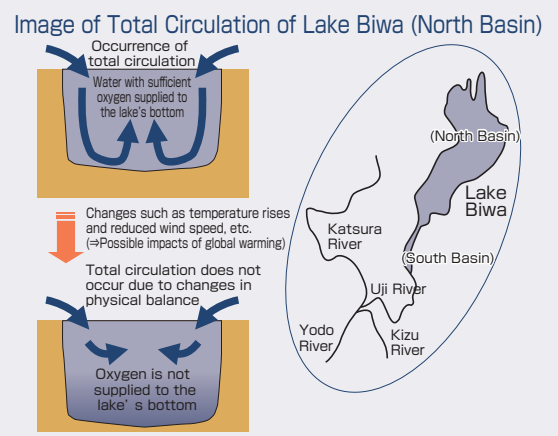
Column Total Circulation of Lake Biwa

In Lake Biwa, layers of water temperatures are formed in summer because of big differences between the surface water temperatures of 26-28 degrees C and deepest-part water temperatures of 6-8 degrees C. When the lake surface cools down from autumn to winter, the surface water temperatures come down and layers of water temperatures disappear, with shallow water and deep water becoming admixed. This phenomenon is called "total circulation." However, if the lake surface does not cool down and the surface water does not sink as deeply as before because of rising atmospheric temperatures, the total circulation would decrease and oxygen is not supplied to the lake's bottom, possibly causing a deterioration of water quality and thus giving an impact on lake ecosystems.



Source: Ministry of Land, Infrastructure, Transport and Tourism, "Water Resources in Japan 2007"

Section 2 Efforts to Solve Water Problems

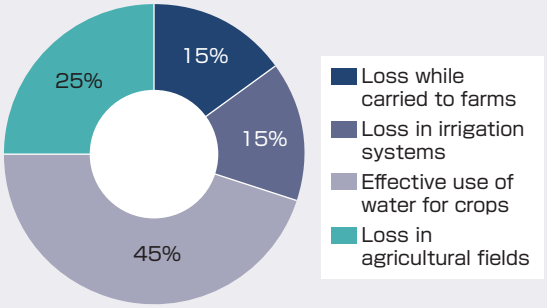
1 Problems in the Use of Water Resources

As discussed in Section 1, water resources available to humans are limited and unevenly distributed geographically. On top of this, we expect to see an increase in water stress due to global warming as well as further rises in demand for water owing to population growth and economic growth. Then, are we using limited water resources effectively without wasting them? For example, in the case of water for agricultural use, which accounts for about 70% of the total water consumption, water is lost in each stage in the course of irrigation of farmland. For example, there a report that in Asia, 20% of irrigation water is lost in the stage where water is carried from reservoirs to irrigated areas, another 15% is lost when water is delivered to agricultural fields, and in addition, 25% of water is wasted in agricultural fields (Figure 4-2-1). In this case, as much as about 60% of water is lost and only the remaining 40% is actually used to grow crops. These loss problems can be improved through the averaging of agricultural fields, improvements to irrigation channels, and the "drip infusion" of irrigation water to crop roots.

In developing countries, the nonrevenue water rate (the ratio of the difference obtained by deducting water sold from water produced to water produced) is said to average at 40%. Nonrevenue water rates in major cities of Asian countries show a lot of water is wasted through water leaks, while very little water is wasted in Japan (Figure 4-2-2). Fact-finding surveys on water projects in China and Vietnam, conducted in FY 2008, found that leaks of clean water are big problems in those countries. In Zhejiang Province, China, 20 to 30% of water projects in the province are estimated to suffer water leaks. In water projects in Changxing County of the same province, the quantity of water supply is as much as 36% lower than the quantity of clean water, presenting the authorities there with a major challenge to taking measures to deal with water leaks.

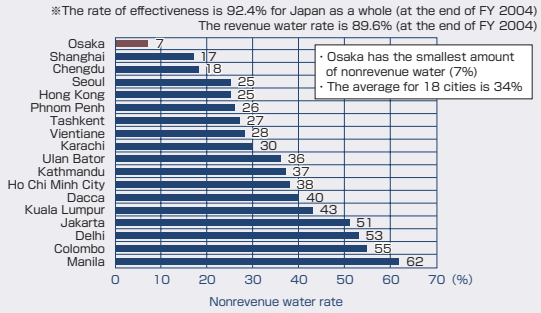
Installation of sanitary facilities remains inadequate in Asian countries as a whole, though the degree of sanitation varies from country to country, standing at 44% in China, 55% in Indonesia, 72% in the Philippines, 61% in Vietnam, 17% in Cambodia, 33% in India, 59% in Pakistan and 39% in Bangladesh. Substantially more effective utilization of water resources is possible if sewage water is adequately treated for reuse as water resources. We need to further promote effective use of water resources through prevention of water leakages and adequate sewage treatment when sewage is discharged into public water areas.

Figure4-2-1 Average Loss of Irrigation Water in the World



Source: Prepared by Ministry of the Environment based on the International Commission on Irrigation and Drainage (ICID), "Irrigation and Drainage in the World - For the Earth Blessed with Water and Green," p.140

Figure4-2-2 Nonrevenue Water Rate in Major Asian Cities



Source: Water in Asian Cities, Utilities' Performance and Civil Society Views, Asian Development Bank 2003 (data is for 2001)

