# SUPPORTING

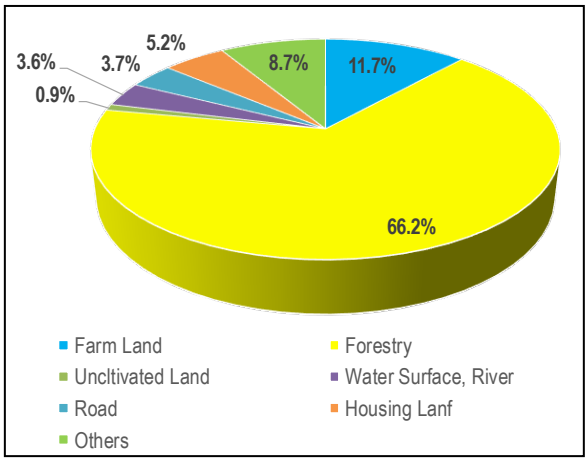
# LAND OF JAPAN AND HISTORY OF WATER RESOURCES MANAGEMENT

**Reference Document**

# 1. Overview of Japan

## 1.1 Land

Japan is an archipelago extending from north to south, with a land area of approximately 378,000 km$^2$ spread across the subarctic and subtropical zones. The vast majority of Japan's land area is mountainous, with forests occupying approximately two-thirds of the country's land. The mountainous terrain is rugged, and only 30% of the land area is inhabitable (Figure 1.1).



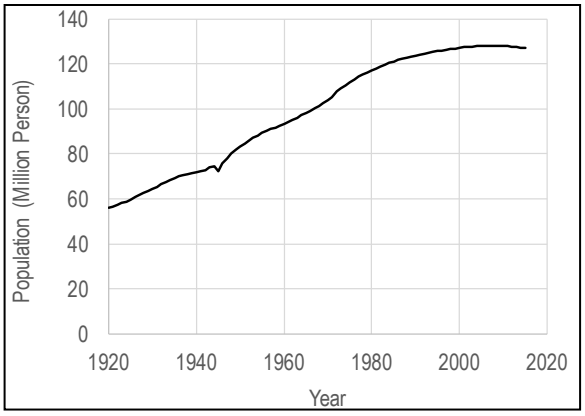

Source: Ministry of Land, Infrastructure, Transport and Tourism

**Figure 1.1 Land Use in Japan**

## 1.2 Population

Japan's current population is estimated at 126,127 thousand (October 2019), and Figure 1.2 shows the population trend. Japan's population peaked at 128 million in 2008 and has been on a downward trend since then. Approximately 50% of Japan's total population lives within 50 km of the urban centers of Tokyo, Nagoya, and Osaka (located in the alluvial plain) (approximately 6% of the total land area).

In addition, due to aging, the average life expectancy of Japanese people is currently estimated at 81.25 years for men and 87.32 years for women (2018).[1]




Source: Statistics Bureau

**Figure 1.2 Trends in Japan's Total Population**

## 1.3 Precipitation

Japan is located on the eastern edge of the Asian Monsoon region, one of the world's heaviest rainfall areas recording annual average precipitation of 1,668 mm (average from1986 to 2015), which is about 1.6 times higher than the world (land area) average annual precipitation of about 1,065 mm, according to the Food and Agriculture Organization's (FAO) AQUASTAT database. The annual average precipitation in each region is shown in Table 1.1. The precipitation and temperature at various locations in Japan are shown in Figure 1.3.

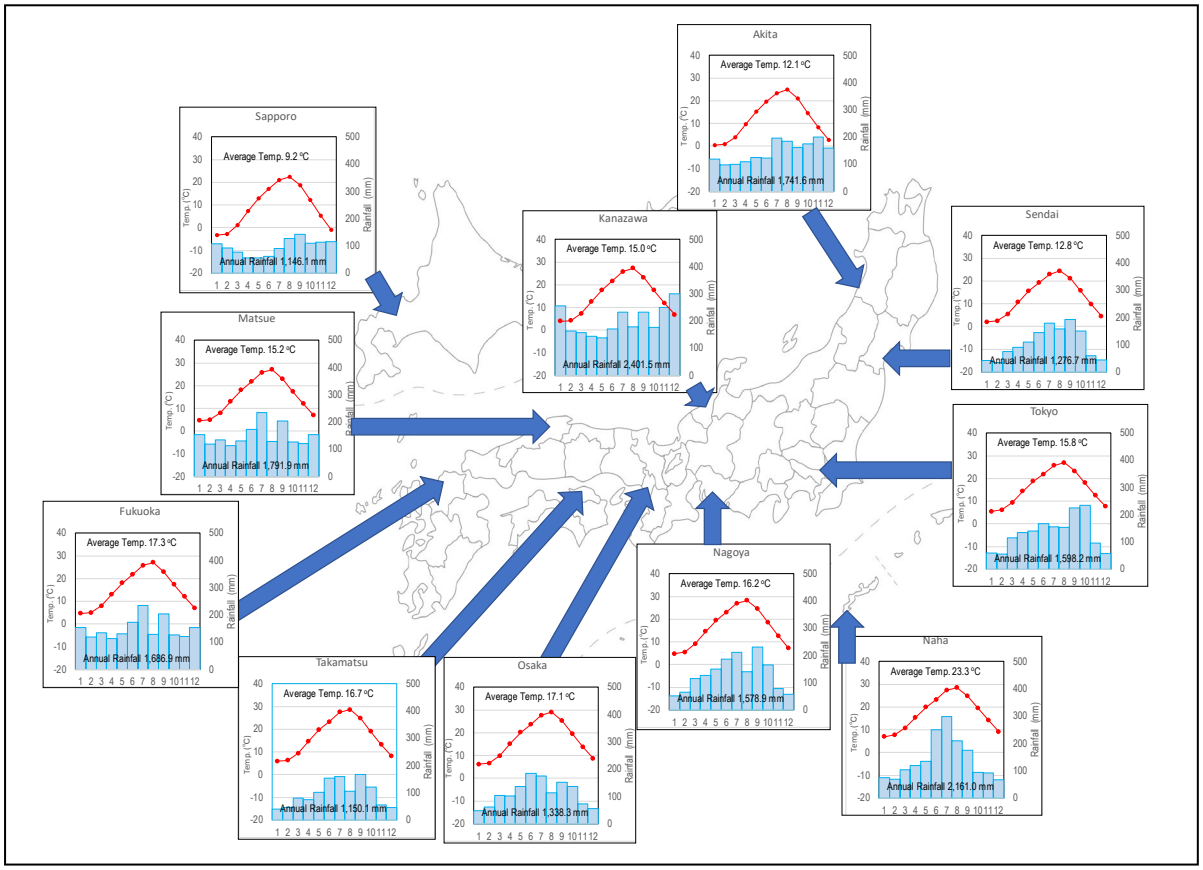
[1] Ministry of Health, Labor and Welfare, Simplified Life Tables.

**Table 1.1 Annual Average Precipitation by Region**

(Unit : mm/year)

| Region | Precipitation | Region | Precipitation | Region | Precipitation |
|---|---|---|---|---|---|
| Hokkaido | 1,148 | Hokuriku | 2,333 | Kyusyu | 2,299 |
| Tohoku | 1,652 | Kinki | 1,791 | Okinawa | 2,086 |
| Kanto | 1,608 | Chugoku | 1,694 | | |
| Tokai | 2,037 | Shikoku | 2,202 | | |

Source: 2019: Current Status of Water Resources in Japan, MILT




Source: Prepared by Project Research Team based on Data from Japan Meteorological Agency

**Figure 1.3 Monthly Precipitation and Temperature in Japan**

## 1.4 Water Resource Potential

Japan's water resource potential is approximately 420 billion $m^3$/year (average from 1986 to 2015: "average water resource potential"). During periods of low rainfall, which occurs approximately once every 10 years, the water resource potential is approximately 290 billion $m^3$ (drought year water resource potential), or 69% of the average water resource potential.

The ratio of drought-year water resources potential to average water resources is lower in the Kinki, Sanyo, Shikoku, Kyushu, and Okinawa regions and larger in the Hokkaido, Tohoku, Kanto, Tokai, Hokuriku, and Sanin regions. Water resource potential per person is lower in the Kanto Coastal Area, Kinki Inland Area, Kinki Coastal Area, Sanyo, Kitakyushu, and Okinawa than entire Japan, and larger in Hokkaido, Tohoku, Tokai, Hokuriku, Sanin, Shikoku, and Southern Kyushu.

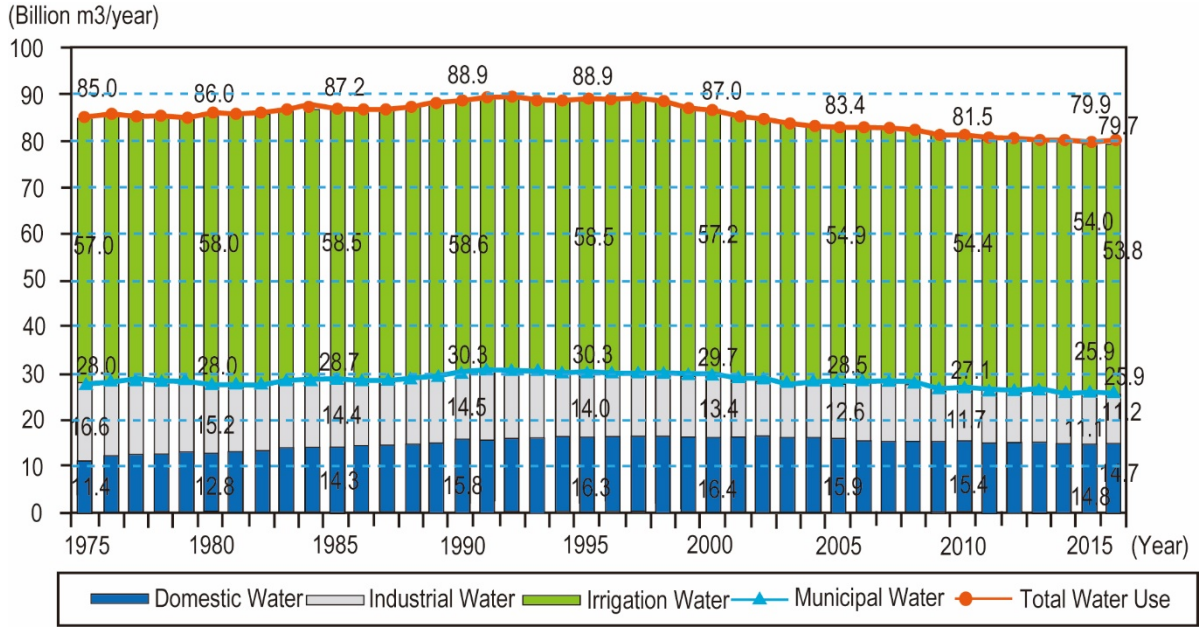
According to FAO AQUASTAT data, water resources potential per person in Japan is about 3,400

$m^3$/person/year, which is less than half the world average of approximately 7,300 $m^3$/person/year.

## 1.5 Water Use and Government Agencies

In 2016, nationwide water use (on an abstraction basis) was 80 billion $m^3$/year, with urban water use at approximately 25.9 billion $m^3$/year and irrigation water use at approximately 53.8 billion $m^3$/year. Figure 1.4 shows the water use trends in Japan.

Table-1.2 shows the relevant administrative agencies for these water uses.




Note: 1. Preparation by Water Resources Department, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
2. This value is based on the amount of water intake, as estimated by the Water Resources Department, and includes the amount of water returned to rivers after use.
3. Industrial water is the amount of fresh water supplied to factories with four or more employees. However, this does not include water used in public utilities.
4. For agricultural water, the values for 1981–1982 are 1980 estimates, values for 1984–1988 are 1983 estimates, and values for 1990–1993 are 1989 estimates.
5. Sometimes the totals do not add up due to rounding.

Source: 2019: Current Status of Water Resources in Japan, MILT

**Figure 1.4 Water Use Trends**

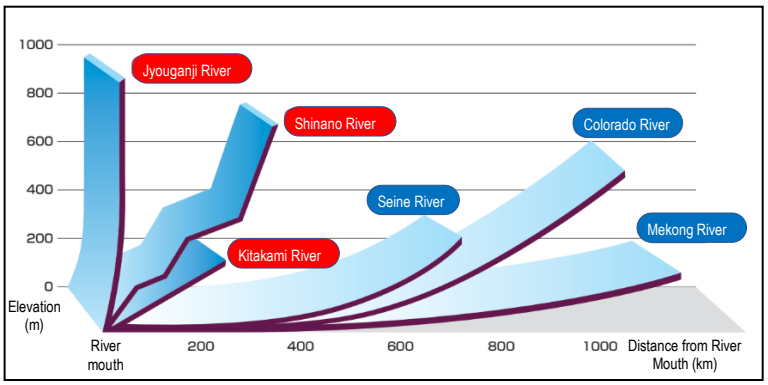
**Table 1.2 Water Use and Government Agencies**

| | Tap Water | Industrial Water | Irrigation Water | Power Generation |
|---|---|---|---|---|
| National Level | Ministry of Health, Labor, and Welfare | Ministry of Economy, Trade, and Industry | Ministry of Agriculture, Forestry and Fisheries | Ministry of Economy, Trade, and Industry |
| Prefecture Level | Water supply business to municipalities may be conducted | Implemented industrial water supply project | | |
| City, Town, and Village Level | Implemented a project to supply water to each household | | | |
| | | | Farmers associations manage water supply | |

Note: If the water supply source is a river, the user must obtain permission from the river administrator.
Source: Project Research Team

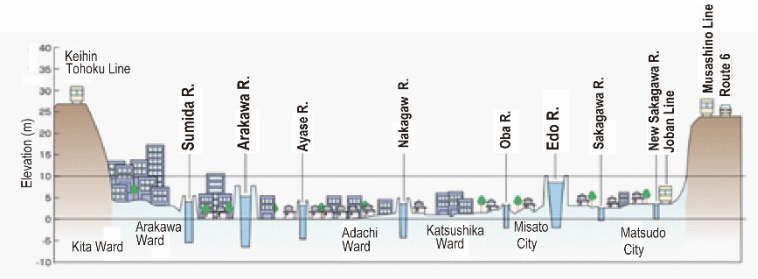
## 1.6 River

Japan is an island nation with a few plains and several steep mountainous areas, and the country is narrowly divided by a series of small rivers. The Tone River, the largest river in Japan, has a basin area of 16,840 km$^2$ and accounts for only 4.5% of the total land area. In Japan, only four rivers (Tone, Shinano, Ishikari, and Kitakami) have a basin area of more than 10,000 km.$^2$




Source: Ministry of Infrastructure, Land, Transportation, and Tourism

**Figure 1.5 River Slope**




Source: Ministry of Land, Infrastructure, Transportation, and Tourism

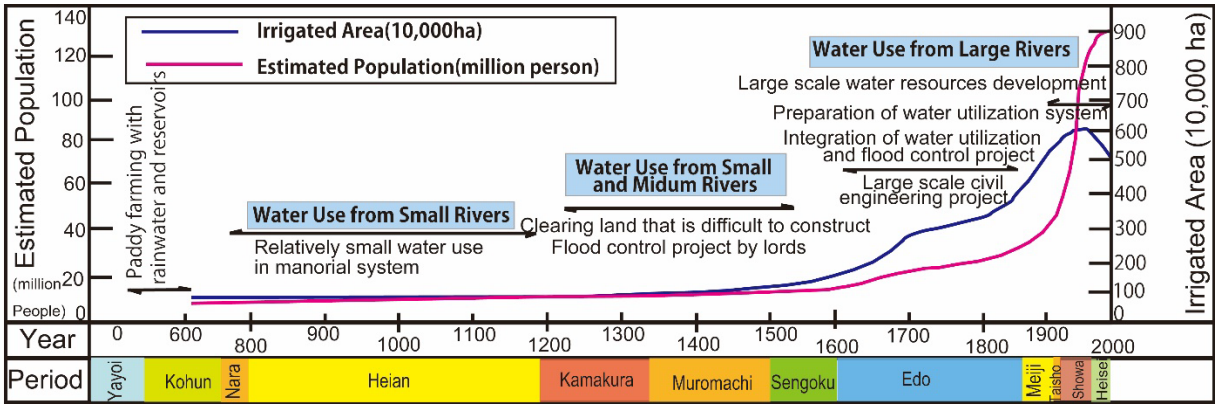
**Figure 1.6 Location of the Edogawa, Arakawa, and Sumida Rivers in Tokyo**

Comparing the longitudinal slope of rivers, the longitudinal slope of Japanese rivers is steeper than that of continental rivers (Figure 1.5). This is due to active localized rising and sedimentation caused by orogenic movement, similar to rivers on islands and peninsulas of the Asia-Pacific. The major rivers in Asia, such as the Yangtze, Ganges, Indus, and Mekong Rivers, also have steep gradients because of the steep mountainous terrain caused by orogenic movements in the upper reaches, but the gradient from the origin to the river mouth is extremely gentle owing to the wide alluvial plains formed in the middle and lower reaches by the confluence of many branch rivers. Rivers in Japan are similar to the upstream branches of continental rivers, and river water flows immediately into the sea. Therefore, the scale of the alluvial plain is small, and the river becomes a rapid stream. As the population and assets are concentrated in the alluvial plain formed in the middle and lower reaches of the river, flood protection measures are extremely important because once a flood occurs, the destructive power of the river is high and flood damage is enormous. As shown in Figure 1.6, many rivers in Tokyo flow at elevations higher than the city center, which tends to increase the damage caused by flooding.

## 2. History of Water Resources Development and Management in Japan

### 2.1 Ancient Times

Paddy rice, the staple food of Japan, was introduced via tropical Asia during the early Yayoi period (around the 3rd century BC). Rice cultivation is believed to have spread gradually northeastward from Kyushu and across all regions. Paddy fields have been chosen for wetlands in the lower reaches of rivers, coastal sandbars, and deltas. However, to protect paddy fields from flooding and to increase crop yields as much as possible, people have to rely on flood protection and water utilization technology. With the spread of rice cultivation, paddy fields have been developed in various areas, and civil engineering technologies for flood protection and water utilization have gradually developed. Figure 2.1 shows the changes in population, irrigated area, and water use.




