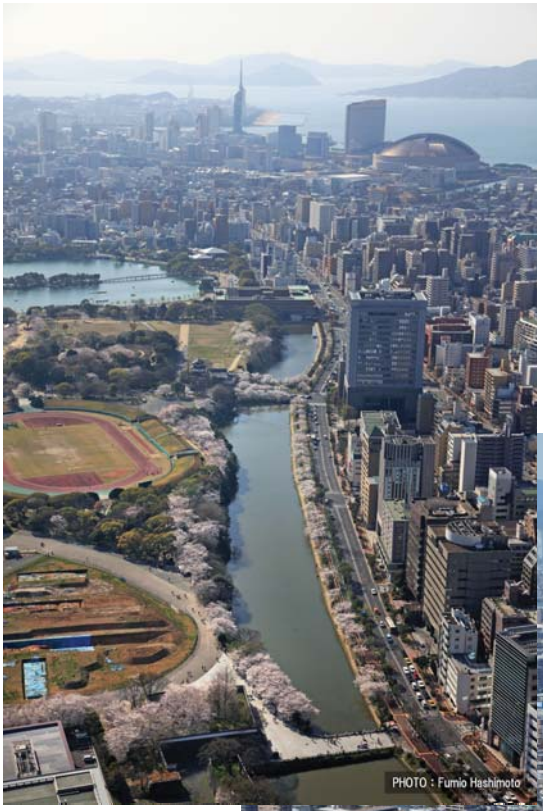
Fukuoka City in 1978
[Minamihata Dam's exposed reservoir bed during severe drought (right) and residents getting water from water truck (above)]

Waterworks Technologies of Fukuoka City

—Overcoming Water Shortages—

Fukuoka City Waterworks Bureau



Present Fukuoka City

Waterworks Technologies of Fukuoka City

Contents

1. Overview of Fukuoka City —Not blessed with large rivers—

Fukuoka City is a major city in southwestern Japan, with a population of roughly 1.5 million on an area of 340 km^2. Almost equidistant from major domestic cities (such as Osaka and Tokyo) and major East Asian cities (such as Busan, Seoul, Shanghai, Beijing and Taipei), this is in an ideal location for exchange with other Asian nations, with many regular international flights. Fukuoka has long thrived as a gateway for cultural exchange due to its proximity to the Asian Continent and Korean Peninsula.

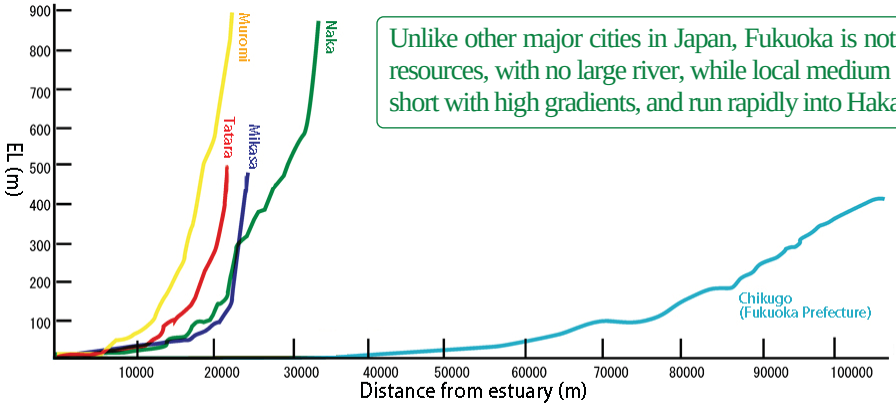
Fukuoka City Statistics [Fukuoka City Government Outline 2012 (Population and households data: as of Feb. 2013)]

Location	130°24'06" E. longitude	Area	341.7 km^2
	33°35'24" N. latitude	Annual mean temperature	17ºC
Population	1,496,066	Annual rainfall	1612 mm
Households	732,910	Establishments (all industries)	73,601
Population growth rate	Approx. 1%/year	Gross municipal product	6.63 trillion yen

Fukuoka City and Major Cities in Neighboring Countries

Topographical Map of Fukuoka City

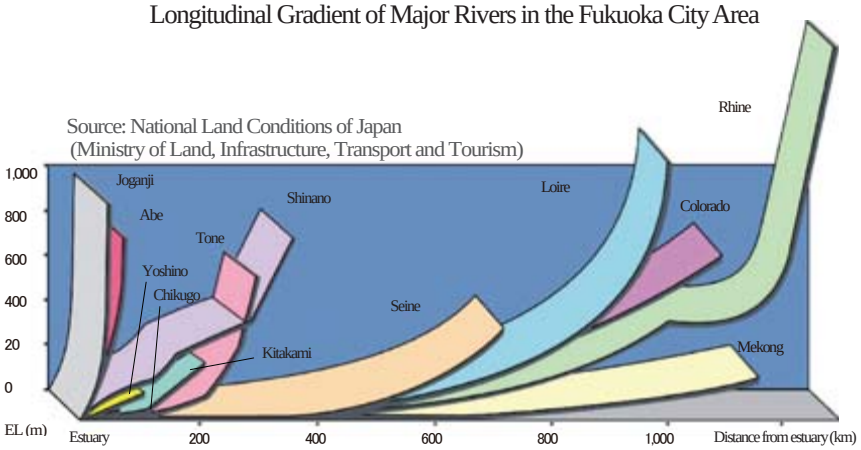
To the north, Fukuoka City faces the Genkai Sea over Uminonakamichi and the Itoshima Peninsula, which form Hakata Bay. The city is nestled on the crescent-shaped Fukuoka Plain, surrounded by the Sefuri mountain range to the south, and the Sangun mountain range to the east. All rivers flowing into Hakata Bay are medium or small rivers, including the Tatara, Mikasa, Naka, Muromi and Zuibaiji.



Unlike other major cities in Japan, Fukuoka is not blessed with water resources, with no large river, while local medium and small rivers are short with high gradients, and run rapidly into Hakata Bay.

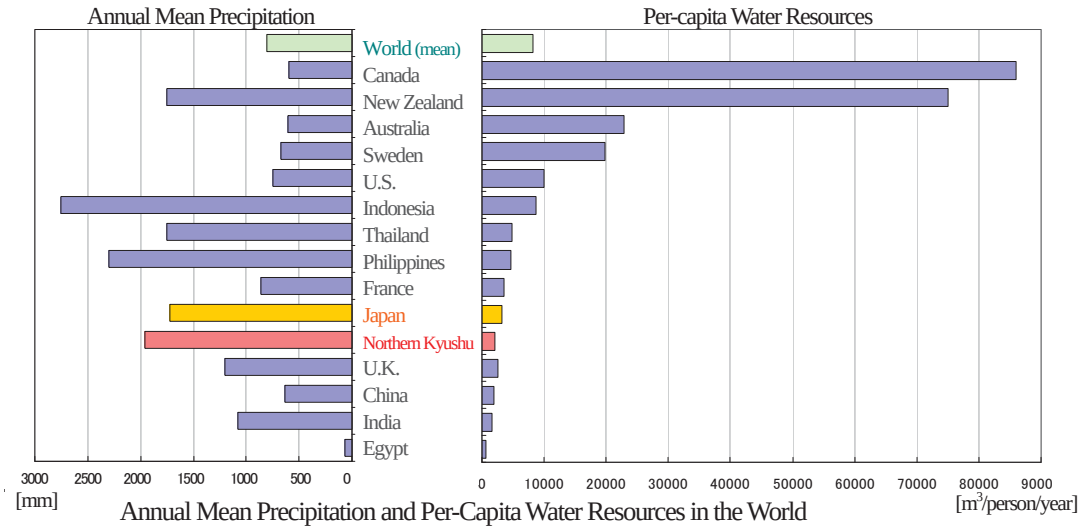
Longitudinal Gradient of Major Rivers in the Fukuoka City Area