2 International Goals and Efforts toward Solving Water Problems

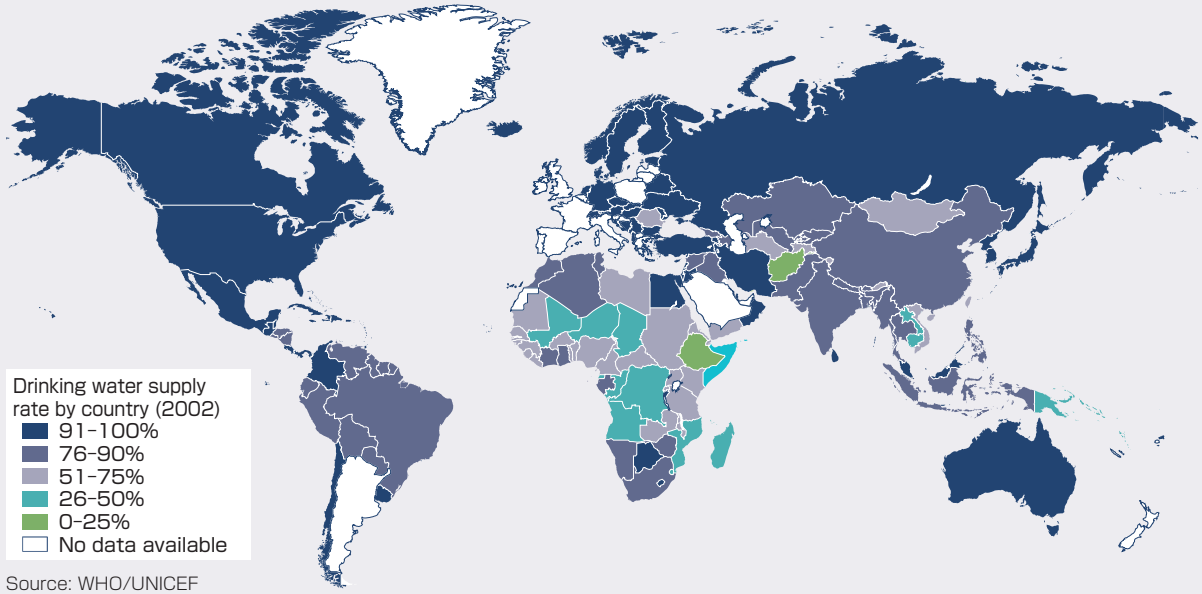
(1) Millennium development goals

By integrating the United Nations Millennium Declaration adopted at the U.N. Millennium Summit held in New York in September 2000 and international development goals adopted at major international conferences and summits held during the 1990s into a single framework, the "Millennium Development Goals (MDGs)" were worked out. In addition, after discussions at the World Summit on Sustainable Development in Johannesburg in 2002, on both aspects of securing safe drinking water and sanitation for adequate wastewater treatment, the numerical target was adopted to "halve, by the year 2015, the proportion of people who are unable to reach or to afford safe drinking water and the proportion of people who do not have access to basic sanitation." (Figure 4-2-3, 4-2-4)

Subsequent international developments on water problems have been revolving around ways to achieve this target, at such forums as G8 Summits, the U.N. Advisory Board on Water and Sanitation (UNSGAB) and the World Water Forum (Figure 4-2-5).

Figure4-2-3 Rate of Access to Safe Drinking Water

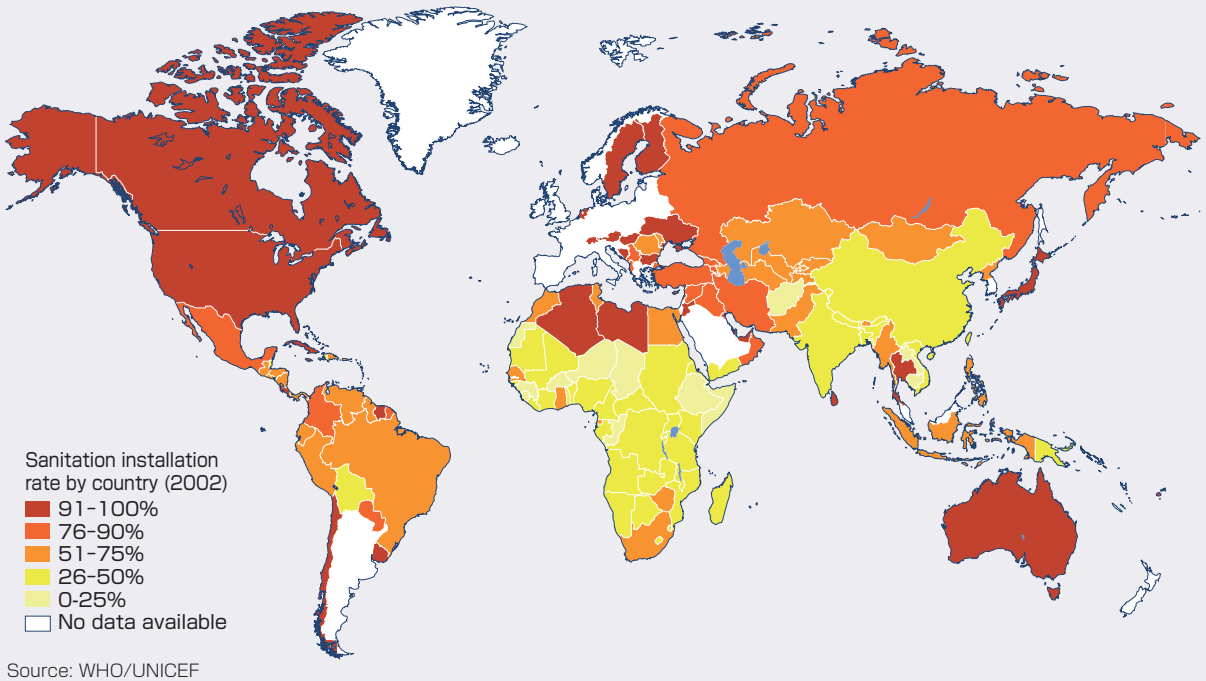
○1.07 billion people (17%) do not have access to safe drinking water around the world (of them, 97% are in developing countries)
○Areas with the low access rate are in Oceania (52%), sub-Saharan Africa (55%), etc.