Source: Partial excerpt and revision of Farmland and Water in Japan Ministry of Agriculture, Forestry, and Fisheries

**Figure 2.1 Changes in Population and Cultivated Area**

**Japan's first recorded water resource development project[2]**

In Kadoma City, Osaka Prefecture, Manda Levee is believed to be the first recorded river improvement work in Japan. Emperor Nintoku established the capital at Namba in 313 CE, after which Yodo River improvement works began. According to the Chronicles of Japan, during the 11th year of Emperor Nintoku's reign, the Manda Levee (flood control project) was constructed at the end of the Yodo River, and excavation works of the Namba no Horie (present Tenma River) began. The Namba no Horie was constructed to prevent riverbed aggradation and drainage improvement of farmland areas by preventing sediment inflow from upstream regions.

### 2.2 Yamato Period (4th century to early 8th century)

During the Yamato period, continental culture (Chinese culture) was introduced along with Buddhism, and irrigation water use technologies, such as ponds, were brought from the continent, and this initiated the development of civil engineering technology in Japan. During the Sui and Tang Dynasty (618–907

[2] History of Modern Japanese Civil Engineering, Second Edition, Takahashi Hirosi

CE), monks who traveled to the continent (present-day China) to study brought not only Buddhism but also continental culture and civil engineering technology directly to Japan.

**Performance of Gyoki**

Gyoki (668–749 CE), a Japanese Buddhist priest of the Nara period, built flood protection facilities and ponds to secure water in the Kinki region. Gyoki's projects were implemented by a large number of civilians (Gyoki's group) called the Aribasho, who sympathized with Gyoki's desire to execute projects to save people in need.

Irrigation ponds that remain today are the Kumeda, Sayama, and Konyo. A spillway and levee were constructed around 730 CE to prevent floods from entering arable lands on the left bank of the middle and lower reaches of the Yodo River further downstream.

In addition to Gyoki, Kukai, a monk who studied in China, also implemented civil engineering projects in various areas, mainly irrigation ponds, including the Mannoike Pond.

### 2.3 Heian Era to Muromachi Era (Early 9th Century–Late 15th Century)

Civil engineering began to decline in Japan around the 9th century, peaking during the 10th century and continuing into the 11th century, when there was a blank period for civil engineering projects. The reason for this decline is attributable to decentralized government power, and it became difficult to execute large-scale civil engineering projects because of the change in agricultural land development from the Ritsuryo system to the manorial system, and no new power emerged even though the ruling class lost power during the late Heian period, when monks executed civil engineering projects.

### 2.4 Warring States Era: Azuchi–Momoyama Era (16th Century)

The distinguished warlords during the Warring States period—a period marked by civil war and social upheaval were leaders of civil engineering projects. First, they responded to the expectations of their subordinates by constructing civil engineering projects in their respective territories and understanding them was the foundation for the surviving warring states. Flood protection projects have been conducted to protect farmland. Warlords, famous for their civil engineering projects, are listed below:

- Takeda Shingen (Kofu City area): The Kamanashi River and its tributaries, which are violent rivers, frequently flood the Kofu area. In response, the waterways were stabilized, and the momentum of the water was controlled. Levees (Shingen-tsutsumi) were built to protect against small-and medium-scale flood risks, while hazy levees were built to allow floodwaters to overflow during large-scale floods and return to the river afterward. Consequently, agricultural damage in the Kofu area was reduced.
- Sasa Narimasa (Toyama City and surrounding areas): Major floods occurred at a point called Mazeguchi on the Joganji River. At this point, a levee (Sasa levee) was constructed to change the direction of the river flow, which later reduced flood damage.

- Kato Kiyomasa (Kumamoto City area): Kumamoto City was prone to flooding because of the three rivers flowing in the area. Flood damage was reduced in Kumamoto City by straightening the Shirakawa River and connecting the Tsuboi River to the Iseri River through the inner moat of the castle. Weirs and irrigation channels were constructed for irrigation.
- Narutomi Hyogo (Saga Prefecture): The Chikuri Levee (hazy levee) was constructed on the Chikugo River to reduce flood damage on the Chikushi plain further downstream.

Flood protection strategies were carefully developed considering the characteristics of each river, and individual flood protection technologies, such as levees, were developed. Several flood protection structures were developed in each area during this period.

### 2.5 Early Modern Period (Edo Era) (early 17th century to late 19th century)

During the Edo era (1603–1868)—a period of peace with no civil wars for approximately 270 years—the country steadily accumulated social capital through various civil engineering projects. Civil engineering projects focused on flood protection, agricultural water utilization projects, and land reclamation projects to expand agricultural productivity. During this period, the farmland area increased from approximately 15,000 $km^2$ at the beginning of the Edo era to approximately 33,000 $km^2$ by the end of the period.

In the early Edo era, public water supply projects were implemented in many cities. Especially, during the Edo period (present-day Tokyo), when the population was rapidly increasing, water demand could not be covered by water supply from springs and wells. The first public water supply project in Japan was the Kanda waterworks. During that period, many public waters supply systems were constructed for irrigation purposes in local cities.

### 2.6 Meiji Era and before World War II (late 19th century to early 20th century)

#### (1) Meiji Era

Although the Edo era was closed to the rest of the world following a prolonged period of national isolation, Christian civilization had a considerable influence on Japan from the Warring States period to the early Edo era. Even during the period of national isolation, Japan was exposed to the influence of Western civilization through Dejima in Nagasaki. The Japanese had mere desk knowledge of Western technology and industry, however, with the advent of a new era, it was only natural for Japan to attempt to fully adopt modern science and technology. The national government hired a large number of foreign engineers to teach science and technology and train the Japanese people.

In the early Meiji era, adoption of most modern technology was dependent on foreign engineers; however, by the mid–1880s, Japanese students who had studied in Europe and the United States began to return to Japan, and Japanese engineers trained by foreign engineers began to appear on the scene. Foreign engineers could implement many technological activities.

During the early Meiji era, low-water channel works on rivers were an important measure to maintain

river routes for boat traffic and drainage systems for irrigation. The Japanese government hired a Dutch engineer Van Doorn, who taught the importance of regularly observing river water levels and installing water level markers. Water levels were mainly observed using water level markers, but in a magazine published in 1890, there was a record regarding the use of a self-registering water level measuring device at Niigata on the Shinano River. In 1881, a self-registering tide gauge imported from the Netherlands was installed on the Kiso River. It is conceivable that the water level observation system has improved since the mid-Meiji era.

In the context of meteorological observations, in June 1875, Joynell conducted regular observations thrice a day, and the Tokyo Meteorological Monthly Report and Annual Report were published in 1876. The importance of meteorological and hydrological observations has been passed on from that period to the present.

Under the national government, the River Law was enacted in 1896, and the Ministry of Home Affairs[3] promoted flood protection projects, such as levee embankments, dredging, and floodway construction, on important rivers throughout Japan. According to the River Law, the governor of each prefecture was the river administrator. (However, since the governor was elected by the national government, the law actually reflected the will of the national government), and land within the river area was considered public land.

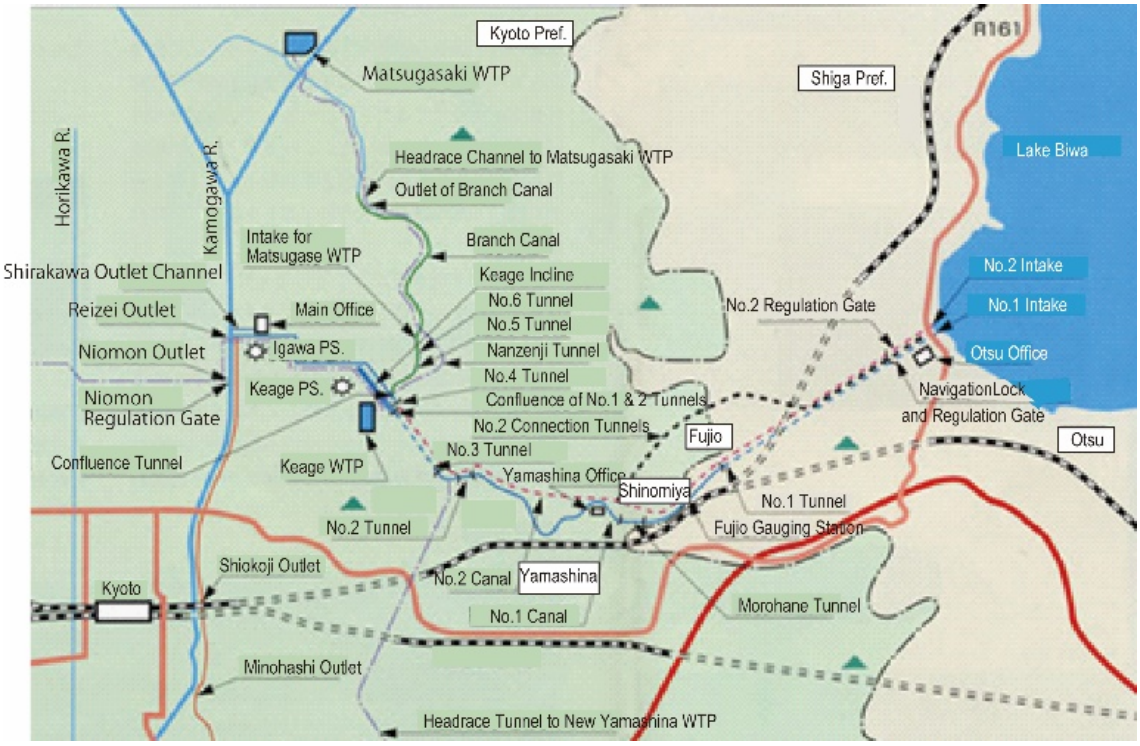
In the case of water rights, used irrigation water was recognized as a traditional water right. As for new water users, water supply, and power generation, it was difficult to acquire new water rights due to a lack of surplus water.

The Lake Biwa Canal project was introduced as a water resources-related project during this period.

**Lake Biwa Canal Project**

In 1881, to restore Kyoto, which had been declining with the capital being relocated to Tokyo, the governor of Kyoto Prefecture, Hokuto Kitagaki, decided to develop the Lake Biwa Canal as the most effective way to promote industry. It was a comprehensive development project comprising a multipurpose project for irrigation, water supply, industrial water supply, shipping, and hydroelectric power generation. This project was the first major civil engineering project in Japan that was implemented entirely by Japanese engineers, with Sakuro Tanabe as the chief engineer.

[3] During the era of the Imperial Constitution, the Japanese administrative body was responsible for domestic and civil affairs. After the war, it was dismantled and abolished by order of the General Headquarters (GHQ).




Source: 100-year Vision for society and Civil Engineering: Opening up all boundaries and laying the foundation for a sustainable society - Japan Society of Civil Engineers, Website of Lake Biwa Canal Memorial Museum
Location map: Website of Kyoto City Water Supply and Sewerage Bureau

### (2) Taisho Era until the pre-World War II period

A major policy for flood protection was established during the Meiji era, and some large projects were steadily promoted across major rivers. The Okozu diversion project was introduced as a representative project.

**Okozu Diversion Project**

The Okozu Diversion Project is a 10-km-long man-made waterway that runs from Okozu—where the Shinano River comes closest to the Sea of Japan—to the Teradomari coast, where the floodwaters of the Shinano River flow into the Sea of Japan, protecting the Echigo Plain from flooding. The Okozu Diversion Project is a diversion channel, a wash weir, a movable weir, and a fixed weir.

Since the Edo era, residents of the neighborhood had petitioned against the construction of this diversion facility, but it was not permitted. At the beginning of the Meiji era, the national government began construction of the facility, but it was suspended in 1875. When an unprecedented flood occurred on July 22, 1896, following the break of the levee embankment called

"Yokota-giri," the national government decided to resume construction in 1907. The modern water diversion technology had been established through the Yodo River improvement work that had been carried out since 1895.

One of the features of the Okozu diversion is that the river width downstream was narrower than upstream. As the area near the river mouth is mountainous, the amount of excavation was reduced. However, from a hydraulic perspective, since the river width is narrowed, the river gradient is made steeper to increase the flow velocity for the required discharge.

Source: Shinano River Okozu Diversion Canal, one of the largest spillways in Japan, Kiyoshi Hirata Consultant Vol.238 Japan Construction Consultant Association
Photo: Shinano River Office, MLIT

However, in terms of water use, it was difficult to develop surface water for new water rights, and ground subsidence had begun to occur due to excessive pumping of groundwater as a source for urban water supply.

In addition to floodways and river shortcuts, such as the Okozu Diversion project mentioned above, river engineering technology was used to construct large dams in the upstream areas. As a forerunner, there was a boom in the construction of run-off type power plants in the Taisho era (1912–1926). Droughts were plentiful in the upper reaches of Japan's rivers, providing favorable conditions for run-off type hydroelectric power generation. In the Taisho era, the electricity demand grew rapidly owing to growing industrialization, and the hydroelectric power business grew rapidly. In 1924, the Oi Dam (53m high) was completed on the Kiso River system, marking the beginning of the era of large dams.

During the Showa era (1926–1989), the Komaki Dam on the Shogawa River (80 m high) was constructed in 1929, the Teishakugawa Dam on the Takahasi River (62 m high) in 1931, the Tsukahara Dam on the Mimi River (87 m high) in 1938, the Tateiwa Dam on the Ota River (67 m high) in 1939, and the Miura Dam on the Kiso River (83 m high) in 1943. Large dams were constructed successively, and the business of hydroelectric power generation and dam construction technology showed steady development.

### (3) After the End of World War II

#### 1) Revival Period (1945–1955)

Amid land devastation and economic turmoil, Japan, which has limited natural resources, had to rely on the effective use of domestic resources and land development. From the end of World War II until the Ise Bay Typhoon in 1959, Japan experienced a series of natural disasters that left more than 1,000 people dead or missing. The cost of damage was greater than 5% of the national income. The Makurazaki typhoon in September 1945, the Nankai earthquake in December 1946, the Kathleen typhoon in September 1947, the Fukui earthquake in June 1948, the Aion typhoon in September 1948, the floods in western Japan in June 1953, and Typhoon No. 13 in September 1953 left a huge mark across the country. Typhoon Aion in September floods in western Japan in June 1953, and Typhoon

No. 13 in September left large traces of damage throughout Japan. Due to inadequate disaster prevention and mitigation systems, damage to Japan's land and people was extensive.

In 1949, the Flood Protection Investigation Committee established by the Ministry of Home Affairs reported on the flood protection plan for ten rivers under the direct jurisdiction of the Ministry of Home Affairs because of the havoc wreaked by Typhoon Kathleen, and the flood protection approach was shifted to a multipurpose dam system including development of water resources. In 1950, with the promulgation of the Comprehensive National Land Development Act, the Land Conservation Project was intensively implemented as part of the Comprehensive River Development Project, which reduced the number of large-scale natural disasters and built the foundation for post-war reconstruction.

**2) Period of Rapid Economic Growth (1955–1973)**

The rapid development of social infrastructure since the post-war reconstruction period has eliminated bottlenecks and paved the way for economic growth. The development of hydroelectric power generation in the 1960s made a significant contribution toward energy production for industrial development. The Sakuma Dam, completed in 1956 with a total loan of $9 million from the Bank of America, was a pioneer in speeding up civil engineering work through the use of construction machinery, and changed the atmosphere of construction sites.

Environmental pollution problems began to appear in many parts of the country during this period. In 1953, people began to show symptoms of Minamata disease in the Kumamoto Prefecture, and itai-itai disease near the Jintsu River was reported at an academic conference in 1955. The Yokkaichi pollution emerged as a problem. Rapid industrial development has resulted in air and water pollution in many regions. Under these circumstances, the natural and social environmental impact of large-scale civil engineering projects have increased, and there is a strong need to understand disasters and pollution that are expected in the future from the development planning stage.

**3) Stable Growth Period (1973–1991)**

As large-scale projects were developed during a period of high economic growth, the natural and social environmental impact became more significant. Lawsuits demanding the suspension of projects, disasters (including floods), and cases blaming the government for the occurrence of accidents began to emerge. For example, in the wake of a disaster due to heavy seasonal rainfall in 1972, numerous flood lawsuits were filed all at once. Residents' awareness of public works and disasters changed from the late 1960s to the 1970s. In 1977, the Interim Report of the River Council indicated that comprehensive flood protection measures, such as watershed and damage mitigation methods must be strongly implemented along with river improvement. Since then, the government has promoted measures, such as securing water retention and recreational functions, setting up hazard maps of flooding, and public announcements. The government continued to seek understanding and cooperation from the watershed residents. Following the adoption of river improvement measures, construction of the metropolitan area outer discharge channel in the eastern part of Saitama Prefecture

began in 1992 and was completed in 2006 as one of the world's largest underground waterways. This contributed toward the safety of Tokyo's capital city.

Japan became one of the world's largest economies in the 1980s due to high economic growth; however, the standard of living and welfare was still low, with small living quarters, difficult commuting conditions, and low penetration of sewage systems. The country could overcome the problem of severe pollution to a large extent and income levels increased, people regained comfort with the hope of improving their living environment. Until Japan attained a period of high economic growth, people were striving for uninterrupted economic growth and were living in circumstances that included polluted rivers, lakes, marshes, and unsettled cities and roads. In 1970, the "National Diet on Pollution" was convened with the aim of drastically improving pollution-related laws and regulations, indicating the need to improve people's living environment. Civil engineering shifted from functional supremacy and priority to economic benefits, aiming for its original form of prioritizing the improvement of the living environment through the creation of amenities for beautification.