Source: National Land Conditions of Japan
(Ministry of Land, Infrastructure, Transport and Tourism)



Longitudinal Gradient Comparison between Major Rivers in Japan and the World

Data: Based on "Water Resources of Japan (2012 Edition, Ministry of Land, Infrastructure, Transport and Tourism)"



Annual Mean Precipitation and Per-Capita Water Resources in the World

The northern Kyushu region (including Fukuoka City) is one of the less water-rich regions in the world, with the relatively few water resources available per capita [(Amount of precipitation less amount of evaporation/transpiration) multiplied by the area of the region and divided by the population of the region].

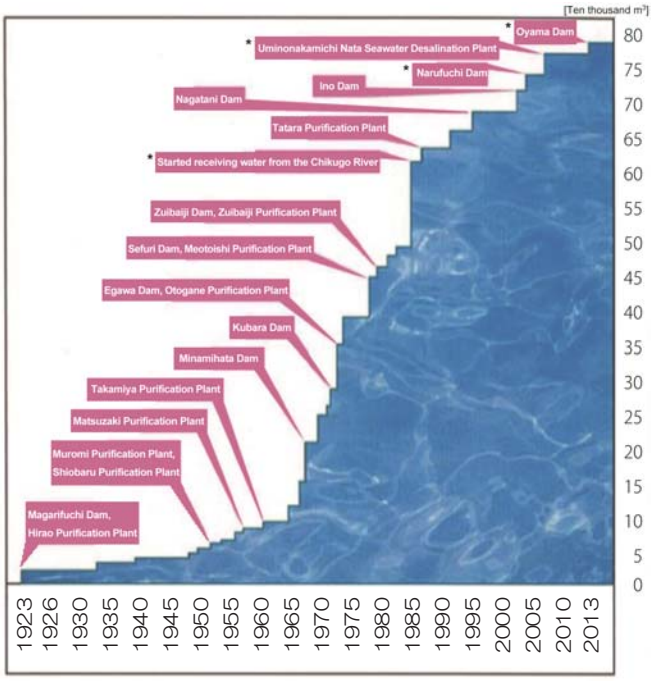
2. Water Resource Developments—Diverse developments implemented to overcome water shortages—

(1) History of water resource developments

Since the foundation of its waterworks in 1923, Fukuoka City has implemented 19 facility expansion projects to cope with the increases in demand caused by population growth and other factors.

In 1978 and 1994, the city suffered severe droughts with extraordinarily low rainfall and had to enforce water restrictions over long periods, disrupting the lives of residents.

Learning from these experiences, the city tackled the development of water resources with an approach unprecedented in Japan, including new source developments at local rivers, the construction of pumped-storage dams, dredging of reservoir bottoms in existing dams, and more effective utilization of agricultural water (such as switching from irrigation channels to pipelines).

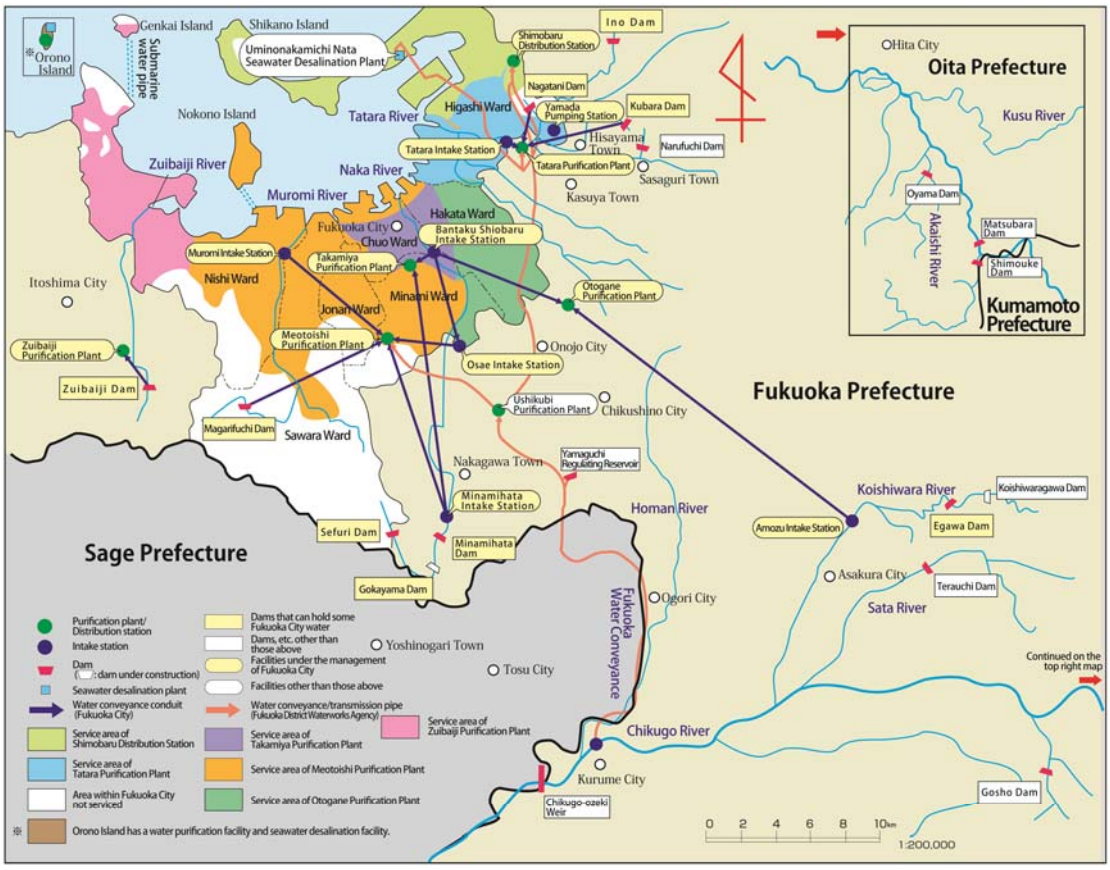


*The City receives water from the Fukuoka District Waterworks Agency

History of Fukuoka City Water Source Developments

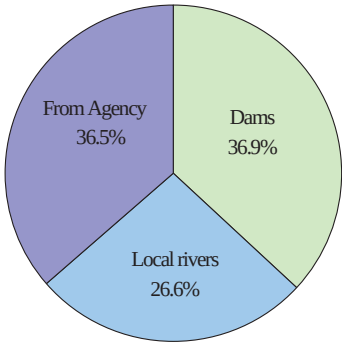
(2) Water conveyance from outside the basin (Fukuoka District Waterworks Agency)

Deficiencies in water resources were common for the Fukuoka metropolitan area, comprising Fukuoka City and neighboring municipalities. To address this problem, entities in the area established the Fukuoka District Waterworks Agency in 1973 (originally 4 cities and 18 towns in 1973, currently 9 cities and 8 towns). With the cooperation of relevant organizations, the agency started to intake water in 1983 from the Chikugo River, a large river outside the Fukuoka metropolitan area.