Source: WHO/UNICEF

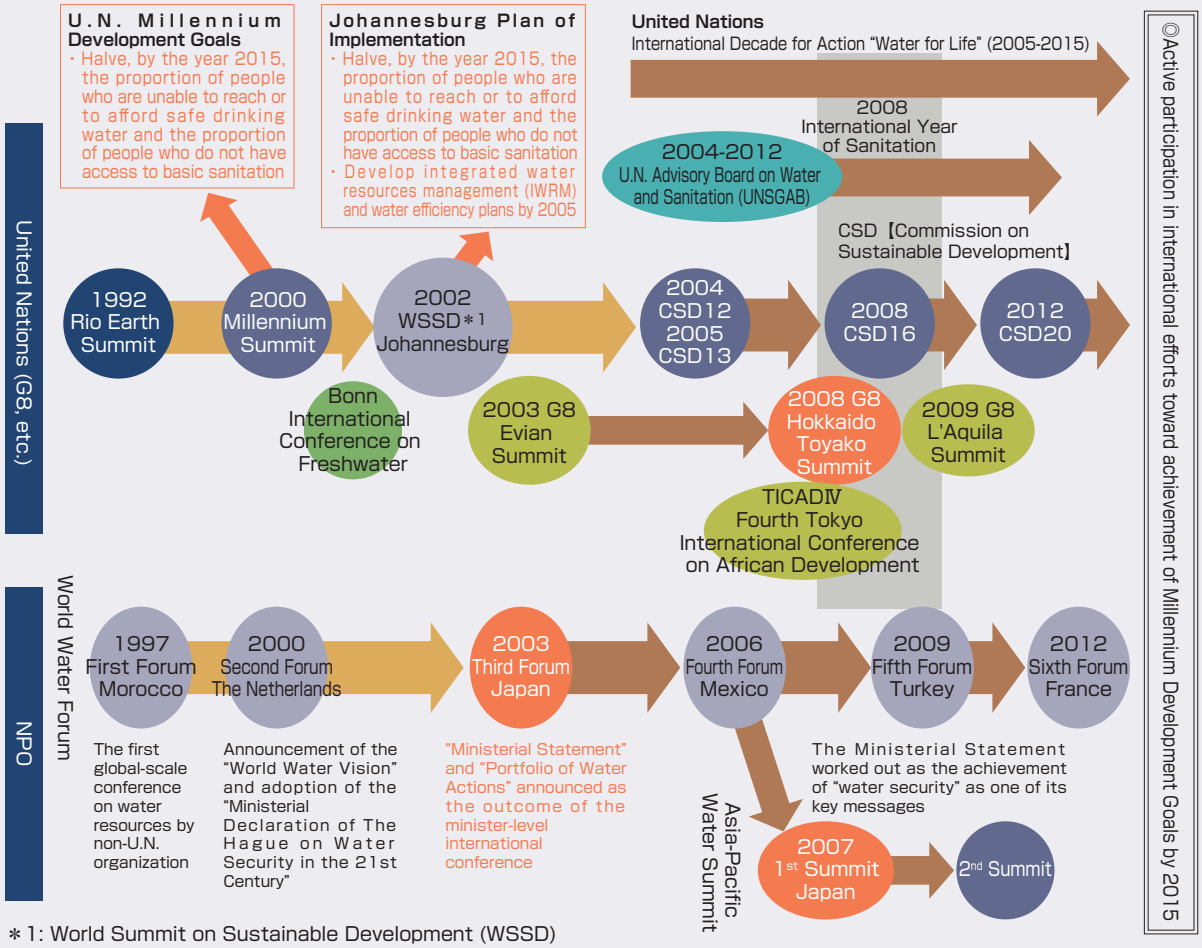
Figure4-2-4 Rate of Access to Basic Sanitation

○2.62 billion people (42%) do not have access to basic sanitation around the world (of them, 97% are in developing countries)
○Areas with the low access rate are in sub-Saharan Africa (37%), South Asia (37%), East Asia (51%), etc.
○Improvements in sanitation lagging particularly in rural areas, with the achievement of MDGs by 2015 seen difficult



Source: WHO/UNICEF

Figure4-2-5 Flow of Global Discussions on Water Resources



＊1: World Summit on Sustainable Development (WSSD)
Source: Water Resources Department, Land and Water Bureau, Ministry of Land, Infrastructure, Transport and Tourism

(2) Comprehensive and integrated water management

There have been movements toward comprehensive and integrated water management for effective utilization of limited water resources, through cooperation among countries in each region and coordination among countries in each hydrographic basin. The Johannesburg Summit in 2002 called upon each government to "develop integrated water resources management (IWRM) and water efficiency plans," and such plans are internationally recognized as effective methods to solve water and sanitation problems. In March 2009, in order to encourage countries to develop such plans, UNESCO coordinated efforts to work out "The Integrated Water Resources Management (IWRM) Guidelines at River Basin Level."

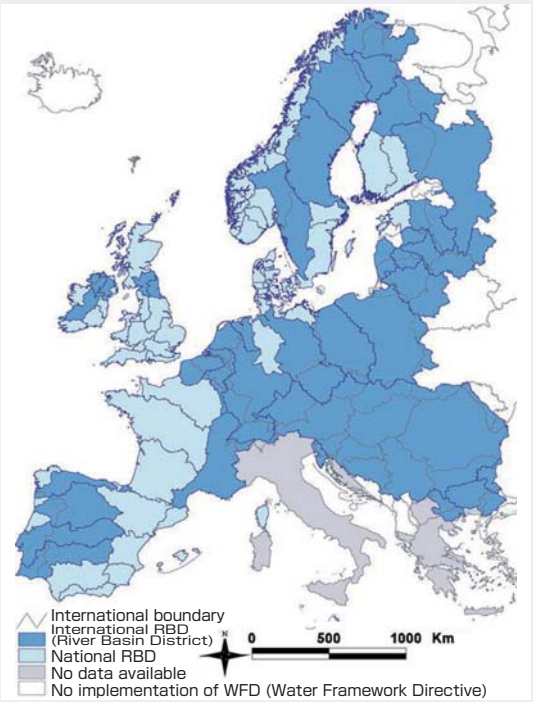
a) Example of Europe

In Europe, as a method of integrated water resources management, the EU Water Framework Directive (WFD) has been introduced. The WFD is designed to achieve, through unified water management, protection of human health by the supply of drinking water and bath water with adequate quality, building of sustainable water management system, protection of aquatic ecosystems and related regional ecosystems, and mitigation of the effects of floods and droughts. To that effect, measures called for under the WFD are characterized by integrated efforts by various water-related sectors, participatory approaches involving various interested parties and river basin management plans developed on the basis of respective river basins instead of administrative areas. What should be implemented to achieve the goals are primarily the following four points:

- Establish a framework for protection to manage water resources such as inland surface waters, estuary waters, wetlands, brackish waters, coastal waters and groundwater, etc. along circulations in nature;
- Prevent environmental deterioration in river basin water systems as a whole and improve them;
- Progressively reduce or cease discharges and consumption of priority substances, and preserve and improve the aquatic environment; and
- Progressively improve the quality and quantity of groundwater.