Against this social background, since the mid-1970s, attempts were made to introduce amenities for leisure as well as achieving peace of mind into civil engineering projects, including rivers, roads, and urban planning, primarily to harmonize them with improving the original functions. It was a new attempt that aimed at designing civil engineering spaces for recreation and leisure for people to enjoy considering the landscape together with adopting measures to prevent environmental pollution, and projects to solve these problems became widely popular in the 1980s. While environmental restoration, rehabilitation, and creation of waterfront spaces, landscape designing, beautiful and comfortable roads, and development of waterfronts, as seen in the creation of coasts and harbors, have progressed, non-structural public works projects have been introduced, such as attractive water and bridges that can be used for tourism. The development of sewage treatment technologies, such as advanced treatment and resource reuse, has played a significant role in expanding sewage projects. At present, although some scholars point out the loss of regional individuality due to uniform development and urbanization, public works projects have shifted from focusing solely on economic rationality to project implementation, considering the improvement in environment and quality of life.

#### 4) Post-growth period (1991- present)

In the era of high economic growth and the spillover effects to rural areas, civil engineering technology has promoted national land development and fulfilled social requirements in the form of building large infrastructure projects, such as dams, highways, Shinkansen, and ports.

Civil engineering technology has reached a turning point and has faced severe trials. Criticism of public works projects triggered by the campaign against the Nagara River estuary barrage transcended the issue of "development" or "environment" and has turned into a social problem. It became the forerunner of the criticism of the public works projects that followed. Criticism of public works projects has provided an opportunity to question how governance should be conducted, such as

technical issues, social issues, criticism of the high-cost structure, and innate characteristics of the construction industry, and decision-making on public work projects. Prior to the above, in the long-term plan for social capital development to promote development in a focused, effective, and efficient manner, the plans for each business field were unified, and the plans were changed from "project cost" to "achievement results." The "Social Capital Development Priority Plan Act" was enacted in 2003, and the "Social Capital Development Priority Plan" based on the Act was determined by the Cabinet during the same year.

The Basic Environment Act was enacted in 1993 to comprehensively develop new environmental policies for the global environmental era.

Until the period of high economic growth, civil engineering created the foundation to support economic growth that emphasized growth in the gross national product (GNP). Currently, a shift to global environmental issues, social safety, stock-oriented in-house production of distinct regional diversity, and building a foundation aimed at becoming a mature economy that citizens can be proud of is underway.

# GLOSSARY

# 用語集 (Glossary)

| | 和文 | 解説 | English | Explanation |
|---|---|---|---|---|
| 1. ガバナンス (Governance) | | | | |
| 1-1 法制度・組織 (Legislation and Organization) | | | | |
| 1 | 河川法 | 河川に関わる水災害の発生が防止、河川水の適正な利用、河川環境の保全を総合的に管理することを目的として制定された。1896年に最初に最低され、1964年、1997年に時代ニーズに沿った大きな改正がなされた。 | River Law | This Law aims at comprehensive river management including prevention of water-related disasters due to river water, proper utilization of river water, and conservation of the river environment. The law was enacted in 1896, and major amendments were passed in 1964 and 1997 for meeting various social needs of the time. |
| 2 | 国土交通省水資源部 | 河川管理の規制官庁である国土交通省にある部門で、水資源政策、水資源開発基本計画、水源地域対策等を担当している。水資源に関する施策は複数の省庁にまたがって実施され、水資源部は関係組織の総合調整を担っている。 | Water Resources Department of Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) | The Water Resources Department is a section in the MLIT that regulates river management. The department is responsible for formulating the policy of water resources management, Water Resources Development Basic Plan, and consideration for water source areas, and comprehensive coordination among several parties related to the water resources department. |
| 3 | 特定多目的ダム法 | 高度経済成長期の水資源開発の主流であった多目的ダムにおける費用負担、ダムの所有権、管理の主体を明確にし、事業の実施を実現するために成立した。 | Act on Specified Multipurpose Dams | The Act stipulates budget allocation, ownership, responsibility of operation, and maintenance of multipurpose dam projects, one of the main measures for water resources development to meet the steep increase in water demand during the period of rapid economic growth. |
| 4 | 水資源開発促進法 | 高度経済成長期に逼迫した大都市の都市用水需要に対し、水系一貫の水資源開発に基づき、広域的かつ計画的に利用すること、また大規模な水源施設や導水施設を一体的に整備する必要が生じた。水資源の総合的な開発を促進する必要がある水系の指定、水資源開発基本計画を策定、水資源開発審議会への諮問などを定めた。 | Water Resources Development Promotion Act | To meet the steep increase in water demand during the period of rapid economic growth, this Act was required to formulate a comprehensive water resources management plan through a basin, realize systematic and efficient water utilization in wide areas, and build large water resources facilities together with water conveyance facilities. The Act aims at identifying river basins where such comprehensive water resources development is required, establishing the process to formulate the Water Resources Development Basic Plan in the specified basins, and stipulating the advisory role of the Water Resources Development Council. |
| 5 | 水資源開発公団法 | 水資源開発基本計画に基づく事業の実施および維持管理を行う水資源開発公団について定めたもので、水資源開発 | Water Resources Development Public Corporation Act | The Act was enacted for Water Resources Development Public Corporation, specifically about who implements and operates the water resources facilities included in the Water Resources Development Basic |

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| | | 促進法と同時に成立した。 | | Plan. |
| 6 | 水資源開発基本計画 | 水資源開発促進法に基づき、水の用途別の需要の見通し及び供給の目標、供給の目標を達成するために必要な施設の建設に関する基本的な事項、その他水資源の総合的な開発及び利用の合理化に関する重要事項を定める。 | Water Resources Development Basic Plan | Water Resources Development Basic Plan was formulated based on the Water Resources Development Promotion Act. The plan contains prospects of water demand by sectors, water supply targets, a basic plan for developing water resources facilities, and critical matters on coordinated and rationalized water utilization. |
| 7 | 水源地域対策特別措置法 | 水資源開発に伴う水源地域に対する配慮、需要地との対立問題、地域住民のコンセンサスに対処することを目的に制定された。 | Act on Special Measures concerning Measures Related to Water Resources Areas | The Act was enacted for special consideration for water resources area against water resources development, issues on conflicts between the beneficiary area and water resources area, and action to help stakeholders reach a consensus on the water resources area. |
| 8 | 水循環基本法 | 人の活動及び環境保全に果たす水の機能が適切に保たれ、健全な水循環を維持し、又は回復させ、経済社会の健全な発展及び国民生活の安定向上に寄与することを目的としている。 | Basic Act on Water Cycle | The Act aims at contributing toward sustainable development of the social economy and improving people's life through maintaining and recovering a healthy water cycle with the proper functioning of water against the environment and conservation of people's life. |
| 9 | 地球温暖化対策の推進に関する法律 | 緩和策に関する目標明記し、政策の継続性・予見性を高め、脱炭素に向けた取組・投資やイノベーションを加速させ、再生可能エネルギーを活用した脱炭素化の地域の取組や企業の脱炭素経営の促進を図る。 | Act on Promotion of Countermeasures for Global Warming | The Act stipulates targets for mitigation of global warming to achieve continuity and predictability of political measures, facilitate and accelerate behavior and investment for decarbonization, as well as support regional policy and management of private companies toward decarbonization through innovation and utilization of renewable energy. |
| 10 | 気候変動適応法 | 環境大臣による定期的な影響評価や、政府による気候変動適応計画の策定が義務化し、国、地方公共団体、事業者、国民が連携・協力して適応策を推進する。 | Climate Change Adaptation Act | The Act obliges the Ministry of Environment to conduct a periodical impact assessment on climate change, and the government to formulate climate change adaptation plans to facilitate adaptation measures by coordination and cooperation among the national government, local governments, business entities, and local residents. |
| 1-2 水利権 (Water Rights) | | | | |
| 1 | 水利権 | 特定の目的(水力発電、かんがい、水道等)のために、その目的を達成するために必要な限度において、流水を排他的・ | Water Right | Water right is the claim to exclusive and continuous use of river water for a specific purpose and to the extent necessary to achieve the stated purpose (hydropower generation, irrigation, water supply) |

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| | | 持続的に使用する権利の事をいう。 | | |
| 2 | 慣行水利権 | 旧河川法の制定前あるいは河川法による河川指定前から、長期に亘り継続、かつ反復して水を利用してきたという事実があって、当該水利用の正当性に対する社会的承認がなされ、権利として認められたもの。 | Customary Water Right | The fact that water users have been using water continuously and repeatedly for a long time before the enactment of the old River Law or designation of a river by the new River Law, and social recognition of the legitimacy of such water use has been made and recognized as a right. |
| 3 | 豊水水利権 | 取水の許可条件として、河川の流量が一定流量を超える場合に限り取水出来る権利をいう、通年取水が不可能であり、渇水年の流況が悪い年は取水可能量が減少する。 | Water Right to use water during a rich water period | This right is given to applicants on the condition that as a water right, users can take water when the flow rate is higher than a certain designated flow rate. Generally, water users cannot take water throughout the year. Moreover, the possible intake of water is decreased during a dry year. |
| 4 | 減水区間 | 発電取水により河川流量が少なくなる区間をいう。 | Depletion Section | Due to intake during hydropower generation, river flow decreases between intake and the outlet of hydropower generation. |
| 5 | 農業用水合理化事業 | 農業水利施設を改修することによって、潜在的余剰水を都市用水へ転用する事業。 | Irrigation Water Rationalization Project | Potential surplus water for irrigation use is diverted to urban water by renovating irrigation facilities. |
| 6 | 渇水調整協議会 | 円滑な渇水調整を図るため、水系内の多くの利水者に河川管理者が提供する河川情報を共有し、協議を行う場 | Drought Coordinating Committee | Committee to hold consultations to ensure smooth drought adjustment and sharing river information provided by the river administrator to water users in the water system. |
| 7 | 水利権料 | 都道府県知事が河川を利用する物から徴取する占用料の内、水利権に基づく取水に対して、徴取する占用料。実際には、工業用水、発電用水から徴取していている。 | Water Use Fees | Water use fees are collected by local governments for water intake based on water rights. In fact, local governments collect a water use fee from industrial water use and hydropower generation. |
| 8 | 土地改良区 | 土地改良法による土地改良事業（農業水利施設の建設、管理、農地の整備等）を実施する事を目的として、農業を営む人たちによって設立された組織。 | Agricultural Irrigation Area Improvement and Management Association | An association established by farmers to conduct construction and management of irrigation water utilization facilities, and agricultural land improvement under the Land Improvement Act. |
| 1-3　住民参加 (Public Participation and Decision-making Process) | | | | |
| 1 | 水ガバナンス | 治水や利水の水マネジメントに加えて、国民の意思や人権を尊重する考えや、合法性、信頼性、 | Water Governance | In addition to managing water to control flooding and water utilization, water governance also includes basic values and principles based on organizations |

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| | | 透明性など、組織や地域に基づいた基本的な価値観を含めた理念をいう。 | | and communities, such as the concept of respecting the will and human rights of people, legality, reliability, and transparency. |
| 2 | 事業再評価 | 社会経済情勢等の変化により必要性の低下した事業を中止、見直す仕組みである。これにより、効果・効率の高い事業のみを実施できる。また、評価結果を公表することにより、公共事業の透明性が確保できる。 | Project Re-evaluation | Re-evaluate, review, and cancel projects that have become less necessary due to changes in the socio-economic conditions. Through the system, the government can implement highly effective and efficient projects. The results of the evaluation will be publicized to ensure public works projects remain transparent. |
| 3 | 魚つき林 | 森林法に基づき指定される保安林の一つであり、①土砂の流出を防止して、河川水の汚濁化を防ぐ、②清澄な淡水を供給する、③栄養物質、餌料を河川・海洋の生物に提供する等の役割がある。 | Forests with Fish | Forests with fish are unique to Japan and have a role in conserving fishery resources. The fish-breeding functions of forests include (1) preventing sediment runoff and polluting river water, (2) providing clear fresh water, and (3) providing nutritional substances and food for river and marine organisms. |
| 4 | 水防災意識社会 | 「施設では防ぎきれない大洪水は必ず発生するもの」へと意識を変革し、行政・住民・企業の全てが災害リスクに関する知識と心構えを共有し、洪水・地震・土砂災害等の様々な災害に備える社会をいう。 | Water-related Disaster Aware Society | This is the society that the government, local residents, and businesses share knowledge and awareness of disaster risks and prepare for various disasters such as floods, earthquakes, and landslides with the awareness that “large-scale floods beyond the capacity of the current facilities are inevitable.” |
| 5 | マイタイムライン | 住民一人ひとりの防災行動計画であり、台風等の接近による大雨によって河川の水位が上昇する時に、自分自身がとる標準的な行動を時系列的に整理し、自ら考え命を守る避難行動のための一助とするものである。 | My Timeline | My Timeline is an individual resident’s disaster prevention plan. When the water level in the river rises due to heavy rain or typhoon, residents organize basic behavior in chronological order, which helps them to think about how to evacuate and save their own lives with their families. |
| 6 | 水防団 | 洪水時に現地において堤防や河川の巡視・警報や避難の呼びかけ・住民の避難誘導・堤防の補強・水防工の設置・ポンプ排水・樋門の操作など水害を防止・軽減する活動を行う団体である。ボランティアの性格を持 | Flood Fighting Teams | Flood fighting teams work on site to prevent and mitigate flood damage by patrolling levees and rivers, issuing warnings and calls for evacuation, guiding residents to evacuate, reinforcing levees, installing flood prevention systems, pumping and draining water, and operating flume gates. Flood fighting teams are volunteers and usually work in their own occupations. |

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| | | ち、常時は各自の職業に就いている。 | | |
| 2. 計画に基づく開発 (Plan-based Management) | | | | |
| 2-1 開発計画 (Management Plan) | | | | |
| 1 | 全国総合開発計画 | 全国総合開発法に基づき、国が作成する国土の有効利用、社会環境の整備等に関する長期計画。1962 年から 1998 年まで 5 回策定された。 | National Comprehensive Development Plan | A long-term plan for effective use of national land and improving the social environment established by the national government in accordance with the National Comprehensive Development Act.<br>Since the first plan in 1962, it has been formulated five times between 1962 and 1998. |
| 2 | 特定地域総合開発計画 | 国土総合開発法に基づく計画の一つ。河川の多目的総合利用による国土の保全、資源開発、工業立地条件の整備を目標とし、主として第二次大戦後の食糧、電力等緊急必要物資の確保を図るために策定された。 | Specific Regional Comprehensive Development Plan | It is one of the plans based on the Comprehensive National Land Development Act. It aims to conserve the national land, develop resources, and improve conditions for locating industrial units through a multipurpose comprehensive use of rivers.<br>It was formulated mainly to secure emergency supplies such as food and electricity after World War II. |
| 3 | 水資源開発水系 | 産業の開発又は都市人口の増加に伴い、広域的な用水対策を実施する必要がある地域の事で、水資源開発促進法に基づいて指定される。 | Water Resources Development River System | A water system was designated under the Water Resources Development Promotion Act as an area where wide-area water supply measures must be implemented due to industrial development or an increase in urban population. |
| 4 | 水資源開発基本計画 | 水資源開発水系における水資源の総合的な開発及び利用の合理化の基本となるべき計画。計画には水の用途別の需要の見通し及び供給の目標と、目標を達成するため必要な施設の建設に関する基本的事項等が記載される。 | Water Resources Development Basic Plan | It is a basic plan for comprehensive use of water resources, and rationalization of water use in water resources development river system. The plan includes basic matters such as the water demand forecast to each water use, supply targets, and construction of required facilities to achieve the target. |
| 5 | 流域治水 | 河川管理者が主体となって行う治水対策に加え、氾濫域も含めて一つの流域として捉え、その河川流域全体のあらゆる関係者が協働し、流域全体で水害を軽減させる治水対策 | River Basin Disaster Resilience and Sustainability by all | Flood protection measures to be implemented by the river management office (river administrator) to reduce flood damage in the entire river basin through the cooperation of all related parties. |
| 6 | 貧困率 | 所得が全人口の家計所得中央値の半分(貧困線)を下回っている人の割合 | Poverty Rate | Percentage of population with income below half the median household income of the total population (poverty line). |
| 7 | ジニ係数 | 社会における所得分配 | Gini Coefficient | Index of equality or inequality in income distribution in society, |

| | 和文 | 解説 | English | Explanation |
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| | | の平等・不平等を計る指標。0 から 1 までの数字で示され、0 に近づくほど平等、1 に近づくほど不平等の格差が大きい事を意味する。 | | expressed as a number between 0 and 1, with 0 indicating equality and 1 indicating inequality. |
| 8 | 高度経済成長 | 1960 年代の日本の経済成長率が年平均 10%を越え、諸外国にも例を見ない急速な経済成長を遂げた事を言う(1955 年~1973 年) | High economic growth | In the 1960s, Japan's economy grew at an average rate of over 10% per year, a rapid rate that is unparalleled in other countries (1955 to 1973). |
| 2-2　流域毎の計画 (Plan for Each River Basin) | | | | |
| 1 | 基本高水 | 洪水防御計画の対象とするハイエトグラフ群 | Design hydrographs | Design hydrographs for studying the flood control plan. |
| 2 | 計画高水流量 | 河道・ダム等の洪水防御施設に配分される計画洪水ピーク流量 | Design flood discharge | Design flood peak discharge allocated to flood control structures, such as rivers channels, or dams. |
| 3 | 治水安全度 | 洪水防御計画の設計規模。防御地域の重要度によって異なり、A 級では 200 年以上としている。 | Safety level of flood control | Design scale for a flood control plan. The design scale is set considering the importance of the protected area. More than 200-year return periods for an A-rank river. |
| 4 | 正常流量 | 低水管理の目標となる流量。基準地点において水利流量と維持流量の双方を満足する流量。 | Normal function flow | The key performance index for river discharge management during dry seasons. Normal discharge consists of water use and maintenance flow. |
| 5 | 利水安全度 | 水資源開発の設計規模。一般的に１０カ年第１位相当の渇水とする。 | Safety level of water use | Design scale for water resources development. Generally, the severest year within 10 years is selected. |
| 6 | 不特定容量 | 多目的ダムに設けられる容量のうちの一つで、河川管理者が建設費用を負担する。不特定容量により維持流量の不足分と既得水利への補給を行い、正常流量を確保する。 | Water for unspecified use | One of the volumes set in a multipurpose dam, where the river administrator bears the cost of construction. Water for unspecified use is used to satisfy the deficit in maintenance flow and existing water users, until return to normal discharge is secured. |
| 7 | 多自然川づくり | 河川全体の自然の営みを視野に入れ、地域の暮らしや歴史・文化との調和にも配慮し、河川が本来有している生物の生息・生育・繁殖環境及び多様な河川景観を保全・創出するために、 河川管理を行うことです。 | Nature-friendly river works | River management to secure a natural ecosystem, landscape, local residents' daily life, history, and culture. |
| 8 | 河川整備基本方針 | 長期的な河川整備の方針 | Basic policy of river improvement | Policy for river improvement and management in the long term. |
| 9 | 河川整備計画 | 20～30 年後の河川整備の目標を定める計画 | River improvement plan | Plan to set the goal of river structure implementation and management over |