Water Sources and Conveyance/Transmission Facilities

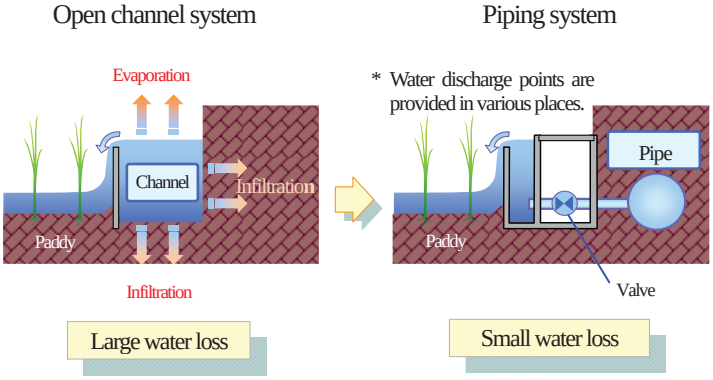
Currently Fukuoka City uses roughly 400,000 m^3 of water each day (daily average of water supply), drawn more or less evenly from each of three types of sources: 8 dams, local rivers (the Tatara, Naka and Muromi Rivers), and water received from the Fukuoka District Waterworks Agency (sources include the Chikugo River and the seawater desalination plant). The water intake is sent to five purification plants (Tatara, Otogane, Takamiya, Meotoishi and Zuibaiji) and the Ushikubi Purification Plant of the Fukuoka District Waterworks Agency, from which it is distributed throughout the city.



Intake Ratio by Water Source
(5-year average during FY2007 -2011)

(3) Piping for agricultural water conveyance

In areas where agricultural water is drawn from the Naka River, Fukuoka City has been switching the water conveyance system from the conventional open channels to pipelines (piping system) since 1968. As a result, water losses due to evaporation or infiltration have been reduced, and the saved water has been effectively utilized for drinking water.



Effect of Piping for Agricultural Water

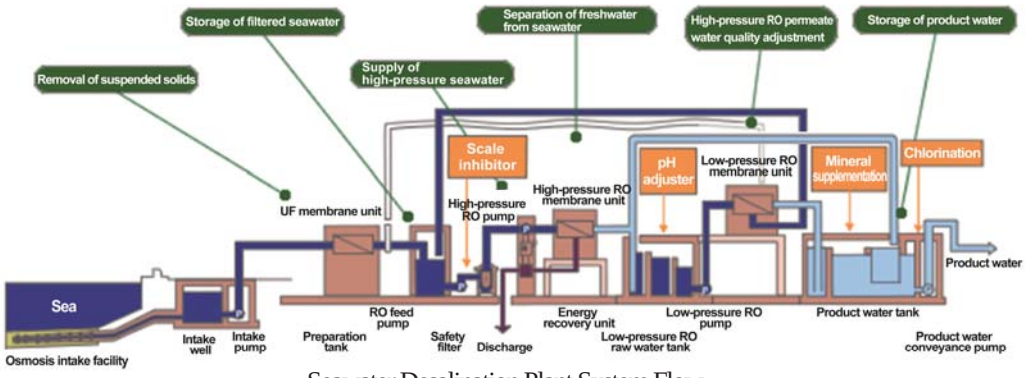
Effect of piping:

Daily max. 70,000 m^3 (developed amount)

(4) Seawater desalination plant (Fukuoka District Waterworks Agency)

The Fukuoka District Waterworks Agency launched a seawater desalination plant construction project in 2000 to provide a new water resource for the Fukuoka metropolitan area, with a total project cost of 40.8 billion yen. The plant started operation in 2005 with the largest maximum daily production capacity in Japan—50,000 m^3 (including 16,400 m^3 apportioned to Fukuoka City (project approval)). While dams usually take several decades to complete, the desalination plant started operation in just 5 years.

Seawater Desalination Center (Fukuoka District Waterworks)



Seawater Desalination Plant System Flow

<Features of seawater desalination plant>
- Osmosis intake facility: The intake pipe is buried in the seabed sand, where the sand layers serve as a filter to remove impurities.
- High recovery rate: With the use of an improved high-pressure RO membrane, the recovery rate (freshwater/raw water) has improved from the conventional rate of around 40% to about 60%.
- Environmental load reduction: Concentrated seawater waste is discharged after being mixed with treated wastewater from the water treatment center to a salinity almost identical to that of seawater.

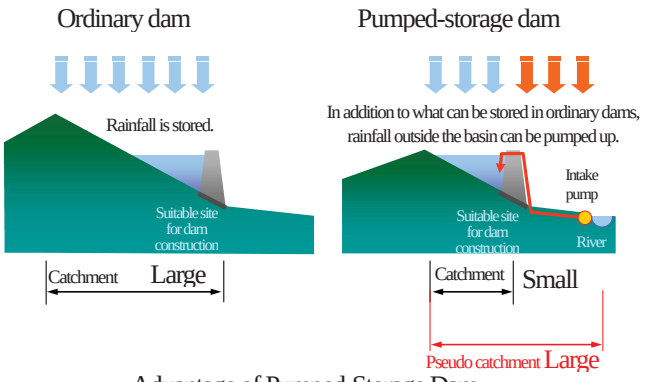
(5) Pumped-storage dam

Nagatani and Kubara Dams are pumped-storage dams, an uncommon type of dam in Japan, designed specifically for water utilization. When the river has a heavy flow, water is pumped up from a downstream site and stored in the dam. Even for dams with only a small catchment area due to site restrictions, this type of dam enables more efficient utilization of water by expanding the pseudo-catchment area during dry spells, etc.