The WFD also requires EU members to develop river basin management plans for all river basins throughout the EU territory by 2009 to push forward with management efforts (Figure 4-2-6). The WFD implementation process is as follows:

Figure4-2-6 Basin Map for River Basin Management Plans in Europe



Source: BioOne website

<WFD implementation process>

By December 2003 EU Water Framework Directive (WFD) comes into effect; transposition of WDF into national legislation

↓

By December 2006 Development of operational monitoring programs as the basis for water management

↓

By December 2008 Development of river basin management plans (draft)

↓

By December 2009 Development of river basin management plans (approval by the European Commission (EC))

↓

By December 2015 Implementation, evaluation and adjustment of river basin management plans

b) Example of Australia

In Australia, irrigation and other measures have been taken in the Murray-Darling river system as broad-based water management (Figure 4-2-7). The governments of relevant states have been managing water resources in the river basin over more than 100 years. In recent years, however, droughts have taken serious proportions due to decreased precipitation since 2000, causing sharp drops in yields of wheat and other crops due to water shortages and poor growth of pasture grass that is having an adverse impact on cattle rearing. As precipitation continued to decline, river flows are likely to decrease further going forward. Despite these poor conditions, the relevant state and territory governments responsible for water resources management continued to grant water

rights excessively and water users also continued to overexploit water resources, rendering water resources management for solving problems difficult, a situation that called for a system under control of the federal government. Under these circumstances, federal Prime Minister John Howard in January 2007 announced the National Water Security Plan for Cities and Towns. The plan was designed for drastic improvement of water resources management across the country, with the federal government spending 10.05 billion Australian dollars (about ¥950 billion at the prevailing exchange rate then), including an overhaul program for irrigation pipes in the Murray-Darling river system. As the plan included the transfer of some powers related to water resources management from states to the federal government, the discord between the federal and state governments also drew attention. In September 2007, the Water Act 2007 was enacted with provisions for the partial transfer of powers related to water resources management in the Murray-Darling river system to a federal government agency. Based on this act, the Murray–Darling Basin Authority was established as an independent agency made up of experts and responsible for preparing an integrated management plan for water resources of the vast Murray-Darling Basin. As the basin management plan includes the establishment of limits on integrated and sustainable use of surface water and groundwater, identification of climate change and other risks to water resources in the river system and a strategy for managing such risks, an indication that the independent agency has been given the functions and powers necessary for management of water resources in the basin in an integrated and sustainable manner. Thus, the Australian government has established, albeit partially, a framework for a federal agency to manage water resources, previously the preserve of state governments and other related parties.

Figure4-2-7 Murray-Darling Basin Map

Source: Murray River Tourism

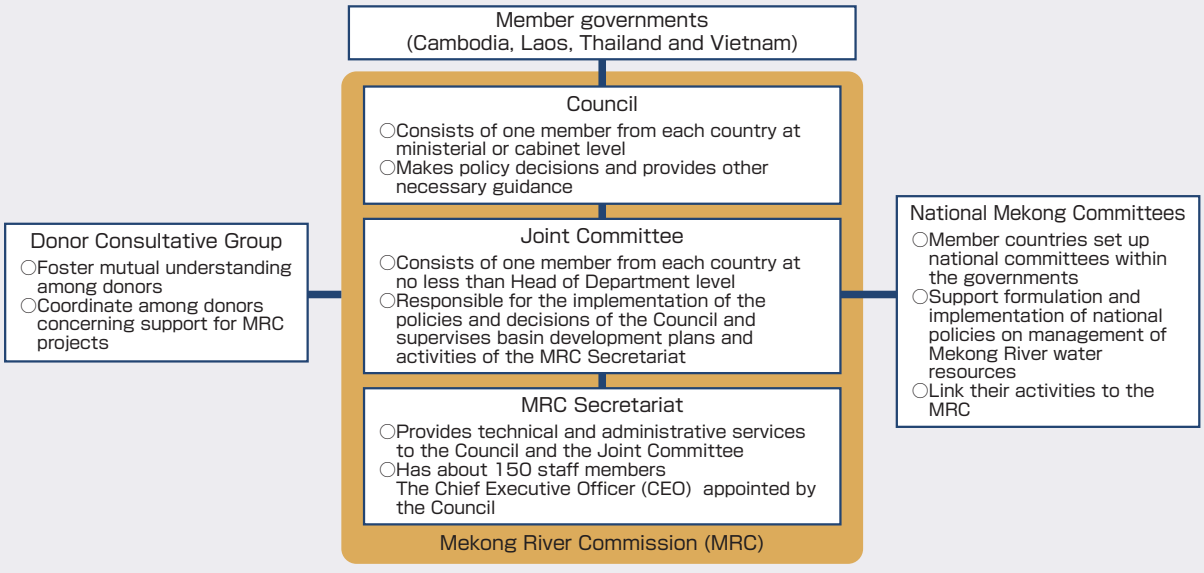
c) Example of Asia

In February 2004, the Network of Asian River Basin Organizations (NARBO) was established by such entities as the Japan Water Agency, an incorporated administrative agency, the Asian Development Bank (ADB) and the Asian Development Bank Institute (Figure 4-2-8). NARBO, which now comprises 71 organizations

Figure4-2-8 Organizations Comprising the Network of Asian River Basin Organizations (NARBO)

Source: Network of Asian River Basin Organizations (NARBO)

Figure4-2-9 Outline of the Mekong River Commission (MRC)

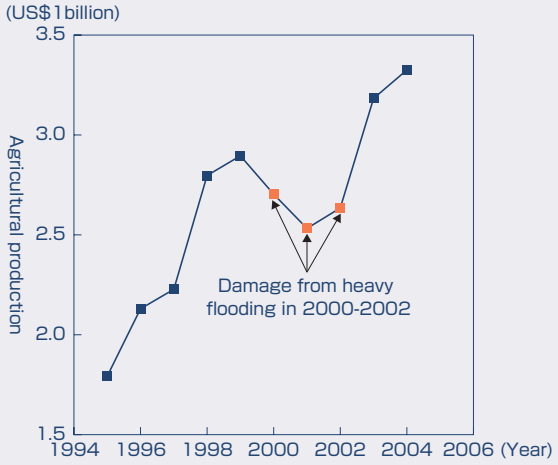


Source: Water Resources Department, Land and Water Bureau, Ministry of Land, Infrastructure, Transport and Tourism

from 16 countries, is designed to serve as a knowledge partner to provide information to river basin organizations and government institutions for the promotion of integrated water resources management (IWRM) in river basins in Asian countries and also function as an institution to offer training and other services for the promotion of IWRM.