| | 和文 | 解説 | English | Explanation |
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| | | | | 20 to 30 years. |
| 10 | 流域マネジメント | 森林、河川、農地、都市、湖沼、沿岸域等において、人の営みと水量、水質、水と関わる自然環境を良好な状態に保ち、改善するための取り組み。 | Watershed management | Management to secure and improve human activity, water quantity and quality, water-related natural environment in forests, rivers, agricultural areas, cities, lakes, and coastal areas. |
| 3 財政 (Finance) | | | | |
| 1 | 国庫補助 | 地方公共団体が行う特定の事務事業に対して、国が補助金の交付を国庫の負担で行なう。 | Government Subsidy | The national government will provide subsidies for specific projects conducted by local governments at the expense of the national treasury. |
| 2 | 治水特別会計 | 一般会計の歳入歳出からは独立し、治水事業のみを扱う会計である。長期的な投資が必要な治水事業に対して、計画と関連付けることで、年毎の財政事情に関わらず、安定した財源を確保するために導入された。 | Special Account for Flood Management | The special account for flood control is independent of the general account revenue, which is spent for flood management projects. It was introduced to secure stable financial resources for flood management that requires large and long-term investment, and by linking to national plans regardless of the annual financial situation. |
| 3 | 財政投融資 | 財政投融資は、国の信用や財投債（国債）の発行などの国の制度を利用して調達した資金を財源として、民間では対応が困難な長期・固定・低利の資金供給により大規模・長期プロジェクトの実施を可能とする投融資活動である。 | Fiscal Investment and Loan Program (FILP) | FILP is financed by funds raised through the use of government credit and government programs such as the issuance of FILP bonds (government bonds). It is used for large-scale and long-term projects with finance on long-term, fixed, and low interest rates, as it is difficult to be funded by private finances. |
| 4 | 建設国債 | 国の歳出は原則として国債又は借入金以外の歳入をもって賄うことと規定されているが、公共事業費は例外として国債発行又は借入金により調達することが認められている。将来の世代も使う施設に用いるとの考えによる。 | Government Construction Bond | In principle, government spending is financed through revenue other than government bonds or borrowing. For public works expenses, however, financing by issuing government bonds or borrowing is allowed as an exception, which is called government bonds for construction. This is the concept that government bonds for construction are used for facilities that will be used by future generations. |
| 5 | 分離費用身替り妥当支出法 | 多目的ダムの費用負担を決めるにあたり、各目的が単独で施設を建設した場合の建設費を利用して、共同で建設するダム施設の費用を配分する方法である。 | Separable Alternative Costs Justifiable Expenditure Method | The calculation method to allocate the cost for the construction of a multipurpose dam to each user, based on the estimated cost of the single-purpose dam for each purpose. |
| 6 | 賦課金 | 土地改良区において、土地改良事業の恩恵を受 | Levy imposed by the farmers' associations | Farmers benefiting from projects in the farmers' association must pay the cost of the land improvement project |

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| | | ける地区内の農業者は、土地改良区に加入し、土地改良区が事業を実施するにあたって要する費用を負担（賦課金）する。 | | through a “levy” that is paid to the farmers’ associaiton. |
| 7 | 官民連携 | 行政と民間が連携して、それぞれお互いの強みを生かすことによって、最適な公共サービスの提供を実現し、地域の価値や住民満足度の最大化を図るもの。 | Public-Private Partnership (PPP) | To optimize public services by coordinating with the government and private sector by leveraging mutual strengths. It is expected to maximize the value of the region and satisfaction of the regional residents. |
| 8 | 水源地域対策基金 | 下流受益地域の負担金により、水源地の地方公共団体が実施する生活再建・地域振興対策事業への助成、啓蒙・交流活動事業への協賛を行う。 | Fund on Measures for Water Source Area | The Fund provides subsidies for livelihood restoration and community development projects implemented by local governments in the water source areas and sponsors educational and exchange activities. The downstream beneficiary areas contribute to the fund. |
| 4. 水質汚濁・環境 (Water Pollution and Environmental Management Measures) | | | | |
| 1 | 公害防止協定 | 地方自治体や国の機関などが、公害発生企業との間に、公害防止に関して結ぶ協定。 | Agreement for Pollution Prevention | An agreement related to preventing pollution between a local government or a national agency and a company that generates pollution. |
| 2 | 総量規制 | 産業の集中、人口の急増等の影響で汚濁の著しい広域な閉鎖性水域を対象に、環境基準の確保を図るため、当該水域に流入する上流県等の内陸部からの負荷、生活排水等を含めた汚濁源に対して、汚濁負荷量の総量を統一的かつ効果的に削減する事を目的として制定された。 | Standards for total pollutant load (Water use regulation) | To ensure environmental standards for significantly polluted and closed water bodies in wide areas due to the concentration of industry and rapid population growth, this standard was enacted with the aim of uniformly and effectively reducing the total amount of pollutant loads on sources of pollution, including loads from inland areas such as upstream prefectures and wastewater that flows into such water bodies. |
| 3 | 特定事業場 | 水質汚濁防止法で、政令で定める特定施設(排水の水質規制が必要な施設)を設置する工場または事業場をいい、規制をかけられる排水は、これから排出される水に限定される。 | Specified Factory | Under the Water Pollution Control Act, this refers to factories that have specified facilities (i.e., those that need to regulate the quality of wastewater) specified by a government ordinance, and the amount of wastewater that can be regulated is limited to the water discharged from these facilities. |
| 4 | 農業集落排水施設 | 農業集落におけるし尿、生活雑排水などの汚水等を処理する施設。農業用排水の水質の汚濁を防止し、農村地域の健全な水循環に資するとと | Agricultural Community Drainage Facility | This is a facility that treats sewage such as manure and miscellaneous domestic wastewater in agricultural communities. It prevents water pollution from agricultural wastewater, contributes to a healthy water cycle in rural areas, and improves the basic living environment |

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| | | もに、農村の基礎的な生活環境の向上を図る。処理水の農業用水への再利用や汚泥の農地還元を行う事により、農業の特質を生かした環境への負荷の少ない循環型社会の構築に貢献する。 | | in rural areas.<br>By reusing the treated water for agricultural use and returning the sludge to the farmland, it contributes toward building a society that is oriented toward recycling waste with less impact on the environment by leveraging the characteristics of agriculture. |
| 5 | 合併浄化槽 | し尿と生活雑排水を併せて処理する浄化槽の事。 | Domestic Wastewater Treatment Tank | A septic tank that treats both manure and miscellaneous wastewater. |
| 6 | 汚染者負担の原則 | 公害防止のために必要な対策を取ったり、汚された環境を基に戻すための費用は、汚染物質を出している者が負担すべきという考え方。 | Polluter-Pay Principle | The concept that polluters must bear the cost of taking necessary measures to prevent pollution or restore the polluted environment to its original state. |
| 7 | 河川水辺の国勢調査 | 河川を環境という観点からとらえた定期的継続的、統一的な河川に関する基礎情報収集のための調査。対象は直轄区間の河川、直轄及び水資源機構のダムを対象としている。 | National Survey on Natural Environment in the River and Water Shore | This survey aims to collect basic information on rivers in a regular, continuous, and unified manner from an environmental perspective. The survey targets rivers managed by the national government and dams under the national government and the Japan Water Agency. |
| 8 | 清流ルネッサンス | 地元市町村等と河川管理者、下水道管理者および関係機関が一体となって、協議会を組織し、各関係者が合意の上で水質改善目標を定め、水環境改善事業を総合的、緊急的にかつ重点的に実施する事を目的としたアクションプログラム | Clear Stream Renaissance | It is an action plan for comprehensive, urgent, and focused implementation of water environment improvement projects. The local municipalities, river management offices (river administrator), sewerage administrators, and related organizations form a council to set water quality improvement targets based on the agreement with each party. |
| 8 | グリーンインフラ | 自然環境が有する機能を社会における様々な課題解決に活用しようとする考え方 | Green Infrastructure | The idea of using the functions of the natural environment to solve various problems in society. |
| 9 | ESG 投資 | 従来の財務情報だけでなく、環境(Environment)、社会(Social)、ガバナンス(Governance)要素も考慮した投資のこと | Environmental, Social and Governance (ESG) Investment | This is an investment that considers not only conventional financial information but also environmental, social, and governance criteria. |
| 10 | グリーンボンド | 企業や地方自治体等が、国内外のグリーンプロジェクトに要する資金 | Green Bonds | Bonds issued by companies and local governments to raise funds for green projects in Japan and overseas. |

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| | | を調達するために発行する債券 | | |
| 5. 都市水マネジメント (Urban Water Management) | | | | |
| 1 | 雑用水 | 生活排水や産業排水を処理して循環利用するものを言う。中水道とも呼ばれる。利用として、水洗トイレの用水、公園の噴水等、人体と直接接しない目的や場所で用いられる。 | | A system that treats domestic and industrial wastewater for recycling. It is also called "grey water." It is used for flushing toilets, water fountains in parks, and other purposes and places where it does not come into direct contact with the human body. |
| 2 | 総合治水 | 流域における保水・遊水機能の維持、浸水被害を抑える土地利用方法など、河川と流域の両面から水害の軽減と防止をはかる治水対策。 | Integrated flood management | Flood protection measures to mitigate and protect from flood damage caused by rivers and watershed areas such as maintaining water retention and retarding functions in the watershed area and considering land use to reduce flood damage. |
| 4 | 雨水貯留浸透施設 | 屋根に降った雨水を貯留し、水資源として活用するための施設や、ろ過して効率よく地中に浸透させる施設の事。設置することにより、河川への負担軽減や都市における浸水被害の緩和、雨水の有効利用が期待できる。 | Rainwater storage and infiltration facility | A facility that stores rainwater that falls on rooftops and utilizes it as a water resource, or a facility that filters and percolates it efficiently into the ground. It is expected to reduce discharge in rivers and mitigate flood damage in urban areas and enhance the effective use of rainwater. |
| 5 | 親水護岸 | 護岸としての機能をもちつつ、人が水辺で楽しめる様に配慮された護岸。 | Visitor-oriented embankment | While functioning as an embankment, it is considered to allow people to enjoy the waterfront. |
| 6 | 高規格堤防（スーパー堤防） | 市街地側に概ね 200～300 メートル（堤防の高さの約 30 倍）にわたって盛り土を行った幅の広い堤防のこと。高規格堤防を整備することにより、万一、大洪水によって水が堤防を越えても水は斜面を緩やかに流れ、堤防の決壊による壊滅的な被害から街を守ることができる。 | High-standard levees (super levee) | It is a wide levee with an embankment of approximately 200 to 300 meters (about 30 times the height of the levee) on the city side. By constructing high-standard levees, even if the river water overtops the levee in the event of a big flood, the river water will flow gently down the slope and protect the city from catastrophic damage caused by a levee breach. |
| 7 | 地下放水路 | 川から溢れた水を一度流下し、他の大きな河川や海へと放流する地下トンネルのこと。 | Underground discharge channel (tunnel) | An underground tunnel that allows water to overflow from a river that flows down once and is released into another large river or the ocean. |
| 6. 河川管理 (River Management) | | | | |
| | 一級河川 | 河川法にもとづいて国土交通大臣が管理する | Class A Rivers | Rivers managed by MLIT based on the River Law. |

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| | | 河川 | | |
| | 二級河川 | 河川法にもとづいて都道府県知事が管理する河川 | Class B Rivers | River managed by prefectural governors based on the River Law. |
| | 河川区域 | 低水路（平常時の河道）、高水敷および堤防敷からなる区域 | River Zone | A zone consisting of a low water channel (river channel at normal condition), high water channel, and levee embankment. |
| | 河川保全区域 | 堤防を保全するために利用制限を課す区域 | River Conservation Zone | This is a land use restriction zone to preserve levees. |
| | 河川管理施設 | 河川管理者自らが設置する河川工作物 | River administration facilities | These are river facilities constructed by the river administrator. |
| | 許可工作物 | 河川管理者以外の者が河川管理者の許可を得て設置する河川工作物 | Permitted facilities | River facilities installed by persons after obtaining permission from the river administrator. |
| | 水防団 | 市町村、市町村の組合、水害予防組合が設置する水害防災組織。地域住民より任用され、非常勤の特別職地方公務員としての身分により活動する。 | Flood fighting teams | A flood disaster prevention organization established by municipalities, municipal unions, and flood prevention associations. The organization is appointed by local residents and operates as a part-time special local government employee. |
| | 河川協力団体 | 河川管理者の指定を受けて河川の美化活動、環境教育・防災教育、河川環境に係る調査・研究などを行う民間団体 | River collaboration organization | A private organization designated by the river administrator to conduct river beautification activities, environmental and disaster prevention education, and surveys and research related to the river environment. |
| | 時間管理保全 | 定期的に交換・更新を行う施設管理の方法 | Time managed maintenance | A facility management method for regular replacement and renewal. |
| | 状態監視保全 | 損傷状態に応じて最適な時期に交換・更新を行う施設管理の方法 | Condition monitoring maintenance | A facility management method to replace or renew at the optimal time and according to the extent of damage. |
| 7. 地下水管理 (Groundwater Management) | | | | |
| 1 | 地下水涵養 | 雨水などが土中に浸透し、帯水層に地下水として蓄えられること | Groundwater recharge | Rainwater percolates into the soil and is stored as groundwater in aquifers. |
| 2 | 地下水盆 | 一つの大規模な帯水層又は帯水層群の分布地域の事。地下水盆と表流水の修水面積は必ずしも一致しない。 | Groundwater basin | A distribution area of a large aquifer or group of aquifers. Groundwater basins and surface water basins do not normally coincide. |
| 4 | 工業用水道 | 工場などの事業場に人体と直接接しない目的で用いる雑用水を供給するもの。 | Industrial water supply | A miscellaneous water supply used in factories and other workplaces for purposes that do not involve direct contact with the human body. |
| 5 | 公害防止条例 | 地方自治体が公害防止に取り組む基本姿勢を示すと共に地方の特性・実情に応じた公害防止対策を盛り込んでいる | Pollution control ordinance | An ordinance that defines the basic stance of local governments on pollution prevention and includes pollution prevention measures that are tailored to local characteristics and conditions. |

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| | | 条例。 | | |
| 6 | 井戸枯れ | 井戸から地下水を汲み上げると、井戸とその周辺の地下水位は低下する。大量の地下水を汲み続けると地下水位は低下し、ポンプの吸込口より地下水位が下がると、それ以上、地下水を汲み上げることができなくなる現象。 | Drying up wells | When groundwater is pumped from a well, the groundwater level in and around the well drops. When the groundwater level drops below the suction port of the pump, it becomes impossible to pump groundwater any further. |
| 7 | 地盤沈下監視ガイドライン | 都道府県等が行う環境監視についての技術的な提言としてとりまとめたもの。 | Guidelines for monitoring ground subsidence | This is a compilation of technical recommendations for environmental monitoring conducted by prefectures. |
| | | | 8.ダム管理 (Dam Management) | |
| 1 | ダム基本設計会議 | 設計段階や試験湛水時に技術専門家の承認を得るために開催される技術会議である。 | Meeting on Basic Design of Dam | Meeting for technical discussion and approval process by prominent technical experts for dam design. The meeting is held during the design stage as well as after first filling the reservoir. |
| 2 | 大規模地震に対するダム耐震性能照査指針(案)・同解説 | 将来発生しうる大規模地震に対するダム構造物の安全性の評価手法に関するガイドラインで、1995年の兵庫県南部地震を契機に策定された。 | Guidelines for Seismic Performance, Evaluation of Dams during Large Earthquakes | These guidelines were established in 1995 after the Great Hanshin Earthquake. The guidelines define the methodology for evaluating the seismic performance and safety of the dam body against large earthquakes, which is defined as “earthquake motion having maximum-scale level of intensity conceivable at the dam site at the present and in future.” |
| 3 | ダム点検 | 河川管理者が設置するダムは「巡視・日常点検」、「臨時点検（地震時、出水時等）」、概ね3年に1回以上の「定期検査」、および概ね30年ごとの「ダム総合点検」が義務付けられる。 | Dam Inspection | Dams constructed by the River Administrator require dam inspections, categorized into “Regular Inspection,” “Extraordinary Inspection (after a large-scale flood or earthquake),” “Periodic Inspection (once every three years),” and “Overall Inspection (once 30 years).” |
| 4 | ダム操作規則 | 河川法に基づきダムごとに制定される。年間水位操作、目的別の容量配分、洪水調節の操作方法、体制、通知方法、点検整備方法、管理記録などについて定める。 | Dam Operation Rule | The River Law stipulates to formulate dam operation rules for any dam. The dam operation rule includes annual reservoir operation, reservoir capacity allocation for each utilization purpose, dam operation for flood time, organization, recording, communication, and method of inspection and maintenance. |
| 5 | 異常洪水時防災操作 | 計画時に想定された規模以上の洪水が発生した場合にダムの安全を確保するために、放流量を流入量に等しくなるまで増加させる操作で | Operation Method during an Extraordinary Flood for Disaster Prevention | The operation rule during an extraordinary flood that is larger in scale than a design flood. The operation rule includes the method to increase flood release up to reservoir inflow to secure dam safety. |