<Nagatani Dam>

Active storage capacity: 4,850,000 m^3

Maximum pumping capacity: 100,000 m^3/day



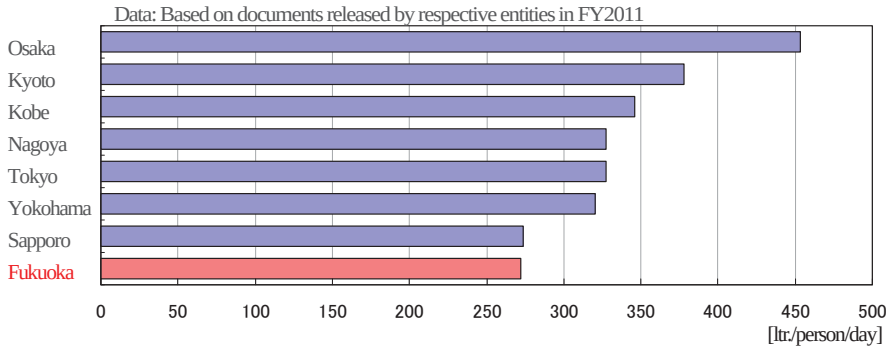
Advantage of Pumped-Storage Dam

Fukuoka City Waterworks Business Data [FY 2011]

Population of the city	1,483,052	Water supply pervasion rate	99.5%	Annual effective supply	142,215,970 m^3
Population of service area	1,479,900	Sewerage pervasion rate	99.5%	Effective supply rate	97.2%
Population served	1,472,300	Annual water supply	146,321,200 m^3	Annual revenue water	140,325,939 m^3
Households in the city	724,286	Max. water supply/day	434,000 m^3	Revenue water rate	95.9%
Households served	802,992	Average water supply/day	399,785 m^3	Capacity of facilities	764,500 m^3

3. A Water-Conscious City —Effective use of limited water resources—

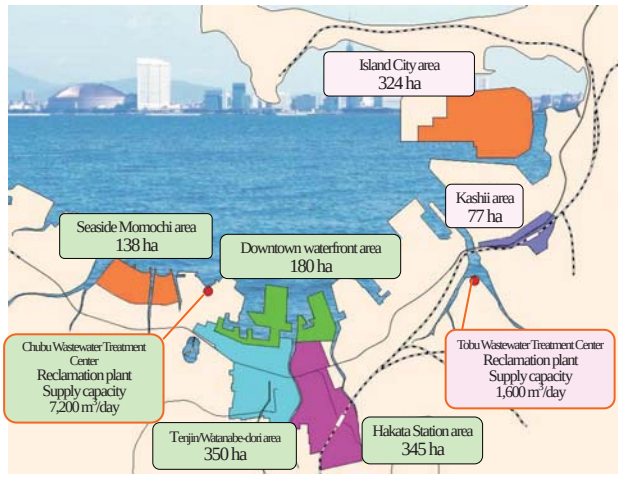
Fukuoka City established the Outline of Measures for Economical Water Use in 1979. In 2003, addressing unstable precipitation and growing water demand, the city was the first in Japan to enact the Ordinance on the Promotion of Water Conservation. Under this ordinance, large buildings with a total floor area of not less than 5,000 m^2 (not less than 3,000 m^2 within reclaimed water service areas) are required to install a non-potable water system. The city also designated water-saving toilets to encourage their wide use. Aiming at the establishment of a water-conscious city, the residents, business operators and the government are working in a united effort. The daily amount of water use per person (per-capita daily mean water use) in Fukuoka City is 272 liters (as of 2011), which is a lowest among major cities in Japan, and reflects the strong awareness of the residents.



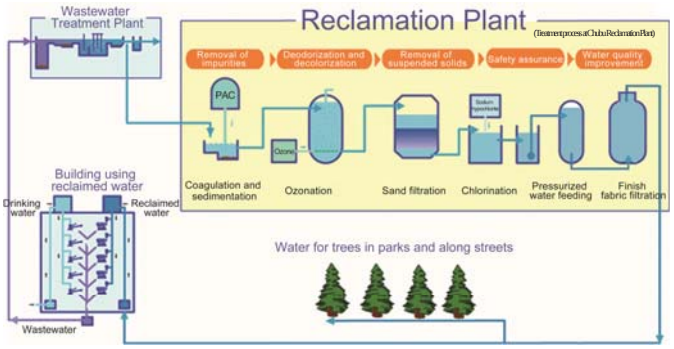
Per-Capita Daily Mean Water Use in Major Cities in Japan

(1) Use of non-potable water (reclaimed water, etc.)

As part of the efforts to become a water-conscious city, Fukuoka City has been promoting the use of non-potable water supply systems in which wastewater is treated and reused for flushing toilets and watering landscapes. There are three kinds of non-potable water recycling methods. The individual facility circulation type treats greywater for reuse within a building, the wide-area circulation type uses reclaimed water supplied from a reclamation plant, and the non-circulation type uses rainwater and other natural sources.



Fukuoka City Reclaimed Water Service Areas
(Serviced facilities: Large buildings with a 3,000 m^2 or larger total floor area)



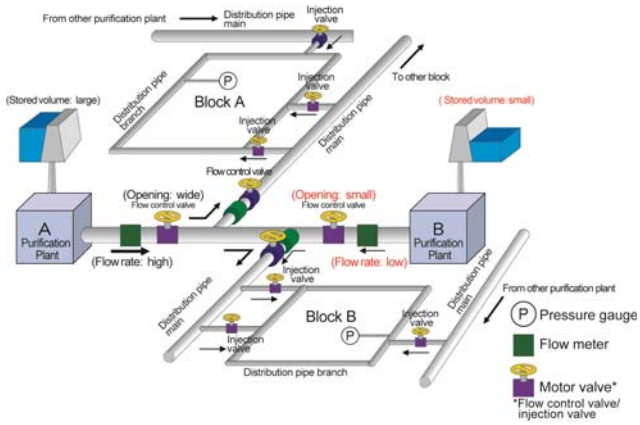
Reclaimed Water Supply System
(Wide-Area Circulation Type)

(2) Water distribution regulation system

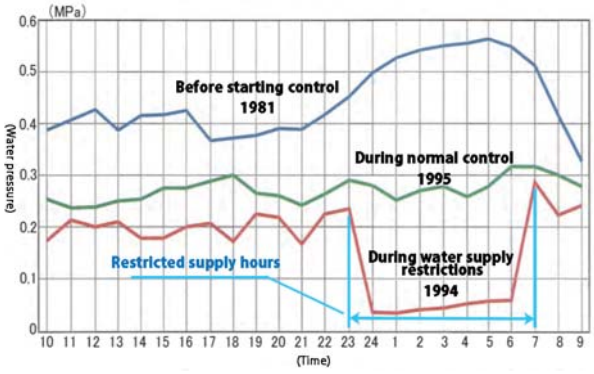
In 1981, Fukuoka City led the rest of Japan by launching operation of the Water Distribution Control Center, used to regulate water flow and pressure in pipes from purification plants to faucets with the following objectives:

- To allow water to be supplied to faucets smoothly and equally across the city, regardless of topographical differences, and
- To cope with varying water source conditions between purification plants caused by diversified water source systems.

At this center, the entire water distribution pipe network within the city, which is divided into 21 blocks, is monitored around-the–clock, with flow meters in 83 locations and pressure gauges in 122 locations. Based on data received via telemeter, the center controls the constantly changing flow and pressure in the pipes by remotely operating motor valves in real-time at 177 sites (as of April 2013).