Separately, at the initiative of Japan (Ministry of the Environment), the Water Environment Partnership in Asia (WEPA) was established by 11 countries in East Asia (Cambodia, China, Indonesia, Korea, Laos, Myanmar, Thailand, Malaysia, the Philippines, Vietnam and Japan) for the purpose of strengthening environmental governance in the region, providing support for relevant countries in their policy implementation by carrying out construction of information database, information sharing among stakeholders, and human resources development and capacity building in an integrated manner. Currently, efforts are under way for information base development, human resources development and policy implementation as well as strengthening and enhancement of aquatic environmental governance in the Asian monsoon region.

Figure4-2-10 Vietnam's Agricultural Production in the Mekong Delta (1995-2004)



Source: Mekong River Commission (MRC)

One example of IWRM initiatives in Asia is the Mekong River, which has multiple countries in its basin. The governments of Cambodia, Laos, Thailand and Vietnam established the Mekong River Commission (MRC) in 1995 (Figure 4-2-9) to regulate water use for the purpose of sustainable development in the entire basin. Achievements of MRC activities in recent years include the establishment of the flood management and mitigation program (FMMP) to mitigate damage from flooding in the Mekong basin. The MRC is building the flood database and providing training and other programs for enhancing management capabilities in order to achieve effective cooperation. These efforts, coupled with river development in the 1990s, helped Vietnam increase agricultural production in the Mekong delta from US$1.75 billion (about ¥154.8 billion) in 1995 to US$3.3 billion (about ¥291.9 billion) in 2004 (Figure 4-2-10). Similarly, farm production in Phnom Penh, Cambodia, in the Mekong basin has also increased.

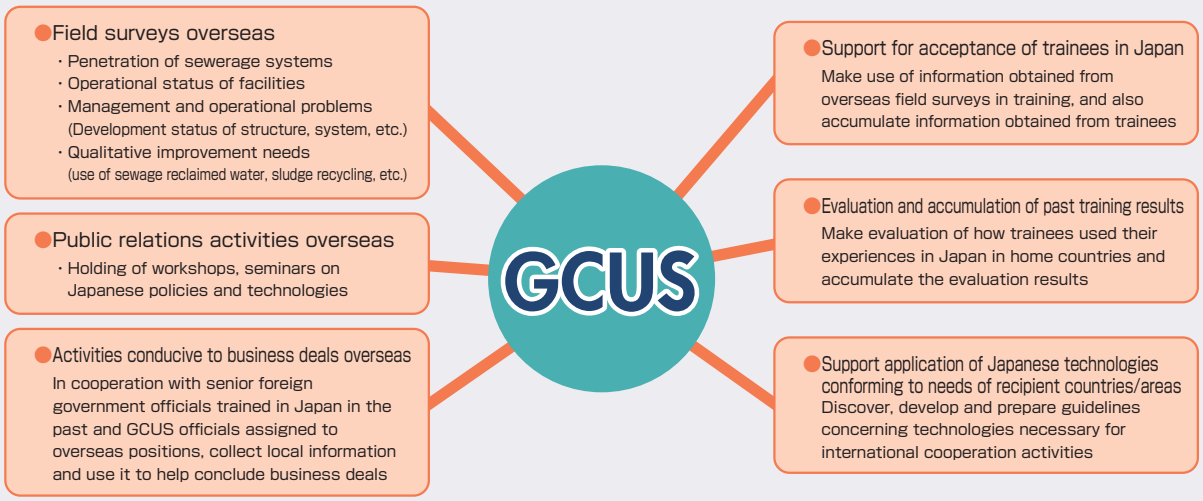
d) Japan's international contribution

Global water problems cannot be solved with efforts by a limited number of countries in limited areas alone. Going forward, Japan needs to actively contribute by offering technical cooperation for the achievement of MDGs as its coordinated efforts on water problems.

For example, the Japan Global Center for Urban Sanitation (GCUS) was established in April 2009 for the purpose of undertaking activities to spread sustainable sewage systems overseas by mobilizing knowhow and expertise held by Japan's industry, academic and public sectors on the sewage system.

GCUS has the three specific objectives: 1) international contribution to solving global water and sanitation problems; 2) support business activities of sewage-related companies; and 3) transposition of overseas experiences into sewage-related policy measures at home. GCUS supports international cooperation activities by the Japan International Cooperation Agency (JICA) and other institutions, while it also consolidate results of overseas field surveys, information on

Figure4-2-11 Activities of Global Center for Urban Sanitation (GCUS)



Source: Global Center for Urban Sanitation (GCUS)

international cooperation activities and information on human resources and technologies in Japan and build the network of sewage-related organizations in Japan and abroad (Figure 4-2-11).

It is also necessary for the Japanese government, businesses and citizens alike to take on the role of sending messages on leading-edge initiatives to the world on efforts to tackle global warming as well as activities to conserve the aquatic environment and diffusion and educational efforts related to such activities.

Column Restoration of the Cheong Gye Chon River in Seoul

The Cheong Gye Chon River, which runs from east to west through the central part of South Korea's capital city, had been gradually slipping away from the memory of Seoul citizens. Because of the progressive contamination, the river had become a hotbed of contagious diseases. Construction work to cover the river continued over some 20 years between 1958 and 1978, and the 16-meter-wide Cheong Gye elevated highway was then built over the river cover for a total length of 5.8 kilometers. Together with the Cheong Gye road that runs under it, the highway served as the artery of Seoul, carrying some 170,000 automobiles a day.