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| | | ある。 | | |
| 6 | 事前放流 | 洪水の発生を予測した場合に、利水の共同事業者に支障を与えない範囲で、利水容量から跳水を放流し、治水容量として一時的に活用する手法である。 | Pre-flood Release of Reservoir Water | When a flood is predicted, reservoir water is released from the reservoir storage for water utilization to temporarily obtain capacity for flood regulation within the volume which does not affect water utilization by water users. |
| 7 | ダム統合運用 | 同一水系等において複数のダムがある場合に、洪水調節や利水補給へのダムの効果を最大限に発揮するために、これらの複数のダムを一体的に運用する。 | Integrated Dam Operation | Integrated dam operation is a coordinated and integrated method of dam operation using several dams in the same river basin or sometimes dams beyond the basin to maximize the function on water supply and flood control by these dams. |
| 8 | ダム再生 | 厳しい財政事情や気候変動への対応のために、既存のダム施設を有効利用することを重視し、社会や自然環境への影響を抑制しつつ、ダムの長寿命化、利水および治水機能の回復および増強を行う。 | Dam Rehabilitation and Upgrading | To meet the government's severe financial situation as well as the severe climate change condition, maximization and increasing the function of existing dams is focused on rehabilitating and upgrading existing dams. This rehabilitation and upgrading aims at restoring and enhancing the flood control and water supply function of dams as well as elongating the life of dams. |
| 9　環境社会配慮 (Environmental and Social Considerations Large-Scale Projects) | | | | |
| 1 | 一般補償・公共補償 | 事業者の補償は、個人や企業の土地建物などを対象とした「一般補償」と、公共的施設を対象とした「公共補償」とに分けられる。 | General Compensation/Public Compensation | "General compensation" covers land and buildings of individuals and companies. "Public compensation" covers public facilities. |
| 2 | 電源三法 | ①電源開発促進税法、②特別会計に関する法律（旧電源開発促進対策特別会計法）、③発電用施設周辺地域整備法を総称するものであり、これらの法律の主な目的は、電源開発が行われる地域に対して補助金を交付し、電源開発を促進し、運転を円滑にしようとするものである。 | Three Acts for Power Development | Three Acts for power-resources are the generic terms for 1) Act on Tax for Promotion of Power-Resources Development, 2) Act on Special Accounts for Electric Power Development Acceleration Measures, and 3) Act on the Development of Areas Adjacent to Electric Power Generating Facilities. The main purpose of these laws is to promote power supply development and facilitate operations by subsidizing areas where power supply development takes place. |
| 3 | 森林環境税・森林環境譲与税 | 森林環境税は、パリ協定の枠組みの下における日本の温室効果ガス排出削減目標の達成や災害防止等を図るための森林整備等に必要な地方財源である。これを | Forest Environment Tax/Forest Environment Transfer Tax | The Forest Environment Tax is a local financial source to develop forests. The purpose is to reduce greenhouse gas emissions under the Paris Agreement and to prevent disasters. The tax will be transferred to each municipality and prefecture as the Forest Environment Transfer Tax. Local governments have |

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| | | 「森林環境譲与税」として各市町村や都道府県に譲与し、自然に対するさまざまな支援活動に向けて還元する。 | | begun to use this tax effectively, primarily to improve resilience to natural disasters, prevent soil erosion and runoff, improve water source recharge functions, conserve biodiversity and increase carbon dioxide absorption. |
| 4 | 水源税 | 森林の水源涵養機能に着目し、その機能の回復・維持等のために地方公共団体が森林整備等の事業を行い、その費用負担を地域住民に求める手段としての環境税の総称である。 | Tax for Reservoir Areas | Generically, this refers to environmental taxes that focus on the cultivation of forests in reservoirs by asking local residents to bear the cost of improving such forests and other projects undertaken by local governments to restore and maintain their function. |
| 5 | 環境アセスメント | 環境保全の観点からより良い事業計画を作り上げていくために、環境影響について、調査・予測・評価を行う。日本では、1972 年(昭和 47 年)に公共事業での環境アセスメントが導入された。水資源関連で環境アセスメントの対象となる事業は、河川整備事業（①ダム、堰、②放水路、湖沼開発）である。 | Environmental Assessment | The environmental assessment system investigates, predicts, and evaluates the environmental impact for a better project plan from the perspective of environmental conservation. In Japan, environmental assessments for public works were introduced in 1972. Projects related to reservoirs that are subject to environmental assessment are river improvement projects such as 1) dams and weirs, 2) floodways, and 3) development of lakes and marshes. |
| 6 | 配慮書 | 事業への早期段階における環境配慮を可能にするため、第 1 種事業を実施しようとする者が、環境保全のために適正な配慮をしなければならない事項について検討を行い、その結果をまとめた図書である。2011 年(平成 23 年)の法改正により、事業実施段階前の戦略的環境アセスメント(SEA)として、「配慮書」手続が導入された。 | Statement of Consideration | A document that summarizes the results of a review of the issues concerning environmental conservation. A person implements a Type 1 project to enable environmental considerations at an early stage of the project. In 2011, the Act was amended to introduce the "Statement of Consideration" procedure as a strategic environmental assessment (SEA) before the project implementation stage. |
| 10. 人材育成・技術開発 (Development of Human Resources and Technology) | | | | |
| 1 | OJT | 実際の仕事を通じて知識・技術などを身に付ける教育方法 | On-the-Job-Training (OJT) | Educational methods to acquire knowledge and skills through actual work |
| 2 | Off-JT | 職場を離れて講習会などを通じて行う教育方法 | Off-the-Job-Training | Educational methods provided through workshops outside the workplace. |
| 3 | SATREPS | 環境・エネルギー、防災、感染症等の地球規模課 | Science and Technology Research Partnership | A Japanese government program that promotes international joint research on global issues such as environment, |

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| | | 題について国際共同研究を推進する日本政府のプログラム | for Sustainable Development | energy, disaster prevention, and infection. |
| 4 | i-Construction | ICT を全面的に活用することで建設業の生産性を向上させるためのプロジェクト | i-Construction | A project to improve productivity in the productivity of construction through full use of information and communication technology (ICT). |
| 5 | オープンイノベーション | 自社以外の組織や機関などが持つ知識や技術を取り込んで製品開発や技術改革、研究開発や組織改革を行う取組 | Open innovation | Initiatives for product development, technological innovation, research and development, and organizational innovation by incorporating knowledge and technology held by organizations and institutions other than the company. |

# EVENTS RELATED TO WATER RESOURCES

| Era | Year | Events and Disasters | Events related to Water Resources |
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| Yayoi | B.C.300–A.D. 250 | Beginning of economic development based on agriculture | Beginning of agricultural irrigation system (Agricultural Development) |
| | | | Small V-shaped drainage channels installed in the village (sewerage) |
| Kohun | 313 | | Construction of the Manda Levee flood control project on the Yodo River (the oldest one recorded in Japan) |
| | 4th century | | Rainfall ditches appeared around the 4th century (sewerage) |
| Asuka | 701 | Taiho legal codes | Construction of irrigation ponds and canals for agriculture development by the Buddhist monk Gyoki and other monks |
| Nara | 710 | Transfer of capital to Nara(Heijyo kyo) | In Heijo-kyo, the drainage system was considered and built at the planning stage, and such a systematic drainage network was inherited in Heian-kyo (sewerage) |
| | 743 | Act for the Privatization of Reclaimed Lands in Perpetuity | Construction of floodway and flood levees for flood control (left bank downstream of the Yodogawa River) |
| Heian | 821 | | Improvement works of the Mannou Pond by a priest named Kukai (agricultural development); construction of Japanese type flushing toilet (Nogen-siki toilet) in a temple on Mt. Koya (sewerage) |
| Civil Wars | 1467–1603 | Flood control and irrigation development by Warriors | Odawara Hayakawa waterworks (domestic and industrial water) |
| | | | Kouhu basin development (agricultural development); construction of Shingen Levee at Kamanashi River and protection of forests against flood damage (Manriki forest) (flood control) by Shingen Takeda |
| | | | Development of Toyama plain (agricultural development) and construction of Levee for flood control (Sasa Levee) by Narimasa Sasa |
| | | | Construction of irrigation facilities for (agricultural development) and flood control of Shirakawa R., Kikuchi R., Midorikawa R., and Kuma R. (flood control) by Kiyomasa Kato |
| | | | Development of the Tikushi plain (agricultural development) and construction of Levee (Chiriku Levee) on the Chikugo River (flood control) by Hyougo Naridomi |
| | | | Developing new fields surrounding the Osaka castle (agricultural development); construction of Taikou Levee and Bunroku Levee (flood control) by Hideyoshi Toyotomi |
| | 1583 | | Construction of the Taikou Sewer Canal (sewer canal system was built in Osaka Castle Town) (sewerage) |
| | 1590 | Hideyoshi Toyotomi unified the country (Japan) | Construction of the Koishikawa waterworks (from Kanda R. to Edo Castle) (domestic and industrial water) |
| | 1594–1654 | | Realignment of the Tone River in the eastern direction (boat transportation, developing new fields, and flood control systems) (agricultural development, flood control, and others) |
| Edo | 1619 | | Construction of sand embankment (Construction of levee to protect flood damage at Fukuyama Castle) (Flood Control) |
| | 1621–1674 | | Construction of the Karigane Levee in the Fuji River (flood control) |
| | 1629 | | The Kanda waterworks (origin of the Inokashira pond, expansion of the Koishikawa water works) (domestic and industrial Water) |
| | 1654 | | The Tamagawa waterworks (from the Tama River to Yotsuya) (domestic and industrial water) |
| | 1660 | | Construction of the Kasai Irrigation Canal (agricultural development) |
| | 1663 | | The Gousen waterworks (the oldest waterworks currently in use today) (Udo City, Kumamoto Prefecture) (domestic and industrial water) |
| | 1704 | | Realignment of the Yamato River in the southern direction (flood control) |
| | 1708 | | Utilization of old river course of Yamato River and old ponds to develop new field (Agricultural Development) |
| | 1728 | | Construction of the Minumadai Irrigation Canal (agricultural development) |
| | 1742 | Flood during the Kanpou Period (more than 10,000 people were estimated killed in Japan) | |
| | 1753 | | Flood control project along three rivers in Kiso (construction by feudal retainers of the Satsuma Domain (presently Kagoshima Prefecture) (flood control) |
| | 1786 | Flood during the Tenmei Period (about 30,000 people estimated to have been killed in Japan) | |
| | 1828 | The Siebold Typhoon(more than 10,000 people estimated to have been killed and missing in Saga) | |
| | 1846 | Flood during the Kouka Period (duration of flood damage: more than 1 month) | |
| | 1872 | | After the Great Fire of Ginza, sewer/drainage facilities were constructed on streets (sewerage), rivers, and ports, and the Road Repair Regulation (Law System) was enacted |
| | 1875 | Establishment of Tokyo Meteorological Observatory | |
| | 1877 | Cholera epidemic that started in Yokohama and Nagasaki, spread nationwide | |
| | 1883 | | Irrigation water supply launched from the Asaka canal (agricultural development) |
| | 1884–85 | | A modern sewerage system was built in Kanda (sewerage) |
| | 1885 | | Construction of the Nasu Canal (agricultural development) |
| | 1887 | Establishment of the Imperial University (Tokyo University) | A modern water supply system was started in the foreign settlements in Yokohama (domestic and industrial water) |
| | 1888 | | Japan's first private hydroelectric power plant was established at the Miyagi Spinning Mills (hydropower) |
| | 1889 | Promulgation of the Meiji Constitution; enforcement of city and town system | |
| Meiji | 1890 | First Imperial Diet | Enactment of an ordinance for water supply (Legal System) |
| | 1891 | The Ashio Copper Mine poisoning problem | Operations begin at the Keriage power station of No.1 Biwa Lake Waterway (Japan's first hydroelectric power plant for industry) (hydropower) |
| | 1896 | | Old River Law (Law System); completion of water supply system in Osaka city (domestic and industrial) |
| | 1897 | | Forest Law and Erosion Control Law (Law System) |
| | 1898 | Establishment of Civil Law; formation of the First Party Cabinet | Completion of water distribution facilities from the Tama River via the Yodobashi Water Treatment Plant (domestic and industrial water) |
| | 1899 | | Completion of Water Supply System in Tokyo (domestic and industrial water) |
| | 1900 | | Old Sewerage Law (Law System) |
| | 1908 | | Water supply to Koriyama using the Asaka Waterway (domestic and industrial water), Water Users' Association Law (Law System) |
| | 1910 | | Excavation project of a new Yodo River channel (starting 1896, Japan's first full-scale flood control work) (flood control) |
| | 1911 | | Electricity Business Law (Law System) |
| Taisyo | 1912 | | Output of hydroelectric power generation exceeds that of thermal power generation(hydropower); securing Kyoto water resources using Biwa Lake No.2 waterway (domestic and industrial water) |
| | 1914 | | Establishment of the Japan Society of Civil Engineers (organization) |
| | 1922 | | Operations start at Mikawashima Water Treatment Plant (Japan's first treatment plant) and sprinkling filter process(sewerage) |
| | 1927 | | Revision of Japan's Electricity Business Law(Law System) |
| | 1930 | | Starting of Nagoya's first activated sludge process (sewerage) |
| | 1934 | | First pumped storage generation begins in Japan (Hokuriku Electric Power Company Oguchi River No.3 Power Station, Tohoku Electric Power Company Ikejiri River Power) Station) (hydropower) |
| | 1945 | Typhoon Ida (Makurazaki Typhoon) (estimated death toll/missing people: 4,429) | Chlorine disinfection(domestic and industrial water) |
| | 1946 | Promulgation of the Constitution of Japan; the Showa Nankai earthquake (estimated death poll/missing people: 1,443） | |
| | 1947 | Amendment of Civil Law, Agrarian Reform, Typhoon Kathleen(estimated death toll/missing people: 1,930 ) | Local Autonomy Law, Agricultural Cooperation Law (Law System） |
| | 1948 | The Fukui earthquake (estimated death toll/missing people: 3,769) | Agricultural Chemicals Regulation Law (Law System) |
| | 1949 | | Land Improvement Law （Law System） |
| | 1950 | | Comprehensive National Land Development Law (Law System) |
| | 1951 | Japan–U.S. Peace Treaty and Japan–U.S. Security Treaty were signed. | Cropland Law (Law System) |