Water Distribution Regulation System Schematic Diagram



Water Pressure Control Time-Series Chart

● Flow control (between purification plants)

For interchange between purification plants, flows are controlled by operating motor valves while monitoring flow meters installed on distribution pipe mains.

● Pressure control

Several pressure gauges and motor valves are installed in each block. Pressure is maintained at an optimal level by operating the motor valves while monitoring the gauges.

Effects of pressure control

As shown in the chart above, by properly maintaining water pressure in each block at all times according to demand, water pressure in pipes has been reduced by approx. 0.1 to 0.2 MPa from the level prior to the establishment of the Water Distribution Control Center. (Leakage has been suppressed by properly maintaining water pressure, which is affected by changes of consumption over time.)

Central Control Room, Water Distribution Control Center

Telemeter Installed on Sidewalk

(3) Maintenance and improvements of distribution pipes

For a stable supply of safe drinking water produced at the purification plants, maintenance and improvements are systematically conducted for distribution pipes. For improvements, ductile iron pipes of superior strength and durability have been adopted as a standard, and the pipes are covered with a polyethylene sleeve to prevent corrosion and ensure durability.

[Total length of Fukuoka City distribution pipes: 3,935 km (as of the end of FY 2011)]

Distribution pipe maintenance and improvements in Fukuoka City are conducted using the following criteria:

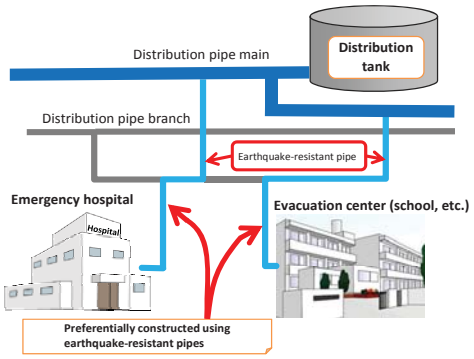
1) To supply safe and palatable water

As old pipes tend to gradually corrode, resulting in water leaks and turbidity, pipes are replaced with priority given to the degree of pipe deterioration and the importance of the line.

Distribution Pipe Installation Work

2) To promote earthquake resistance

In addition to the use of highly earthquake-resistant pipes for all distribution pipe replacement work, an earthquake-proof network is being constructed to ensure earthquake resistant water supply routes to emergency hospitals and to elementary and junior high schools that will serve as evacuation centers during an earthquake.



Earthquake-Proof Network Construction Schematic Diagram

Earthquake-resistant pipe that withstands external force (compression and expansion) and adapts to ground deformation

3) Well-balanced water distribution and efficient water management

Distribution tanks that temporarily store drinking water and distribution pipes are maintained and improved so that water from five purification plants can be distributed in a well-balanced manner according to the current status of use.

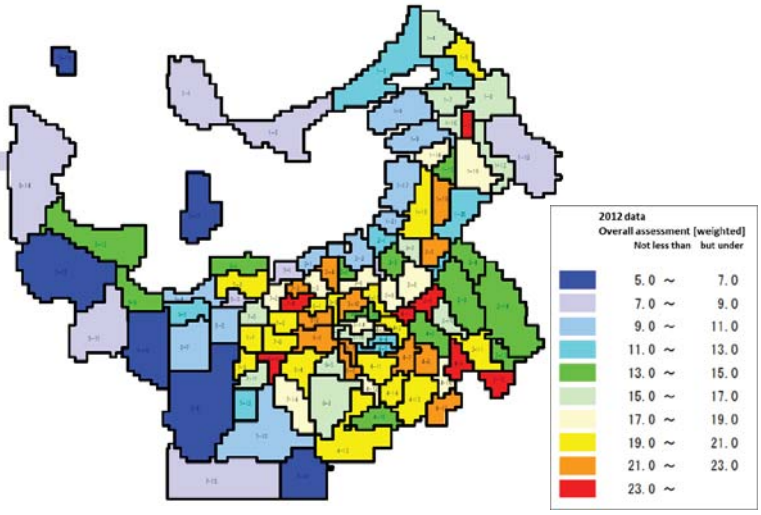
(4) Leakage prevention

Inspections are conducted by listening for subterranean sounds that might indicate underground leakage, to locate leaks that cannot be noticed above ground. Early detection of leaks and quick repairs facilitate the effective use of water and the prevention of secondary problems.

Leakage Inspection

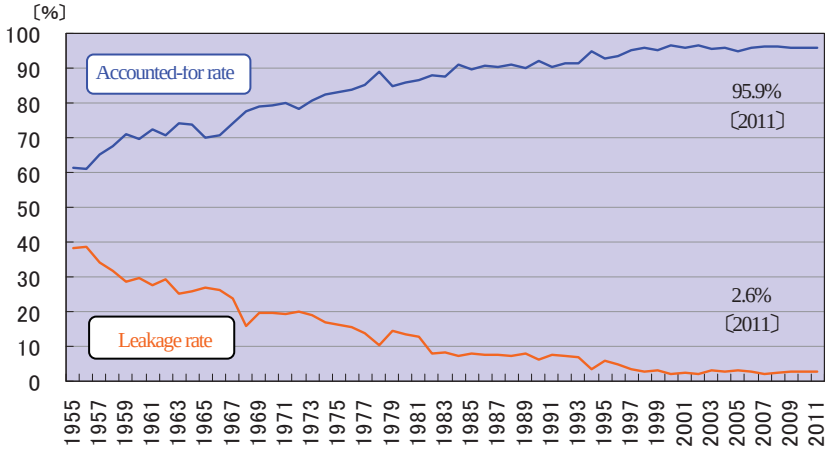
The entire city is divided into 250 grids. Data, including history of transmission/distribution pipes failures, leakage data, lengths of aged pipes, the number of remaining lead service pipes, pressure inside pipes and soil corrosivity, are analyzed every 4 years to assess leakage risk on a 3-level scale. Then, leakage inspections are conducted either annually (60%), every 2 years (32%) or every 4 years (8%) in descending order of assessed risk. Based on leakage risk assessment results, the leakage inspections cover 2,907 km of distribution pipes, along with 2,370 km of door-to-door and valve and cock acoustic inspections, as well as 537 km inspected by acoustic correlation method.

As 90% of leakage occurs with service pipes, replacement of aged service pipes is also conducted to prevent further leakage.



Water Leakage Investigation Grid Blocks

As a result of implementing the distribution regulation system, systematic maintenance/improvements of distribution pipes, leakage prevention and other measures, Fukuoka City is now maintaining a high accounted-for water rate with a reduced leakage rate.



Changes in Accounted-for Water Rate and Leakage Rate

(5) Communications with local residents

1) Publicity activities

The great drought in 1978 was a disaster, but it helped renew public recognition of the importance of water. In order to prevent this experience in the future, in 1979, Fukuoka City designated June 1 as Water-Saving Day, and established a water-saving logo that is descriptive of water circulation. Starting on Water-Saving Day each year, the city runs a water-saving campaign from June to August, when water consumption tends to be greater. In addition, diverse publicity efforts are continued throughout the year, including delivery of the Waterworks Bureau's newsletter to each household in the city, publication of a supplementary reader for use in elementary school social studies classes and implementation of waterworks facility tours to raise residents' awareness of the importance of limiting water consumption in the establishment of a water-conscious city.