About 20 years since then, calls grew among citizens for the restoration of the Cheong Gye Chon River. In 2003, the Seoul mayor, Mr. Lee Myung-bak, who is now president of the country, decided to bring down the degraded highway and developed the hydrophilic space by planting trees along the river.

Currently, the riverside provides a comfortable recreation area for Seoul citizens, and the restored Cheong Gye Chon River has become one of the best-known tourist spots in the sightseeing city of Seoul.

Photo4-1-4 Restoration of the Cheong Gye Chon River

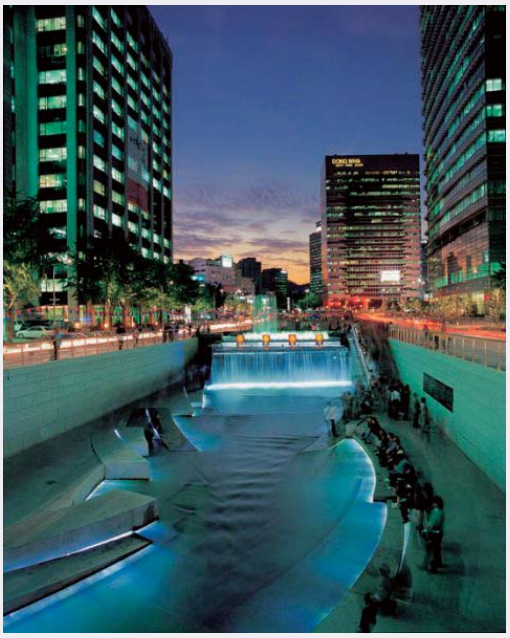


Photo: Seoul City

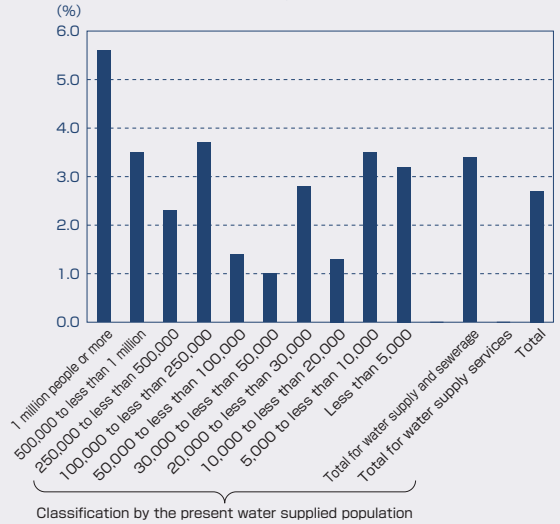
3 Efforts and Measures in Japan

(1) Aquatic infrastructure

a) Measures to cope with decrepit facilities

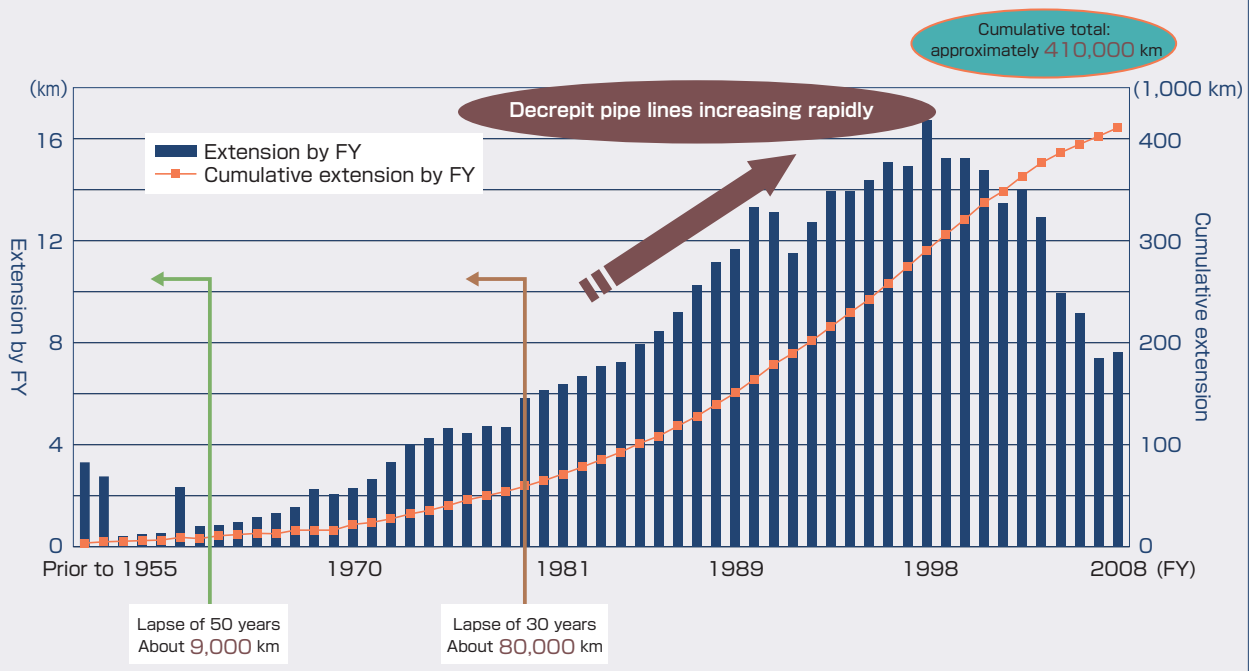
Waterworks and sewage systems in Japan had been constructed rapidly during the high growth period. Many of them are now becoming decrepit. In order to forestall accidents or failures due to aging facilities and use water resources effectively and appropriately, it is necessary to carry out well-planned replacement or reconstruction of water-related infrastructure, including measures to prolong the life of existing facilities from the early years of the 21st century, also giving heed to the perspective of minimizing life cycle costs (Figure 4-2-12). Water supply systems across Japan have the combined water-purifying capacity of some 88 million cubic meters per day, with the water-purifying capacity of facilities past the statutory useful life standing at some 2.4 million cubic meters per day, or about 2.7% of the total (Figure 4-2-13). The total extension of water conduits, water pipes and distributing pipes runs about 610,000 kilometers, with the extension of these pipes past the statutory