| Era | Year | Events and Disasters | Events related to Water Resources |
|---|---|---|---|
| Showa | 1952 | | Establishment of Electric Power Development Co., Ltd.(hydropower), Power Resources Development Law (Law System) |
| | 1953 | Heavy rainfall in Kitakyusu (estimated death toll/missing people: 1,028); heavy rainfall in Wakayama Prefecture(estimated death toll/missing people: 1,015); outbreak of Minamata disease | |
| | 1955 | Outbreak of Itai-itai disease | Establishment of Aichi Irrigation Public Corporation (agricultural development), Industrial Water Law (Law System), First Arch Dam, and operations start at Kyusyu Electric Power Company at the Kamishiba Power Station (hydropower) |
| | 1956 | Japan becomes a member of the United Nations | Operations start at the Sakuma Power Station (beginning of large-scale power development) (hydropower) |
| | 1957 | | Establishment of Water Supply Act, Specified Multipurpose Dams Act, Professional Engineer Act (Law System) |
| | 1958 | Typhoon Ida (Karino River Typhoon) (estimated death toll/missing people: 1,269) | Starting of River Purification Projects (environment), Industrial Water Supply Business Law, Clean Water Law, Factory Effluent Control Law, New Sewerage Law (Law System) |
| | 1959 | Typhoon Vera (Isewan Typhoon)(estimated death toll/missing people: 5,177) | |
| | 1961 | | Completion of Aichi Water Supply Project (agricultural development), operations start at the Miboro Hydropower Station (Japan's highest fill type dam), Okutadami Hydropower Station (largest effective storage volume in Japan), Tagokura No.4 Hydropower Station (largest embankment volume in Japan) (hydropower), Water Resources Development Promotion Law, Water Resources Development Corporation Law, Basic Law on Disaster Management, Basic Law on Agriculture(Law System) |
| | 1962 | Preparation of Comprehensive National Development Plan; Tokyo's population surpasses 10 million for the first time | Laws on regulating pumping of groundwater for use in buildings (Law System) |
| | 1963 | | Construction of Toyokawa Water Supply Canal (agricultural development, domestic and industrial water); starting First Five-Year Plan for Sewerage Development (Sewerage), thermal power output exceeds hydropower output. Completion of No.4 Kurobe River Power Station (highest arch dam in Japan) (hydropower) |
| | 1964 | Occurrence of water shortage in Tokyo (Olympic drought); outbreak of Niigata Minamata disease | New River Law, Electricity Business Law (Law System) |
| | 1965 | | Proceedings for regional sewerage system (Neyagawa City, Osaka Prefecture) (sewerage) |
| | 1966 | Japan's population surpasses 100 million | Implementation of riverside parks (environment) |
| | 1967 | Drought in Nagasaki; pollution-related diseases became more serious | Basic Law for Environmental Pollution (Law System) |
| | 1968 | Japan's gross national product (GNP) becomes the second largest in the world; officially recognized that itai-itai disease is induced by environmental pollution | |
| | 1969 | Preparation of the New Comprehensive National Development Plan | Second Agricultural Structure Improvement Project (agricultural development) |
| | 1970 | Pollution Diet | Water Pollution Prevention Law, Revision of Basic Law for Environmental Pollution, Partial Amendment of Sewerage Law, Waste Management, Public Cleaning Law, Law to Prevent Soil Contamination of Agricultural Land (Law System) |
| | 1972 | | Natural Conservation Law (Law System) |
| | 1973 | Drought in Takamatsu | Law on Special Measures for Up-stream Area Development (Law System) |
| | 1974 | | Law on Compensation for Pollutant-related Health Damage (Law System), Establishment of Public Sewerage Business for Specific Environmental Preservation (Sewerage) |
| | 1975 | | Report on River Environmental Management (River Council ) (environment); completion of the Okutatara Hydropower Station (the biggest pumped storage power station at that time) (hydropower) |
| | 1977 | Preparation of 3rd Comprehensive National Development Plan | Announcement of "Comprehensive Flood Control Measures" for Urban Rivers (River Council) (flood control) |
| | 1978 | Long-term water demand and supply plan; drought in Fukuoka, the Love Canal incident (U.S.); Wrecker Kerk Case (Netherland) | Revision of Water Pollution Prevention Law (total column control) (Law System) |
| | 1980 | | Notice on Comprehensive Flood Control Measures (flood control) |
| | 1981 | Silicon Valley's groundwater contamination problem(U.S.) | Promotion of measures to prevent land subsidence (decision of the Ministerial Conference on Measures to Prevention Land Subsidence) (domestic and industrial water); implementation of comprehensive flood control measures on the Tsurumi River ahead of any other river in Japan (flood control); completion of the New Takase River Hydropower Station (highest installed capacity (1,280 thousand kW) of hydropower station) (hydropower) |
| | 1982 | Heavy rainfall in Nagasaki (death and missing: 299Persons) | Groundwater contamination survey (Environment Agency) (environment) |
| | 1983 | | Rural Sewerage Projects (sewerage), formulation of the "Basic River Environment Management Plan" (environment), and Purification Tank Law (Law System) |
| | 1984 | | A law on Special Measures concerning Conservation of Lake Water Quality (Law System) |
| | 1985 | | Decision on the Guideline of Measures to Prevent Land Subsidence in the Nobi Plain, Chikugo, and Saga Plain (domestic and industrial water) |
| | 1986 | | Basic Direction of Agricultural Policy for the 21st Century (Report by the Council for Agricultural Policy) (agricultural development) |
| | 1987 | Preparation of 3rd Comprehensive National Development Plan, National Water Resource Plan (Water Plan), and establishment of Liaison Council for drought related Ministries and Agencies | |
| Heisei | 1990 | Asset price bubble burst | Promotion of the River Restoration Program; National Census on River Environment (environment) |
| | 1991 | | Decision on the guideline of measures to prevent land subsidence in the northern part of the Kanto Plain (domestic and industrial water), environmental standards related to soil contamination (25 items) (environment) |
| | 1992 | | Revision of the Water Quality Standards for tapped water (from 26 to 45 items) (domestic and industrial water); revision of Environmental Standards related to water quality (from 9 to 23 items and required monitoring of 25 items) (environment) |
| | 1993 | | Establishment of Stream Renaissance 21 (environment) |
| | 1994 | Drought in Japan | Standards for permission to install structure (flood control) |
| | 1995 | The Great Hanshin Awaji earthquake disaster ( estimated death toll: 6,308) | Promotion of measures for preventing illegal mooring (flood control); report on the future of river environment (River Council) (environment) |
| | 1997 | | Law on Environmental Impact Assessment, Revision of River Laws (Law System), Environmental Standards related to Water Pollution of Groundwater (23 Items) (Environment) |
| | 1998 | Grand design for the 21st century; starting of operations of New Technology Information System (NETIS) | Agricultural Reform Principle (agricultural development) |
| | 1999 | Water Plan 21, Establishment of Liaison Council for Building Healthy Water Cycle related Ministries and Agencies | |
| | 2000 | | Future Hometown 21 (proposal for social gatherings related to the vision for Future Communities in the 21st Century) (agricultural development); prohibition of single treatment septic tanks (sewerage); environmental standards for dioxins (environment) |
| | 2001 | | Establishment of the Construction Technology Research and Development Subsidy Program (Technology Development) |
| | 2002 | Confirmation of soil contamination at the planned site of the new Toyosu market in Tokyo | Construction of the Toyokawa Water Supply Canal (phase 2) (agricultural development, domestic and industrial water); establishment of Nature Restoration Projects and Stream Renaissance 2 (environment) |
| | 2003 | | Law on Priority Plan for Social Infrastructure Development, Soil Contamination Countermeasures Law, Law on Promotion of Nature Restoration (Law System) |
| | 2004 | | Formulation of Water Supply Vision (domestic and industrial water), National Spatial Planning Law (name changed due to revision of the Comprehensive National Land Development Law) (Law System) |
| | 2005 | The Kyoto Protocol was officially adopted | Establishment of a Comprehensive River System Environment Improvement Project and Integrated River Environment Improvement Project (environment) |

| Era | Year | Events and Disasters | Events related to Water Resources |
|---|---|---|---|
| | 2006 | | Promotion of a River Restoration Program (environment) |
| | 2009 | | Establishment of supporting system for urban development related to rivers (Environment) |
| | 2010 | | Review of Tapped Water Quality Standards (basic items 50, management target-setting items 27, required consideration items 44) (domestic and industrial water), revision of Soil Contamination Countermeasures Law (soil contamination of natural origin is also included) (Law System) |
| | 2011 | The Great East Japan Earthquake (estimated death toll: 15,735 people) | |
| | 2012 | Torrential rainfall in the northern part of Kyusyu (estimated death toll: 30 people) | Preparation project for Local Agriculture Master Plan (agricultural development) |
| | 2013 | Establishment of a river cooperation organization system | Formulation of New Water Supply Vision (domestic and industrial water) |
| | 2014 | Grand Design for 2050; heavy rainfall in August (estimated death toll: 6 people) | Basic Law on the Water Cycle, Law related to Promotion of Rainwater Utilization (Law System) |
| | 2015 | Torrential rainfall in Kantou and Tohoku (estimated death toll: 14 people); decision on the preparation of the Basic Plan on Water Cycle | Basic Plan of Food, Agriculture, and Rural Areas (agricultural development) |
| | 2016 | Drought in Heisei 28; earthquake in Kumamoto（estimated death toll and injured: 267 people, including related deaths) | |
| | 2017 | Heavy rainfall in the northern part of Kyusyu (estimated death toll: 40 persons) | |
| | 2018 | Heavy rainfall in July (Nishi–Nippon heavy rainfall) (estimated death toll: 263 people) | Climate Change Adaption Law (Law System) |
| Reiwa | 2019 | Typhoon Hagibis (Higashi Nihon Typhoon) (Death 105 Persons) | |
| | 2020 | Heavy rainfall in July (Death 84 Persons) | |

# TRANSLATION OF WATER RELATED ACTS AND LAWS

1. River Law (1997)
http://www.idi.or.jp/wp/wp-content/uploads/2018/05/RIVERE.pdf
2. Water Pollution Prevention Act
http://www.japaneselawtranslation.go.jp/law/detail/?vm=04&re=01&id=2815
3. Soil Contamination Countermeasure Act
http://www.japaneselawtranslation.go.jp/law/detail/?id=2038&vm=04&re=01
4. Sewerage Act
http://www.japaneselawtranslation.go.jp/law/detail/?id=2810&vm=04&re=01
5. Climate Change Adaptation Act
http://www.japaneselawtranslation.go.jp/law/detail_main?re=01&vm=04&id=3212
6. Environmental Impact Assessment Act
http://www.japaneselawtranslation.go.jp/law/detail/?id=3375&vm=&re=
7. National Spatial Planning Act
https://www.cas.go.jp/jp/seisaku/hourei/data/Plan_2.pdf
8. Basic Environment Act
http://www.env.go.jp/en/laws/policy/basic/index.html
9. Law Concerning the Promotion of the Measures to Cope with Global Warming
http://www.env.go.jp/en/laws/global/warming.html
10. Basic Law on the Water Cycle
http://arjamalev2012.blog.fc2.com/blog-entry-102.html
11. Water Supply Service Act
https://libopac.jica.go.jp/images/report/12285276.pdf
12. Technical Criteria for River Works: Practical Guide for Planning
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0519.htm

Source:
1. Infrastructure Development Institute-Japan
2. to 6. Japanese Law Translation
7. Cabinet Secretariat
8. and 9. Ministry of Environment
10. English Translation of Medical Law Reading Group
11. Japan's Experience on Water Supply Development (JICA)
12. Public Works Research Institute

# PRESENTATION SLIDE

# Executive Summary



1



# Contents of This Text (1/2)

**This text consists of executive summary and 13 themes.**

**Executive Summary**

**Theme 1 Governance**

**1-1 Legislation and Organization**

**1-2 Water Rights**

**Theme 2 Plan-based Management**

**2-1 Management Plan**

**2-2 Plan for Each River Basin**

**Theme 3 Finance**

Explanation of Water Resources Management



2

# Contents of This Text (2/2)

| | |
|---|---|
| Theme 4 | Water Pollution and Environmental Management Measures |
| Theme 5 | Urban Water Management |
| Theme 6 | River Management |
| Theme 7 | Groundwater Management |
| Theme 8 | Dam Management |
| Theme 9 | Environmental and Social Considerations in Large-Scale Projects |
| Theme 10 | Development of Human Resources and Technology |

Explanation of Each Field

Capacity Development



3



# Contents of Executive Summary

1. Introduction
2. Summary of Each Theme



4

## 1. Introduction (1)

**Resolving water-related issues is crucial to achieving sustainable development.**

**Water-related issues are becoming more severe around the world.**

**Water-related issues** ⟷ **SDGs**

**Water resources management is closely related to Sustainable Development Goals (SDGs)**







## 1. Introduction (2)


**Relation between the Management of Water Resources and SDGs**

Source: Project Research Team

# 1. Introduction (3)

**Case examples and lessons learned from Japan's experience in water resources management**

- Water-related issues vary by regions and basins.
- There is no one-solution-fits-all model for water management.

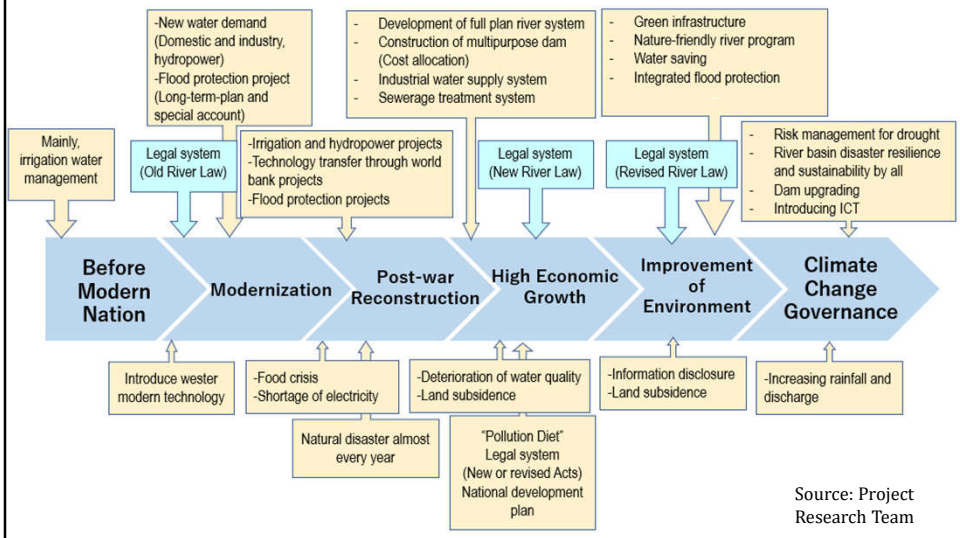
Each country or region may develop its strategies and refer to appropriate experiences from the Japanese residents to meet their requirements.







# 1.1 Evolving Management of Water Resources(1)

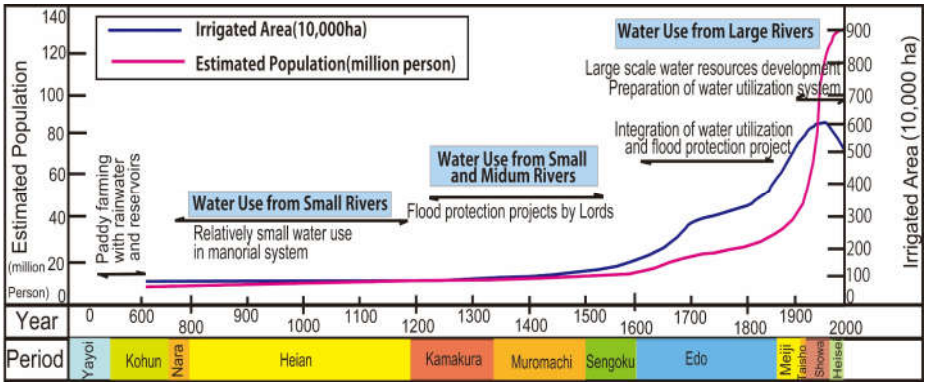



Source: Project Research Team

**Efforts for Water Resources Management in Japan**

## 1.1 Evolving Management of Water Resources(2)

**Japan fought against disasters such as floods and droughts and managed water resources over nearly 2,000 years.**




Source: PRT based on Farmland and Water in Japan, Ministry of Agriculture, Forestry and Fishery

**Changes in Population and Cultivated Area**







## 1.1 Evolving Management of Water Resources (3)

**Japan has developed the current system and practices for water resources management.**

| | End of 19th Century | |
|---|---|---|
| Water-related Issues | Local Communities | → National Government |
| Water Use | Traditional Water Use | → Water Rights System |

## 1.1 Evolving Management of Water Resources (3)

**Japan has evolved mechanisms of managing water resources to meet the emerging water-related issues along with the nation's growth and socioeconomic changes.**

End of 19th Century: Establishment of the modern nation

- Navigation in Rivers
- Requirement of urban public health improvement

→

- Flood Protection Projects
- Water Supply and Sewerage Projects

After 1945: Reconstruction of the devastated land

Food shortage, Power shortage, and sever flood damages

→

- Development of irrigation water, hydropower
- Flood protection and forest conservation







## 1.1 Evolving Management of Water Resources (4)

Period of High Economic Growth (Years 1955 to 1973, 19 years)

- Reduced Flood Damage
- Developed Water Resources
- Increased Domestic, Industrial, and Irrigation Water supply
- Increased Hydropower

Distortion of High Economic Growth

- Pollution related disease
- Urban floods
- Water pollution
- Land subsidence

↓

Public Concern

- Maturing Society
- Diversified People's Sense of Values
- Increased interest in environmental issues

→

After High Economic growth

- Water Environment Improvement

## 1.1 Evolving Management of Water Resources (5)

**River management offices (RMOs) are responsible entities that implemented water resources management in cooperation with relevant agencies.**

Responsible entities

- River Administrators

Old River Law (1986)

- Prefectural Governors

→

New River Law (1964)

- Class A Rivers: Minister of MLIT
- Class B Rivers: Prefectural Governors







## 1.1 Evolving Management of Water Resources (6)

**The Water Resources Department coordinates with multiple government organizations at the national level to create policies and plans.**

- River Basin Committee
- Drought Council
- Others

→

- Governments/Agencies
- Experts
- Water Right holders, Residents

## 1.1 Evolving Management of Water Resources (7)

**The government-formulated water resources management plans are entirely government plans with a long-term perspective and are implemented through coordination with relevant sectors and stakeholders.**

National Comprehensive Development Plan

To develop country's
- ✓ Economy
- ✓ Welfare

To promote water resources development, flood protection

**Each Sector**

The government formulated plans for each major river basin to manage the water resources based on relevant data, science, and engineering evidence.



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## 1.1 Evolving Management of Water Resources (8)

**Roles and responsibilities are defined to secure finance.**

**National Projects**

Sharing Cost by
- National Government
- Local Government

**Local Government Projects**

Sharing Cost by
- Subsidies from National Government
- Local Government

**Other Projects**

Sharing Cost by
- Farmers for irrigation facilities
- Users for water supply
- Private companies for hydropower

**Flood Protection Projects**

Financing with
- Due to long period of construction works
- Special account for Projects (independent from general account)



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## 1.1 Evolving Management of Water Resources (9)

**The approach of consensus building for project implementation has continued to change.**

| | |
|---|---|
| **Matsubara-Shimouke Dams**<br>**Affected People**<br>**Rebuilding Submerged Communities** | • Act on Special Measures for Water Source Area |
| **Nagaragawa River Mouth Barrage**<br>**Civil Society Organization**<br>**Environmental Problems** | • Change in Water Governance<br>• Information Disclosure, Transparency, Accountability |
| **Yanba Dam**<br>**Dam Policy and Science Debate** | • Policy debate on Flood Protection and Environment<br>• Re-evaluation based on Scientific Data |

**Three Projects Affected on Consensus Building**



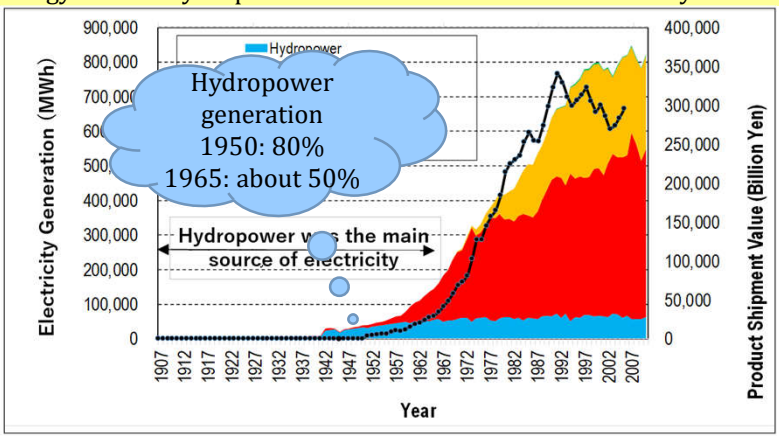




## 1.2 Japan's Accomplishment in Water Resources Management (1)

**Water resources management contributed to the quality improvement.**

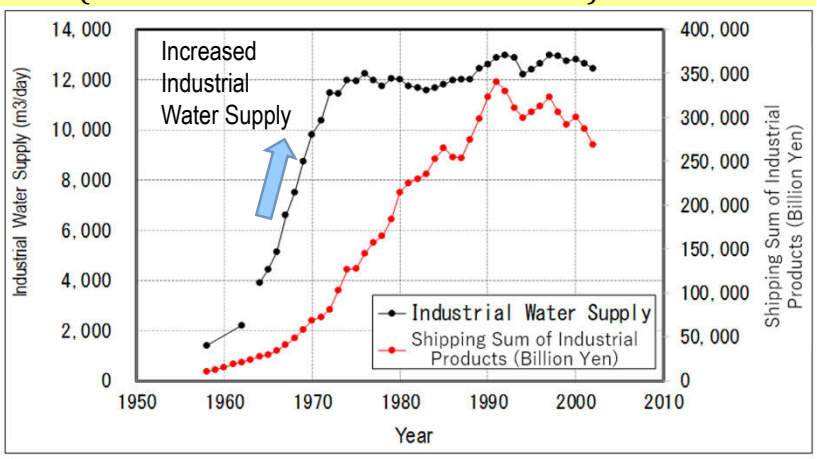
Energy Sector: Hydropower was the main source of electricity until 1965.




