earthquake resistance of water distribution reservoirs [Otemae, Sumiyoshi] Doubling of power-receiving lines [Sumiyoshi, Sanadayama] Construction of new water pumping station No. 1 Installation of rotation speed control equipment [Kunijima Distribution Plant 3, Joto, Oyodo, Tatsumi] Renewal and improvement of aging electrical and mechanical equipment Installation of remote water quality monitoring device 	<ul style="list-style-type: none"> Water purification and distribution reservoirs (105,000 m³) secured [2.43 million m³/day base] Sufficient for 5.8 hours → 6.8 hours Sophistication of management systems [Kunijima, Niwakubo, Toyono] Introduction of sodium hypochlorite [Toyono] Modernization of water purification facilities associated with introduction of advanced water treatment Renewal and improvement of aging electrical and mechanical equipment 	<ul style="list-style-type: none"> Water purification and distribution reservoirs (75,000 m³) secured [2.43 million m³/day base] Sufficient for 6.8 hours → 7.6 hours Installation of in-house generator for facility operation [5 purification and distribution plants] Earthquake-proofing of water purification facilities [7 control towers and pumping stations] Introduction of advanced water distribution management systems [Otemae, Sanadayama, Sumiyoshi, Suminoe] Renewal and improvement of aging electrical and mechanical equipment Installation of additional remote water quality monitoring devices 	<ul style="list-style-type: none"> Reinforcement of the earthquake resistance of key facilities [Niwakubo No. 1 system purification facilities (Earthquake-proofing rate: 0.0% → 9.9%) Earthquake-proofing of buildings (pumping stations, etc.)] Water purification and distribution reservoirs (24,000 m³) secured [2.43 million m³/day base] Sufficient for 7.6 hours → 7.8 hours Installation of in-house generator for facility operation [4 distribution plants] Integration and sophistication of water purification and distribution management systems Shift to a distributed chlorine injection system Renewal and improvement of aging electrical and mechanical equipment 	<ul style="list-style-type: none"> Securing the water treatment capacity for the great Nankai Trough earthquake [FY2017: 0.24 million m³/day] [FY2027: 1.09 million m³/day] Water treatment capacity by in-house power generator [FY2017: 0 m³/day] [FY2027: 1.09 million m³/day]