Figure4-2-13 Water Purification Capacity Past Statutory Useful Life in FY 2007



Note: The total water-purifying capacity stands at some 88 million cubic meters per day, with the water-purifying capacity of facilities past the statutory useful life standing at some 2.4 million cubic meters per day, or about 2.7% of the total
Source: Health, Labour and Welfare Ministry, "Water Works Statistics"

Figure4-2-12 Extension of Sewage Pipe Lines by FY (Nationwide)



Source: Sewerage and Wastewater Management Department, City and Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism

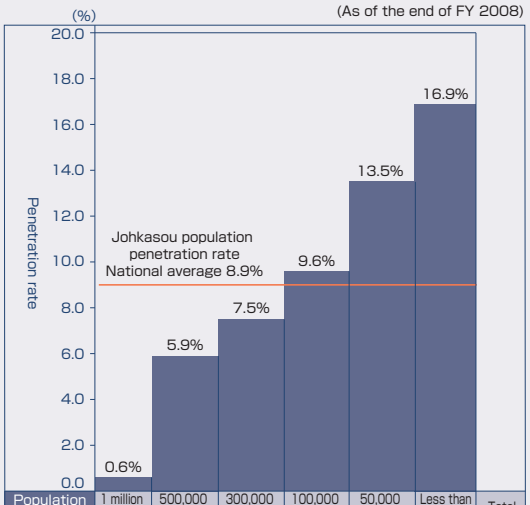
useful life coming to about 38,000 kilometers, or some 6.3% of the total extension.

b) Spread of Johkasou

The Water Quality Pollution Control Act provides for the promotion of measures to treat domestic sewage as well as for regulations on waste water discharges from factories and business offices and underground permeation.

In Japan, particularly in intermediate and mountainous areas, the declining population density stemming from the decreasing population and the progressing aging of residents led to drops in the diffusion ratio of sewage system treatment population particularly in municipalities with the population of less than 50,000, underscoring the widening problem of domestic sewage treatment. Under these circumstances, Johkasou are spreading. Johkasou, individual waste water treatment facilities can treat wastewater efficiently even in areas with small populations. As they are compact, it is easier to install them. Because of these advantages, Johkasou are now being introduced into intermediate and mountainous areas as an important means of treating domestic sewage (Figure 4-2-14). The transfer and spread of this technology to developing countries, which often cannot afford to introduce expensive, large-scale water treatment equipment, while ensuring the protection of intellectual property rights, can be one of forms of Japan's visible international contributions.

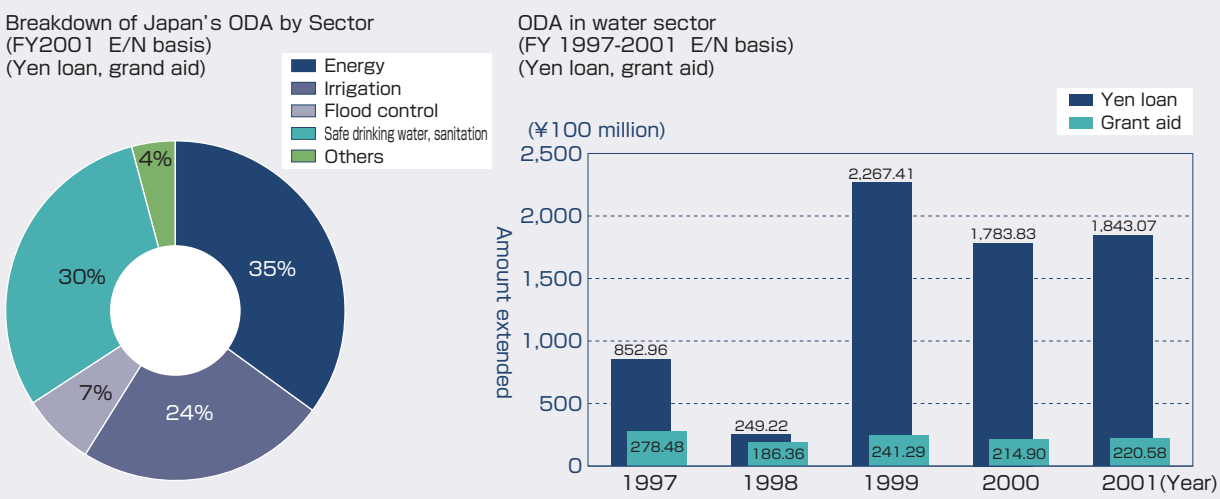
Figure4-2-14 Penetration Rate of Johkasou by city size



Population size	1 million or more	500,000 to 1 million	300,000 to 500,000	100,000 to 300,000	50,000 to 100,000	Less than 50,000	Total
Total population (10,000)	2,766	1,040	1,776	3,048	1,892	2,185	12,708
Composition ratio	21.8%	8.2%	14.0%	24.0%	14.9%	17.2%	100%
Penetration population (10,000)	15	61	132	293	256	370	1,127
Penetration rate	0.6%	5.9%	7.5%	9.6%	13.5%	16.9%	8.9%
Number of municipalities	12	15	46	190	271	1,244	1,778
Composition ratio	0.7%	0.8%	2.6%	10.7%	15.2%	70.0%	100%

Note 1: The total number of municipalities of 1,778 is broken down into 784 cities, 802 towns and 194 villages (wards in Tokyo are included in cities)
2: The total population and penetration population may not add up due to rounding
Source: Ministry of the Environment

Figure4-2-15 Breakdown of Japan's ODA by Purpose



Source: Japan's ODA on Water – Japan's Contributions to the Resolution of Water Issues (Ministry of Foreign Affairs brochure)

(2) Organizations, partnerships and measures to tackle water problems

a) Japanese organizations and measures involved with water problems

As water problems involve policy measures in a variety of fields, the Japanese government organizes a liaison conference among ministries and agencies involved in water problems, bringing together the Cabinet secretariat, one office and 12 ministries and agencies for better policy coordination through exchanges of information and views on water problems at home and overseas. Japan also provides much international support in water and sanitation fields through official development assistance (ODA) (Figure 4-2-15). Aside from the quantity side of Japanese ODA in these fields, which accounts for about 40% of global assistance, the ratio of untied aid is very high, demonstrating the fair and exemplary nature of Japanese assistance.