**Electricity Generation by Type and Product Shipment Value**

## 1.2 Japan's Accomplishment in Water Resources Management (2)

Development industrial water supply system since the 1950s (Countermeasure to Land subsidence)




**Trend of Industrial Water Supply and Shipping Sum of Industrial Products**



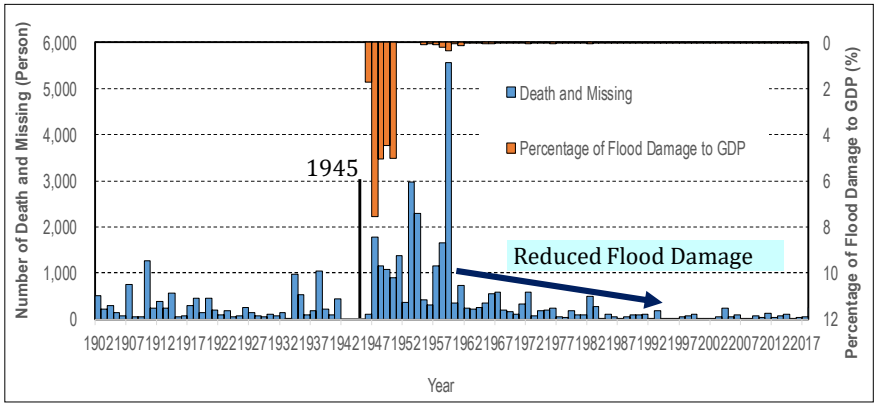




## 1.2 Japan's Accomplishment in Water Resources Management (3)

(1) Social Resilience

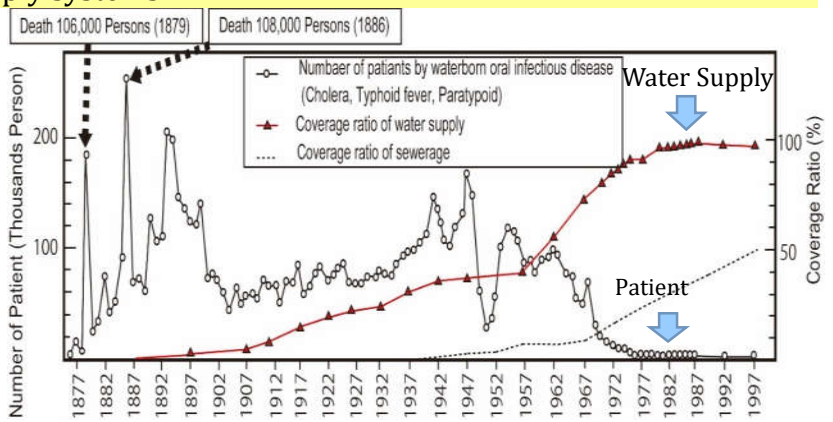
The investment in the flood protection reduced the flood damages.




**Number of Casualties due to Floods and Flood Damages**

## 1.2 Japan's Accomplishment in Water Resources Management (4)

Infectious diseases were reduced through developing water supply systems.




Source: Urban Development and Public Health, Nakatsuji Hideji, WHO in sight No.44(2010)

**Number of Patients with Waterborne Oral Infections and Water Supply and Sewerage Coverage**

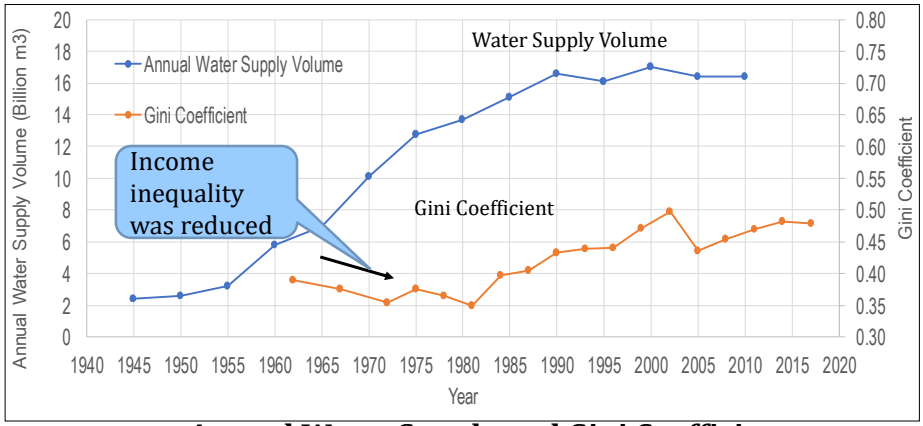




## 1.2 Japan's Accomplishment in Water Resources Management (5)

(2) Inclusive Services

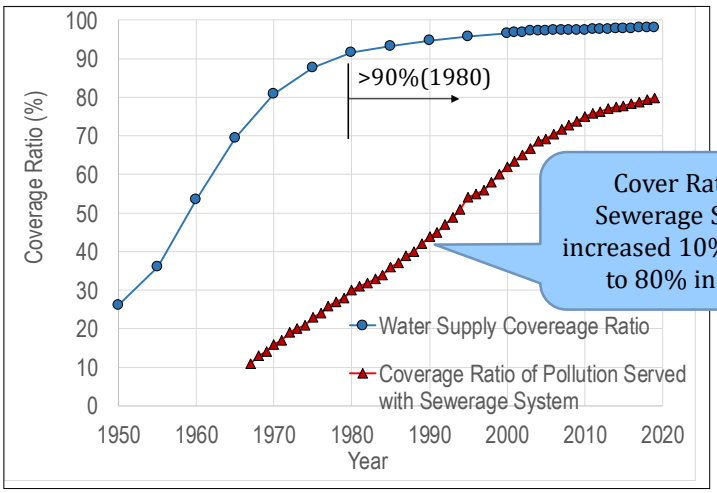
The improved water supply and flood protection supported urban development and mitigated regional disparities.




**Annual Water Supply and Gini Coefficient**

## 1.2 Japan's Accomplishment in Water Resources Management (6)

Access to safe drinking water and health was improved.




**Water Supply and Sewerage Coverage Ratio**



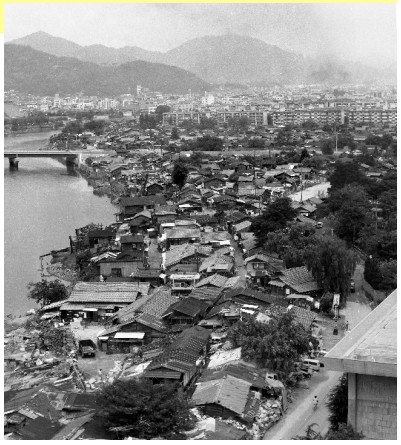




## 1.2 Japan's Accomplishment in Water Resources Management (7)

In conjunction with river improvement, the government implemented projects to support the urban poor living near the river area

The government constructed public housing for low-income people and provided them with poor resettlement.



Source: The Hirosima City Archives

**Atomic Bomb Slum in Hirosima**

## 1.2 Japan's Accomplishment in Water Resources Management (8)

(3) Sustainability

Japan improved the quality of river water through establishment of drainage regulations and construction of sewage systems.

- Pollution disease by effluent from factories
- Water quality deterioration by wastewater

→ Improvement of Water Quality

- Effluent control
- Promotion of sewerage system



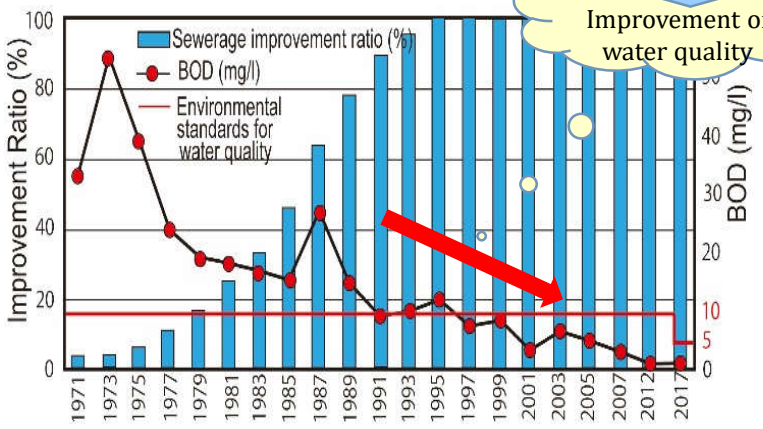




## 1.2 Japan's Accomplishment in Water Resources Management (9)

Example: Water Quality of Yanase River

Decreasing BOD → Improvement of water quality

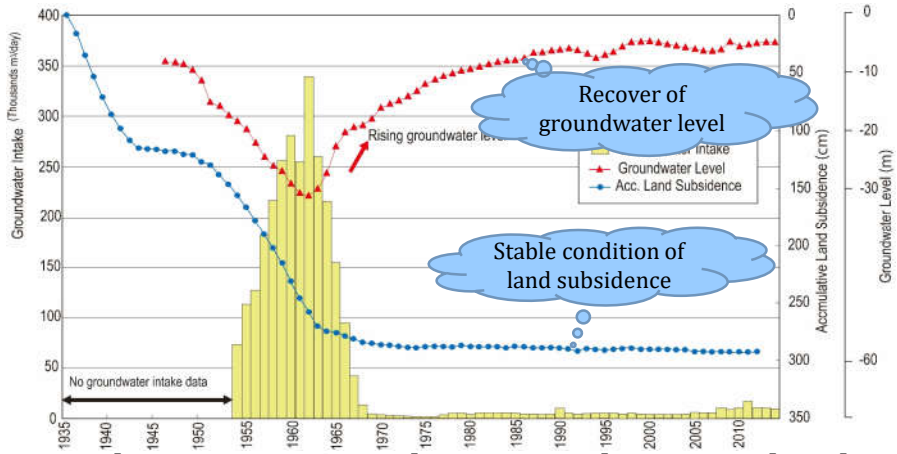



**Water Quality of Yanase River and Sewerage Coverage Ratio**

Source: Bureau of Sewerage, Tokyo Metropolitan Government

## 1.2 Japan's Accomplishment in Water Resources Management (10)

Industrial water supply systems have contributed to the cessation of land subsidence.



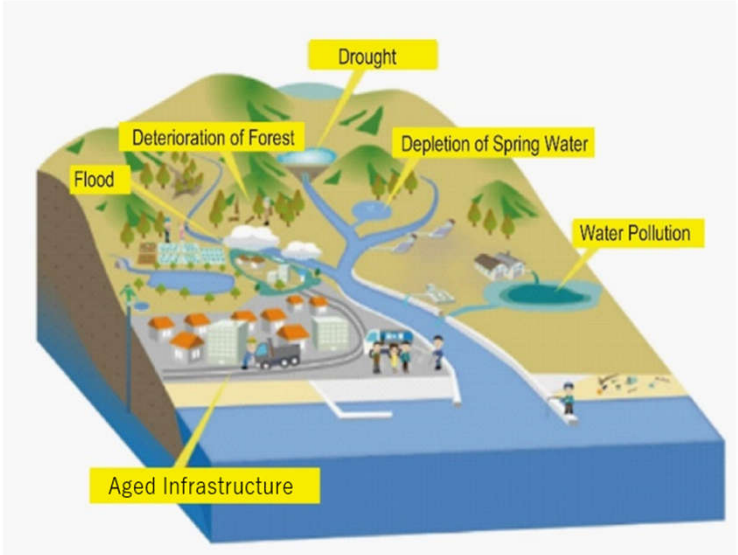

**Groundwater Extraction Volume, Groundwater Level, and Cumulative Land Subsidence (Osaka City)**







## 1.3 Issues for Water Resources Management in Japan(1)




**Issues in Water Resources Management**

## 1.3 Issues for Water Resources Management in Japan(2)

**(1) Limited quick response and flexibility**

- **Pollution diseases**
- **Water demand projection**

**(2) Establishment of water governance**

- **To respond quickly to the diversified needs of an ever-changing society.**

**(3) Adaptation of climate change and socioeconomic change**

- **To enhance the resilience and sustainability of river basins by all stakeholders.**
- **To maintain the vitality of people's communities and improve productivity and national growth.**







## 2. Outline of Each Theme

| Theme | | Flood Protection | Water Use | Environ-ment |
|---|---|---|---|---|
| 1. Governance | 1-1 Legislation and Organization | 0 | 0 | 0 |
| | 1-2 Water Rights | | 0 | 0 |
| | 1-3 Public Participation and Decision-Making Process | 0 | 0 | 0 |
| 2. Plan-based Management | 2-1 Development Plan | 0 | 0 | 0 |
| | 2-2 Plan for Each River Basin | 0 | 0 | 0 |
| 3. Finance | | | 0 | 0 |
| 4. Water Pollution and Environmental Management Measures | | | | 0 |
| 5. Urban Water Management | | 0 | 0 | 0 |
| 6. River Management | | 0 | 0 | 0 |
| 7. Groundwater Management | | | 0 | 0 |
| 8. Dam Management | | 0 | 0 | 0 |
| 9. Environmental and Social Considerations for Large-Scale Projects | | | | 0 |
| 10. Development of Human Resources and Technology | | 0 | 0 | 0 |

Note: "O" indicates there is description in the Theme.

## 2.1 Legislation and Organization to Coordinate Sectors and Regions(1)

**Government should establish legal systems and to coordinate interests of stakeholders.**

- Conflict Stakeholders, Sectors, Regions
- Role-sharing Cost-sharing
- Environment Ecosystem

**Over the past 2,000 years, Japan has restored to river management to make use of the water and to reduce flood damage.**

**End of 19th Century: established Modern Nation**

**Legal and organization system** → **Old River Law (1896)** → **New River Law (1964)** → **Revised River Law (1997)**



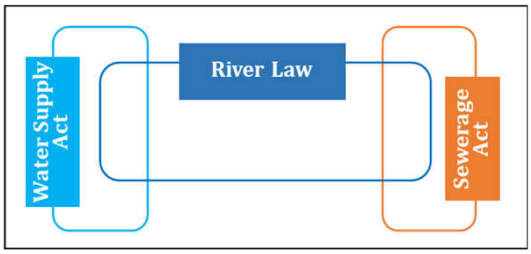




## 2.1 Legislation and Organization to Coordinate Sectors and Regions(2)

**Japan transformed institutions to meet the changing needs of the country along with the nation's growth, socioeconomic changes, and climate change**

Modernization: End of 19th Century-Mid 20th Century



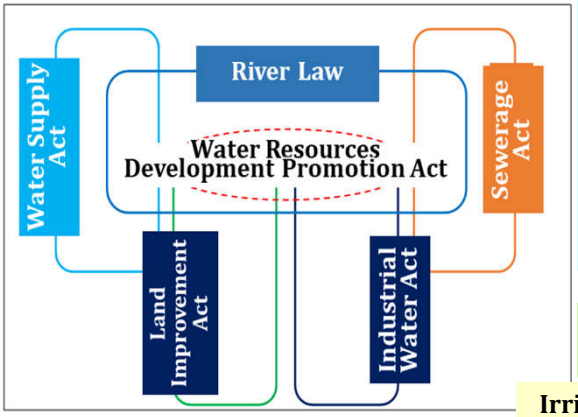

Flood Protection
1896 Old River Law

For Public Health
1890 Water Supply Act
1900 Sewerage Act

**Flood Prevention and Public Health**

## 2.1 Legislation and Organization to Coordinate Sectors and Regions(3)

High Economic Growth period: Mid 20th Century to 1970




**Water Resources Development**

**Water Resources Development**
1957 Specific Multipurpose Dam Act
1958 New Sewerage Act
1963 Water Resources Development Promotion Act

**River Basin Management**
1964 New River Law

**Irrigation and Water Supply**
1949 Land Improvement Act
1956 Industrial Water Act

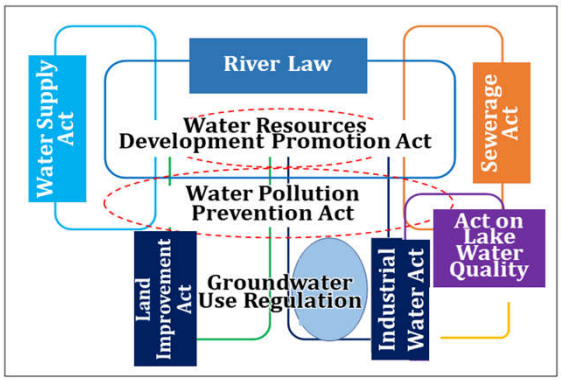






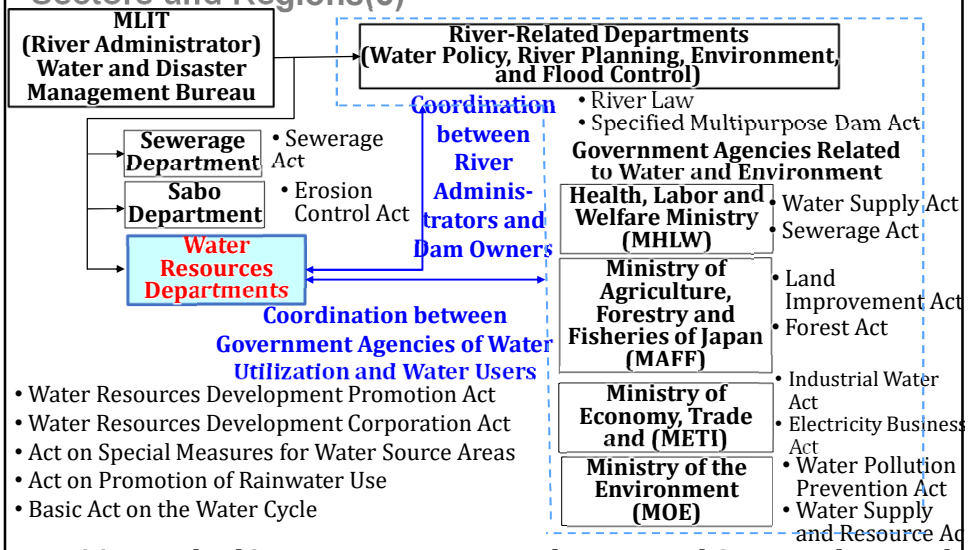
## 2.1 Legislation and Organization to Coordinate Sectors and Regions(4)