2) A crowd-sourced dam built by water-saving efforts

If every resident in Fukuoka City saves a bucket of water (10 liters) each day, roughly 54 million m^3 of water can be saved. For a city with few water resources of its own, which greatly depends on outside sources, water conserved by each resident's efforts has been another valuable water resource, a "crowd-sourced dam." It is, in effect, a large-scale water resource developed throughout the city, and has been a significant pillar in building a water-conscious city.

4. Safe and Quality Water—A supply of water that the public can trust—

(1) Improvement of drinking watershed protection forests

1) Watershed protection forests at 3 dams exclusively for the city's drinking water

In 1980, Fukuoka City started acquiring forests and other areas to enhance the watershed protection function of the catchment area for the Magarifuchi, Sefuri and Nagatani dams, which exclusively supply the city's drinking water, as well as to prevent water pollution at these water sources that might be caused by unrestrained development and such. In 2004, the Fukuoka City Drinking Watershed Protection Forests Improvement Project was formulated, and organized maintenance of forests has been carried out in line with this project.

Nogochi Gorge (Magarifuchi) with clean water

2) Cooperative work with residents and others (maintenance of watershed protection forests)

Maintenance activities for watershed protection forests are promoted to help ensure safe and palatable water. These tasks are carried out in cooperation with Watershed Protection Forest Volunteers[*1], a group of citizens who have come to protect and maintain the watershed protection forests, and with companies and NPOs participating in the Cooperative Program for Watershed Protection Forests[*2].

Tree planting by watershed protection forest volunteers (Magarifuchi)

Maintenance of watershed protection forest by company employees and families (Magarifuchi)

*1 Watershed Protection Forest Volunteers

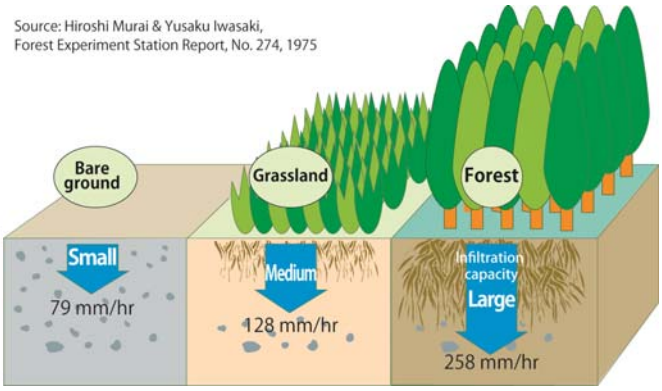
Citizen volunteers first acquire the knowledge and skills needed for forest improvement and maintenance tasks through a program offered by the Fukuoka City Waterworks Bureau. They then serve as "evangelists" to spread awareness of maintenance activities and their importance for watershed protection forests, as well as to encourage an understanding of water resource areas.

*2 Cooperative Program for Watershed Protection Forests

When non-government organizations such as companies and NPOs take part in forest conservation as a social contribution activity, the Waterworks Bureau allows them to use their watershed protection forests.

Watershed protection function

The water retaining capacity of forests captures rainwater in the soil and alleviates flooding and drought. In addition, the purifying ability of forests brings us clean and palatable water.



Function of Watershed Protection

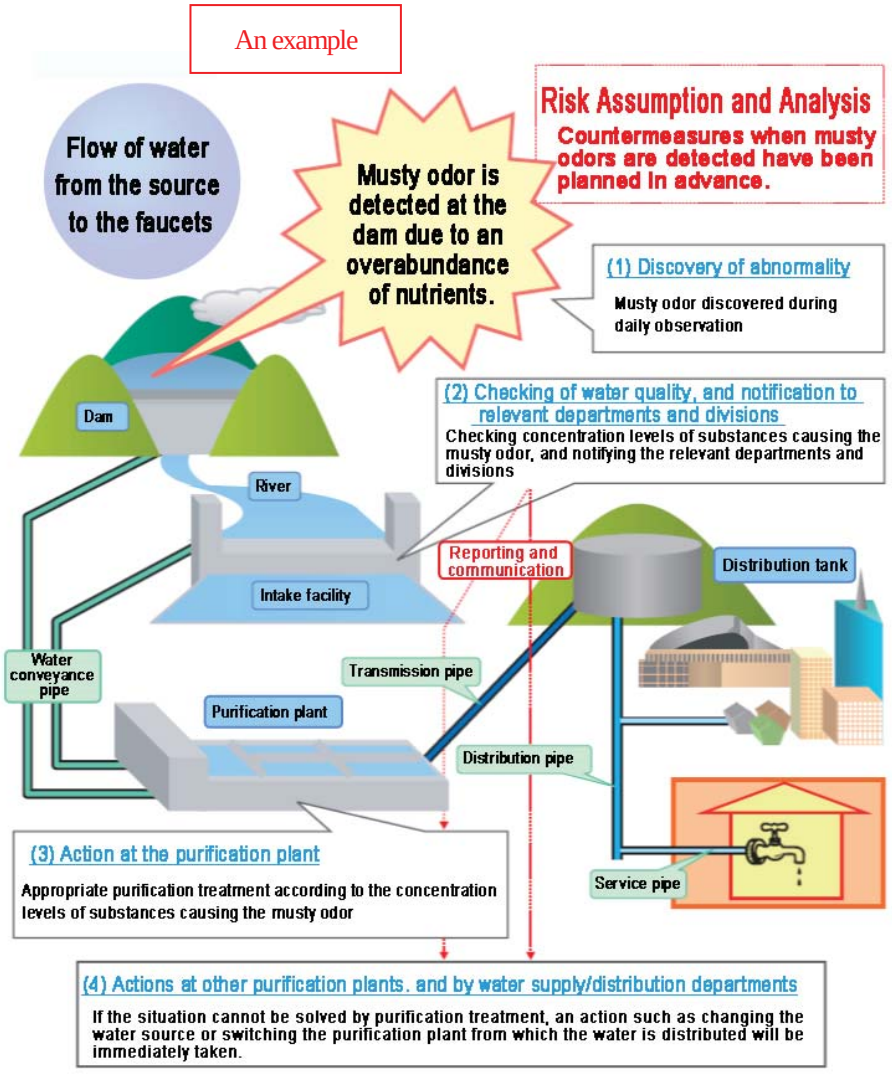
(2) Water quality management

In Fukuoka City, water taken from dams and rivers is purified at 5 purification plants. As the Tatara River, Naka River and Muromi River are shorter and have lower discharge, these rivers are easily affected by the inflow of substances from the watershed areas. At dams, there are problems such as the generation of odorants caused by algae thriving on the overabundance of nutrients. To address these issues, we have taken measures such as the complete monitoring of quality variations in raw water, utilization of an aero-hydraulic gun to suppress algae proliferation at dams, and adoption of an advanced water treatment facility using ozone and granular activated carbon at the Tatara Purification Plant.
In addition to the efforts taken thus far, the Fukuoka City Water Safety Plan was formulated in March 2011 and has been put into practice since April 2011. The plan was created to predict and analyze risks that may arise between a water source and a water supply outlet, to liaise with other departments and divisions, and to prepare detailed countermeasures.