b) Task Force on Water Environment Strategies

In January 2010, the Ministry of the Environment established Task Force on Water Environment Strategies, chaired by Parliamentary Secretary of the Environment Nobumori Otani. The taskforce is investigating into policy issues for the conservation of the aquatic environment and also discussing not only domestic administrative issues but also ways of internationally contributing to solving global water problems. Regarding international contributions as of urgency, the taskforce is considering Japan's support for Asia and Africa facing serious water shortages in such areas as water quality purification and sanitation measures.

c) Water Environment Partnership in Asia

As an initiative proposed by the Ministry of the Environment at the 3rd World Water Forum held in 2003, under the partnership among 11 countries in East Asia, we are providing support for relevant countries in their policy implementation by carrying out construction of information database, information sharing among stakeholders, and human resources development and capacity building in an integrated manner for the purpose of strengthening environmental governance in the region.

The WEPA (Water Environment Partnership in Asia) database Japan provides consists of four databases on "policy information," "water environment conservation technology," "information on NGO and CBO activities" and "information on information sources," offering basic background information for policy development and implementation.

d) Japan-China water environment partnership

In April 2007, Japan signed the "Joint Statement by Japan and the People's Republic of China on the Further Enhancement of Cooperation for Environmental Protection" with China, where water contamination has become a problem of urgency. The statement, on the first area of bilateral cooperation, says, "Cooperation will be implemented … in particular water pollution prevention measures in vital waters …" In May 2010, the two countries concluded the "memorandum of understanding on the implementation of cooperation in the model project for decentralized wastewater treatment in rural areas, etc.," which called for efforts for the penetration of compact wastewater treatment systems suited to local conditions in each of decentralized rural communities. Under these agreements, the Chinese government is pushing ahead with efforts to spread wastewater treatment systems to rural villages. Japan is cooperating with China in holding seminars and policy dialogue, making demonstrative research on wastewater treatment technology through model projects, evaluation and analysis of outcome, and considering management guidelines and measures to spread these systems.

Column Restoration of Riparian Areas by *"Fuyu Mizu Tanbo"*

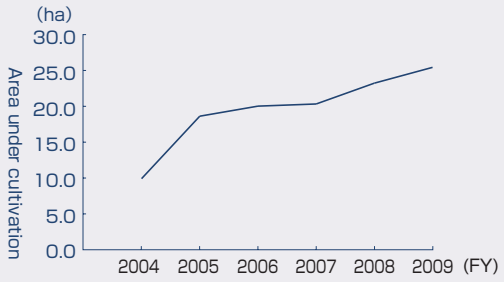
Around Izunuma and Uchinuma straddling Tome City and Kurihara City in the north of Miyagi Prefecture and also Kabukurinuma in Osaki City of the same prefecture, all registered wetlands under the Ramsar Convention, rice paddies after harvesting are flooded with water during winter. These paddies are called "*fuyu mizu tanbo*," literally rice fields covered with water throughout winder.

The "*fuyu mizu tanbo*" rice-growing method is practiced across Japan, though on a limited scale, as an environment-friendly method as it does not use agricultural chemicals or other chemical substances.

Come spring, rice farmers can plant seedling without tilling as required in the conventional way of rice growing. Keeping rice paddies flooded during winter precludes the need to take in large quantities of water right before planting, thus avoiding concentrated water intake in a short span of time and promoting effective utilization of water resources.

These wetlands are wintering places for migratory waterfowls. Rice paddies flooded with water during winter offer good roosts for these birds, and they in turn play an important role in promoting biodiversity of rice paddies as their dung encourages propagation of microorganisms.

"Fuyu Mizu Tanbo" Area under Cultivation in Tajiri, Osaki City (Formerly Tajiri Town)



Source: Industry Promotion Section, Tajiri General Branch, Osaki City

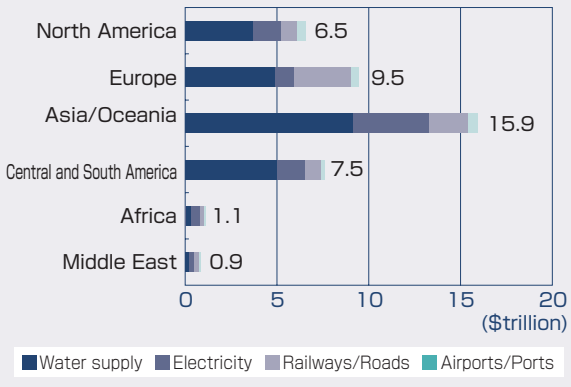
Rice fields adopting the "*fuyu mizu tanbo*" method are expanding, particularly around Kabukurinuma. This is not an easy way of growing rice, but expanding acreage evidently show rice farmers' endeavors to coexist with nature.

Section 3 International Contribution and Water Business

1 State of Global Water Business

The world water business market is estimated to grow to ¥100 trillion by 2025, with $22.6 trillion of investment in water-related infrastructure expected between 2005 and 2030, according to the Council on Competitiveness-Nippon (COCN) (Figure 4-3-1). While the market for the supply of membrane materials, an area Japan excels in, is only about ¥1 trillion, and the market for water purification systems, including membrane engineering, procurement and construction, is just about ¥10 trillion, the dominant area of the global water business market is management, such as facility management and operations for water intake, raw water transmission, water purification and water distribution. Japan has excellent technologies, but there are only a modest number of examples of Japanese entities moving into the water management market. Given successes of European and Asian companies in this market, it is desired that Japanese firms will also enter this vast and promising market aggressively. Japan has excellent technologies that contribute to environmental conservation and effective utilization of resources, including wastewater treatment and leakage prevention technologies. It is necessary for Japan to promote efforts in the water business market going forward through deeper cooperation among the industry, academic and public sectors.

Figure4-3-1 Projected Infrastructure Investment by Region (2005～2030)



Source: Morgan Stanley Flash Report (February 2009)