1) Characteristics of Fukuoka City Water Safety Plan

Points where there may be a risk are checked in advance, and the manual was written to include a communications system and countermeasures so that quick and appropriate action can be taken at the time of an emergency.

- **Risk assumption and analysis**
  Learning from past experience, the probable frequency of a risk actually occurring and its impact on the water supply are analyzed in advance.
- **Detailed countermeasures**
  Variations in water quality levels when a risk has occurred are predicted and quantified, and the countermeasures are listed by level.
- **Improved cooperation between relevant departments and divisions**
  A communications system and countermeasures at the occurrence of a risk have been written into the manual and shared with relevant departments and divisions.



Risk Assumption and Analysis

2) Water quality tests

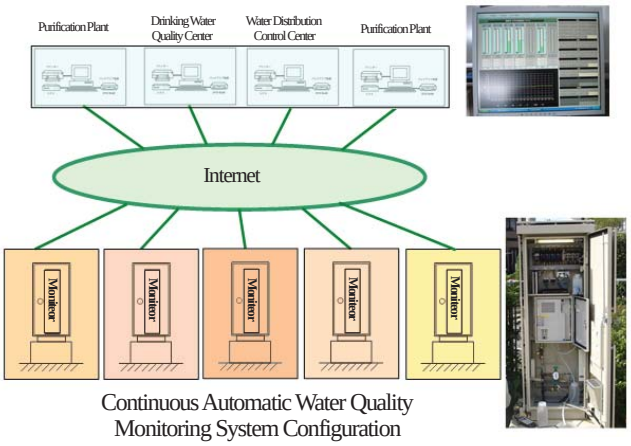
To supply safe and trusted drinking water, highly accurate water quality tests with ensured reliability are conducted. We use a test system improved by installing and maintaining advanced test devices and enhancing test personnel skills. To aim for more appropriate and transparent water quality tests, a water quality test plan is formulated every year to specify test items, sampling points and frequency, and the test results are publicized.

Water quality tests are strictly carried out for each checkpoint between the water source (dam, river, etc.) and the water supply outlet. In this way, water quality is thoroughly managed.

<Water quality test checkpoints>
(1) Water source: Water source is not contaminated.
(2) Raw water receiving well: Raw water is of good quality.
(3) Sedimentation tank: Coagulation-sedimentation treatment to remove sand and dust has no problems.
(4) Filter tank: Filtered water is clear.
(5) Water supply: Water is safe and satisfies water quality standards.

3) Automatic and continuous water quality monitoring (improvement of water quality monitoring functions at water distribution areas)

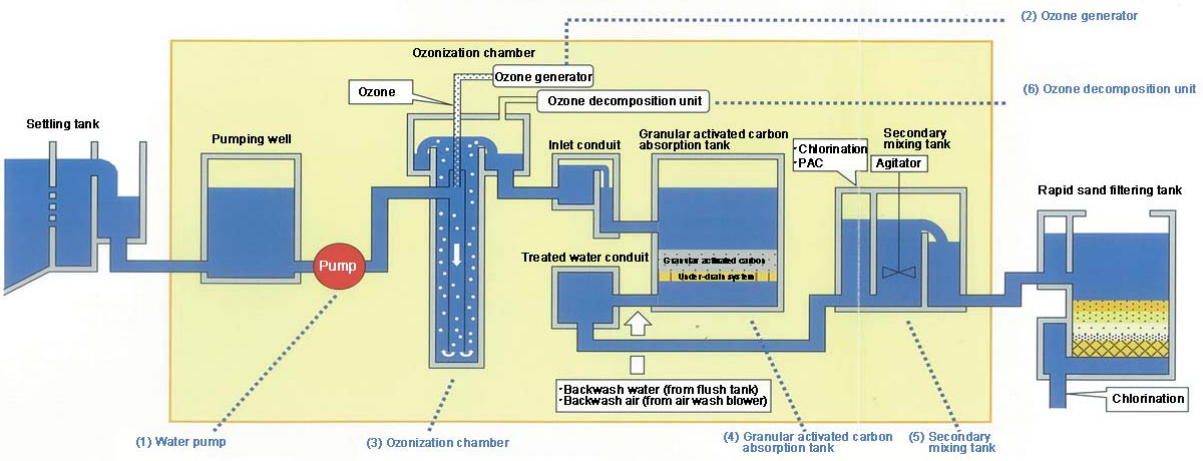
Fukuoka City has installed automatic and continuous water quality monitors for the distribution pipes. These automatically measure residual chlorine, chromaticity and turbidity, and send the data to each purification plant, water distribution control center and drinking water quality center.
As well as enabling early detection of water quality problems, they also allow finer adjustment of chlorine concentrations to reduce levels of residual chlorine.



Continuous Automatic Water Quality Monitoring System Configuration

(3) Advanced water purification

At each purification plant in Fukuoka City, a rapid filtration system has been adopted for water treatment. However, the raw water in the Tatara River, which is the main water source for the Tatara Purification Plant, contains a larger amount of organic matter than do other rivers in the city, and this causes the generation of trihalomethanes and musty odors. To remove these, an advanced water purification facility was installed in the Tatara Purification Plant in 2005. The facility can complete advanced water purification on as much as 61,000 m^3 of water per day.



Tatara Purification Plant—Advanced Water Treatment Facility System Flow Diagram

Advanced water purification facility

The advanced water purification facility consists of ozone treatment equipment and granular activated carbon absorption equipment. The facility has been designed to remove substances (musty smelling materials, organic matter responsible for trihalomethanes, anionic surfactants, etc.) that cannot be removed by ordinary settling or filtering purification methods.

<Ozone treatment>

The significant oxidation powers of ozone (O_3) allow the degradative treatment of organic matter, odorous materials and other substances.

<Granular activated carbon absorption treatment>

The absorption capacity of granular activated carbon enables the absorptive treatment of odorous materials, organic matter, anionic surfactants, etc.

* Facility features

The ozonization chamber uses a lower injection method to save space. By placing the granular activated carbon absorption treatment facility ahead of the chlorine treatment, microorganisms can grow in the granular activated carbon bed and spark an expected biological treatment effect.

(4) Environmental Management System (ISO 14001)

To continuously improve our environmental conservation measures, the environmental management system was introduced in 2002, and ISO 14001 certification was granted in 2002.

Fukuoka City Waterworks Bureau Environmental Policies

<Basic principles>

Recent years have witnessed many global environmental problems, such as global warming and the destruction of the ozone layer. As a result of these problems, extraordinary water shortages and water contamination are significantly affecting our vital water resources. The Fukuoka City Waterworks Bureau is determined to protect our indispensable water from these problems, conserve a water-rich natural environment, and pass down an appreciation of the importance of water to future generations.

Environmental objectives and goals (2012)

1) Environmental load reductions in business activities

- Measures to reduce energy consumption and promote its effective utilization will be implemented.
  - Suppression of power consumption at purification plants will be carried out according to the plan.
- Measures for environmental considerations in public works will be implemented.

2) Water conservation

- Water conservation (leak prevention) measures will be implemented, and a 95% or higher accounted-for water percentage will be maintained.
  - Appropriate water pressure will be managed and adjusted by using the water distribution regulation system.

3) Forest protection in water resource areas

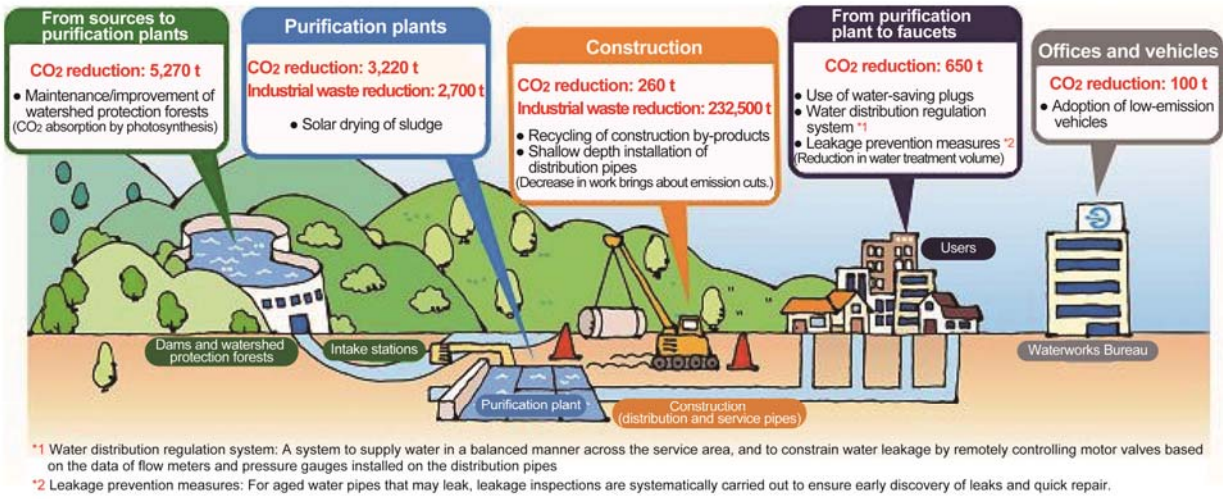
- Measures to improve watershed protection functions will be implemented.
  - Conversion of bamboo groves into broad-leaved forest, tree thinning and other work needed for a well-maintained forest, preparation of strip roads, watershed protection forest activities of those who complete the volunteer program, and acquisition of land for watershed protection forests around dams exclusively for drinking water

4) Energy and resource conservation in office activities

- Reductions in power consumption
- Reductions in fuel consumption for air conditioning
- Reductions in copy paper use

5) Introduction of new energy sources

- Small hydropower generation facility (Zuibaiji Purification Plant)
- Photovoltaic power generation facility (Meotoishi Purification Plant, etc.)



Environmental Conservation Effect (Amount of CO_2 reduction) [FY 2011]

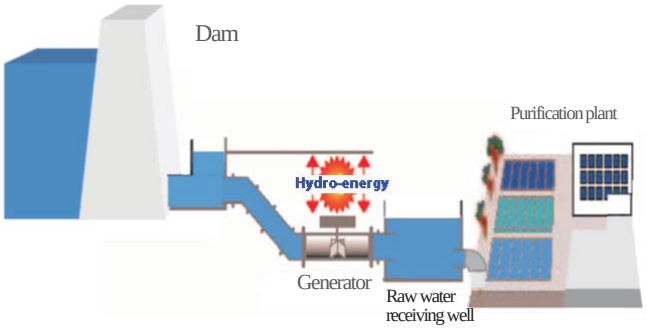
(5) Environmental conservation efforts

1) Environmental load reduction (introduction of new energy sources)

In order to reduce the environmental load to counteract global warming, the Fukuoka City Waterworks Bureau is engaged in efforts to save energy, and is introducing new energy generation methods, such as small hydropower generation and photovoltaic power generation.

● Small hydropower generation

We are targeting a reduction in CO_2 emissions by establishing a small hydropower generation facility at the Zuibaiji and Otogane purification plants, where the difference in elevation between the water source and purification plant is exploited to cover some of the power consumption at these purification plants.



Small Hydropower Generation Schematic Diagram

Zuibaiji Purification Plant Small Hydropower Generation Data

Small hydropower generation facilities	Generation capacity	35 kW
	Turbine type	Double-suction reverse-running-pump turbine
	Max. flow rate	0.13 m^3/s
	Generator type	Three-phase synchronous generator
System interconnection	Interconnection type	High-tension interconnection (with reverse power flow)
Result	Annual energy generation (FY2012)	288,000 kWh
	Equivalence in terms of power consumption of standard homes	80 households
	Annual reduction of CO_2 emissions	108 t

● **Photovoltaic generation**

A photovoltaic generation facility, one of our cleanest energy sources, has been set up at the Meotoishi Purification Plant and the Waterworks Bureau's building shared with the Hakata-eki North Pumping Station (for sewerage), to reduce CO_2 emissions.

Photovoltaic Generation

2) International technological cooperation

To contribute to the global goal of environmental conservation, and for the technological transfer of waterworks management needed by other Asian countries, including effective water utilization achieved by water-conscious city creation, the dispatch of personnel and the initiation of technological exchanges with sister cities have been carried out upon request of the Japan International Cooperation Agency (JICA) and other organizations.

JICA Projects for which Fukuoka City Sent Specialists Overseas (long term)

Host nations	Dispatch period	Program
Malaysia	May 8, 1987 – May 7, 1989	Leakage control
Malaysia	May 1, 1989 – Apr. 30, 1991	Leakage control
Thailand	June 7, 1991 – June 6, 1993	Distribution planning
Thailand	June 1, 1993 – May 31, 1995	Distribution planning
Indonesia	Mar. 15, 1995 – Mar. 14, 1997	Waterworks planning
Indonesia	Apr. 10, 1997 – Apr. 9, 1999	Waterworks planning
Indonesia	Apr. 1, 1999 – Mar. 31, 2001	Waterworks planning
Slovenia	Aug. 22, 2001 – Aug. 21, 2003	Leakage control
Philippines	Sept. 2, 2002 – Sept. 1, 2005	Waterworks planning
Bhutan	Apr. 3, 2007 – Mar. 31, 2009	Water resource management
Myanmar	Apr. 4, 2012 –	Waterworks planning, and leakage control

Waterworks Technologies of Fukuoka City

● Host countries of the JICA projects for which Fukuoka City sent specialists (long term)

Treasure our water

Fukuoka City
Waterworks Bureau

Waterworks Technologies of Fukuoka City (April 2013)

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