Sustainable Growth Period: 1970 - Present




**Environment Preservation**
1984 Act on Special Measures Concerning Conservation of Lake Water Quality
1997 Revised River Law
2014 Basic Act of Water Cycle

## 2.1 Legislation and Organization to Coordinate Sectors and Regions(5)




**Entities Involved in Water Resources Development and Concerned Law and Acts**

Source: Project research team referring to MLIT website







## 2.2 Water Use Order with Water Rights System (1)

**The government should establish the water-using order by introducing a water rights system based on past water management and the background of past development, customs and history.**

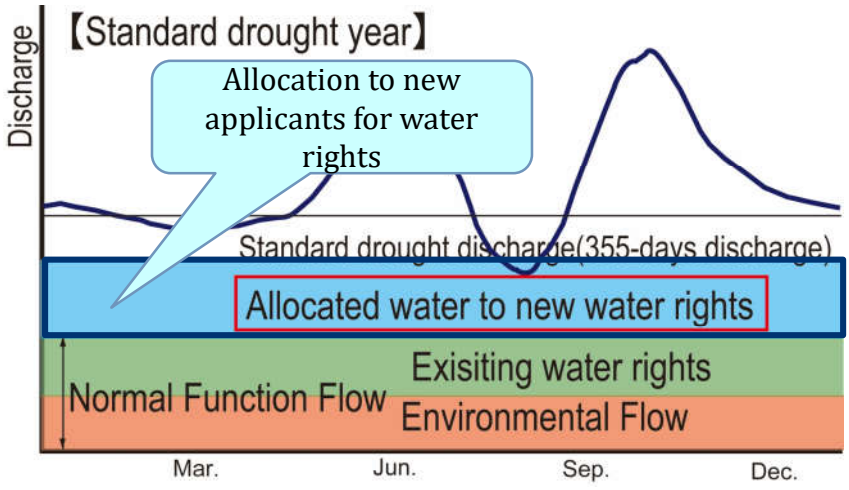
**After establishment of modern legal system**
- **Customary water right**
- **Licensed water right**

**The River Management Offices (RMOs) manage the water rights and issue licenses.**

**The RMOs stipulated by the river administrator in the river law.**

**River administrator**
- **Major Rivers: Minister (MLIT)**
- **Other Rivers: Prefectural Governors**

## 2.2 Water Use Order with Water Rights System (2)




**Available Permit Water**







## 2.2 Water Use Order with Water Rights System (3)

**During drought event, water users coordinate their abstraction volumes at drought-coordinating committees in the spirit of co-assistance, which was fostered through the practices and history in each river basin.**

**The drought-coordinating Committee (Member: Water right holders, Observer River Administrator) establishes rule of water saving (priority, water saving ratio, etc.)**

**Farmers' Associations (Agricultural Irrigation Area Improvement and Management Association) manage irrigation facilities.**

**Farmers' Associations**

- Member: farmers in the irrigation area
- Required Cost: Levy from the members
- Project : subsidies from governments and some cost pay by farmers
- Tax exempted due to highly public organization
- To manage Irrigation facilities
- To perform maintenance and renovation of facilities

## 2.2 Water Use Order with Water Rights System (3)

**During drought event, water users coordinate their abstraction volumes at drought-coordinating committees in the spirit of co-assistance, which was fostered through the practices and history in each river basin.**

**Farmers' Associations set rules for water allocation within irrigation area and manage irrigation facilities.**

**Farmers' Associations**

- Member: Farmers in the irrigation area
- Required Cost: Levy by the members
- Project : Subsidies from governments and some cost pay by farmers
- Tax exempted due to highly public organization

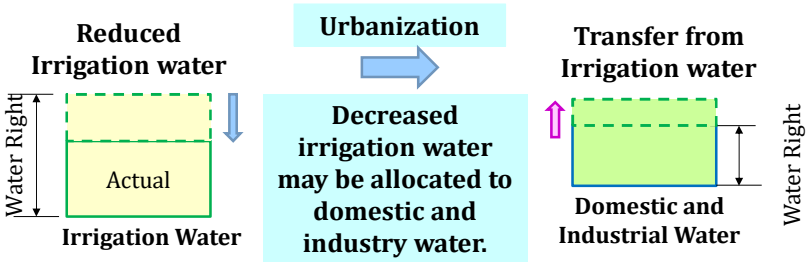






## 2.2 Water Use Order with Water Rights System (4)

**By establishing systems for the transfer of water rights, water resources can be managed effectively**



## 2.3 From Government Management to Building Water Governance(1)

**Water governance should be established according to the actual conditions of each river basin and local community.**

- Consensus building by government
- Diverse needs of increased complex society
- Vertically segmented administration system

**Building Water Governance**

Participation of residents and civil society organizations in the decision-making system

Disclosure of information

Accountability of the government



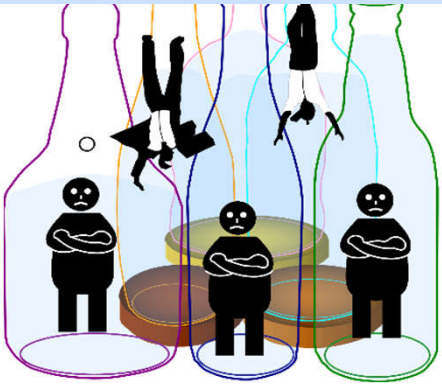




## 2.3 From Government Management to Building Water Governance(2)

**Water governance should be established according to the actual conditions of each river basin and local community.**

**The bottles are governments. Citizens fall through the gap in the bottles.**



Source: Japan Water Forum, Takemura Koutaro

**Vertically Segmented Administrative Model**

## 2.3 From Government Management to Building Water Governance (3)

**The controversy over the Nagaragawa River Mouth Barrage provided an opportunity for water governance reform.**

Since around the 1980s

There has been an increase in the number of cases in which the environmental impacts of public works, such as dams and barrages, became major social issues.

**Nagaragawa River Mouth Barrage**

- MLIT: Information disclosure (all relevant data)
- Roundtable meeting

→

- Enhancement of transparency
- Accountability in the decision-making process

**River Basin Committee**







## 2.3 From Government Management to Building Water Governance (4)

**River basin committee is established in each river basin to formulate "River Improvement Plans" for flood protection, water utilization, and environment conservation.**

**1997: Revised River Law**

- Preparation of River Improvement Plan

Establishment of River Basin Committee

Govern-ments | Experts | Residents

**Public Hearing from Residents**

**Yodo River Basin Committee**

- Committee members were selected by third party(Secretariat): 2001
- Wide range of issues were discussed
- Conflict occurred on dam construction

Committee was suspended in 2007.

## 2.3 From Government Management to Building Water Governance (5)

**Information disclosure is essential to establish water governance through citizens and stakeholder participation.**

- 2001: Information Disclosure Act
- 2003: Guideline for procedure of resident participation (MLIT)

**There may be more than one correct answer to resolve issues by coordinating stakeholders' opinions, and the attitude to keep looking at the most preferable answer is most required.**

- Quite difficult to reach a unanimous agreement in consensus
- Efforts to find the most preferable solutions
- Expect that the project will contribute to the region's interest and for which all residents and stakeholders accept.

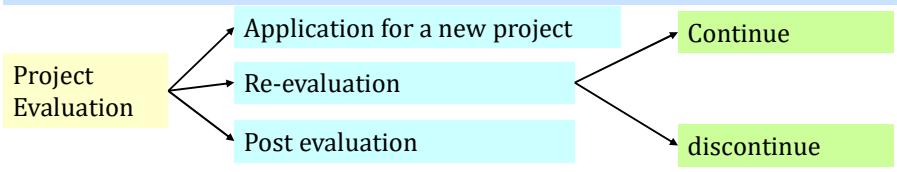






## 2.3 From Government Management to Building Water Governance (6)

**A review of the projects is necessary for keeping with socioeconomic changes.**



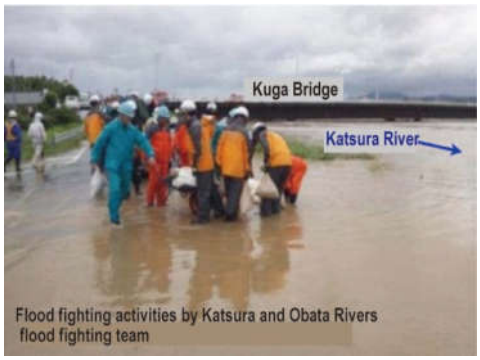

**It is important to strengthen the cooperation between the public and private sectors and local communities for environmental conservation and disaster prevention**

**Public Sector (Governments)**
- Institutional support
- Financial supports

**Private Sector (Residents)**
- Voluntary actions
- Daily efforts in the field

## 2.3 From Government Management to Building Water Governance (6)

**Disaster Prevention**




Source: Outline of Typhoon No.18 in September 2013, Kinki regional development bureau, March 2014

**Flood Fighting Activities**

**Environmental Conservation**

Source: Tree Planting for Fish Breeding Campaign Regain the 100-year-ago natural beach

**Tree Plantation**







## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (1)

**Water resources development plan should be a consistent framework of higher-level plans, such as the National Comprehensive Development Plan (NCDP).**

Water resources Management is not done properly. → Floods, Droughts, Water quality deterioration → Water resources are not be used properly. → It affects to the growth of the country.

Proper Water Resources Development → Achievement of resilient, sustainability, inclusive and quality growth

## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (2)

**Water Resources Development**

**After 1945: Promoted as the core issue of the comprehensive regional development for the reconstruction after World War II**

**In 1960s : Became the important sector in the national development to resolve the issues accompanied to the high economic growth.**

**After 1962: Formulated the National Comprehensive Water Resources Plan (the Water Plan) to match the framework of the NCDP.**

| After 1945 | 1960s | After 1962 |
|---|---|---|
| • Increased Food supply and Energy<br>• Increased Flood Damages | • Issues accompanied to the high economic growth | • Formulation of NCDP<br>• Formulation of the Water Plan |







## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (3)

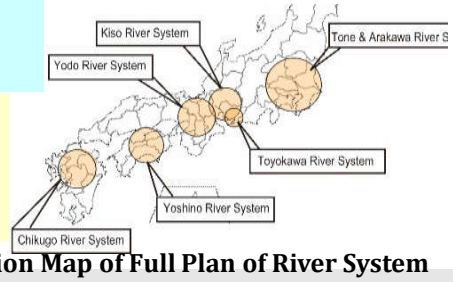
**The Japanese government formulated a basic plan for water resources management in the important river systems from the perspective of socioeconomic activities.**

- Increase of Water Demand
- Difficult Coordination among Sectors and Stakeholders

→ Water Resources Development Promotion Act (1961) → Water Resources Development River Systems (Full Plan)

Full Plan: To provide for comprehensive development and rationalization of use of water resources

- Demand projection of water use and target of water supply
- Necessary facilities to achieve the supply targets




**Location Map of Full Plan of River System**

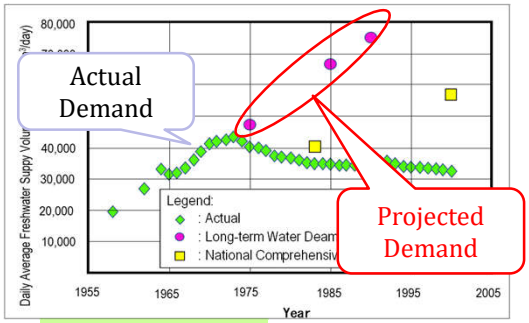
Source: PRT based on MLIT data

## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (4)

**All plans require a review mechanism.**

- Deviation between actual water demand and long-term plan water demand

- Resources allocation tends to be almost fixed.
- Planned projects were required to be changed.




**Establishment of Plan Review Mechanism**

**Comparison of Projected and Actual Water Demand in Japan**

Source: Analysis and Evaluation of Japan's Water Demand Forecasting System, Nishioka Takashi, Nasu Shingo







## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (5)

**Formulating a long-term plan contributes to securing a budget for long-term project implementation.**

- Water resources development project
- Flood protection project

Long period until completion

**Special account to secure long-term budget**

## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (6)

**Under climate change, the flood management with a comprehensive and multi-layered approach by various stakeholders throughout the river basin, and the "risk management" for droughts are required.**

**River basin disaster resilience and sustainability through all**

(1) Flood protection: irrigation ponds, rainwater infiltration, and flood storage in urban areas
(2) Exposure reduction: regulate urban development in hazardous areas, and
(3) Disaster resilience: cooperation with the stakeholders for disaster response and reconstruction.







## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (7)

**River basin disaster resilience and sustainability through all**

## 2.4 Long-term Plan of Water Resources Management in a National Development Framework (8)

**Climate Change Impact: MLIT expected climate change impact**

**Rate of Change in Rainfall, Flow Rate, and Flood Frequency due to Climate Change**

| Climate Change Scenario | Rainfall | Flow Rate | Flood Frequency |
|---|---|---|---|
| **2°C increase** | Approx. 1.1 times | Approx. 1.2 times | Approx. 2 times |
| **4°C increase** | Approx. 1.3 times | Approx. 1.4 times | Approx. 4 times |

Source: Proposal for Flood Control Planning in Light of Climate Change, Revised Edition, MLIT, April 2021







## 2.5 River Basin as a Unit of Water Resources Management (1)

**The governments formulate water resources management plans according to basin characteristics and regional customs.**

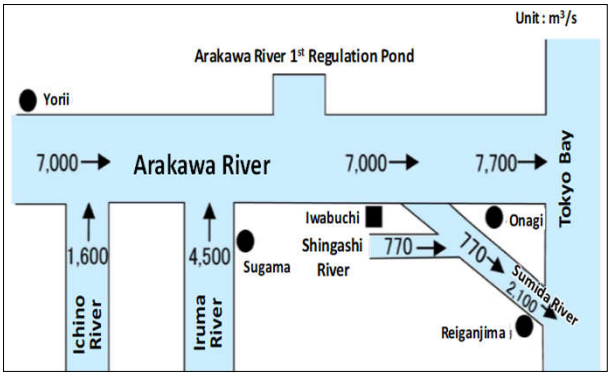
- Coordination of related sectors
- Setting flood protection level
- Optimization of improvement of facilities and water management

- The hydrological data are essential for developing management plans.
- If the observation data are insufficient, satellite observation, past marks, hearsay should be recorded.

## 2.5 River Basin as a Unit of Water Resources Management (2)

**The safety level of flood protection should be set according to the importance of the protected areas.**

- Flood Prevention Level : Probability of Occurrence
- Important river: Tokyo, Osaka 1/200




**Planned Flood Discharge of the Arakawa River**

Source: Arakawa Upstream Basin Office, MLIT



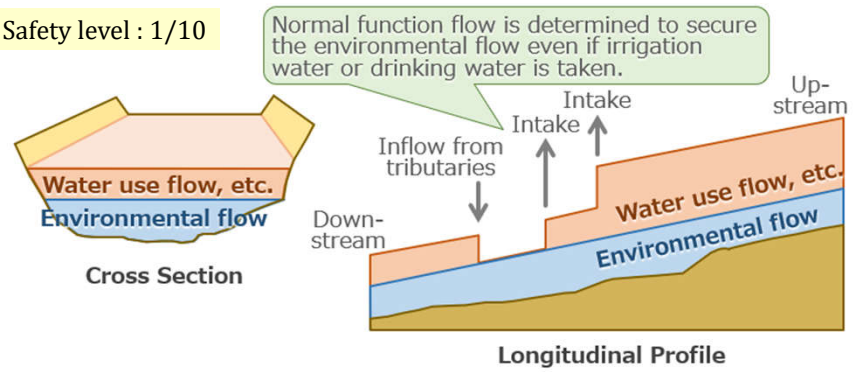




## 2.5 River Basin as a Unit of Water Resources Management (3)

**The safety level (probable year of drought frequency) should be set as a target for the water use plan.**

Safety level : 1/10




**Normal Function Flow**

Source: Project Research Team based on website of Hyougo Prefecture

## 2.5 River Basin as a Unit of Water Resources Management (4)

**Factors for Environmental Flow**

1. Navigation
2. Fishery
3. Tourism
4. Maintenance of clean water flow
5. Prevention of salt damage
6. Prevention of blockage of estuaries
7. Protection of river management facilities
8. Maintenance of the groundwater level
9. Landscape
10. Habitat of animals and plants
11. Securing rich contact between people and rivers







## 2.5 River Basin as a Unit of Water Resources Management (5)

**A master plan and action plan should be prepared to improve the river.**

**Revision of River Law (1997)**

- Preparation of Basic Policy for River Development
- River Improvement Plan

**Basic Policy for River Development (Master Plan)**

- Flood protection
- Maintenance of water use and functions
- Improvement and conservation of the river environment

**River Improvement Plan (Action Plan)**

- Specific goals of river improvement for the period of 20 to 30 years
- Specific individual project
- River Basin Committee

## 2.5 River Basin as a Unit of Water Resources Management (6)

**The River Management Offices (RMOs) understand the issues and needs of the field.**

- The RMOs are responsible for Water Resources Management.
- The MLIT has a RMO for each river.

**RMOs under MLIT**

- To understand the issues and needs of local communities in the field
- To prepare measures together with the communities
- To collaborate with various stakeholders
- To build trust relationships with relevant persons, organizations and communities

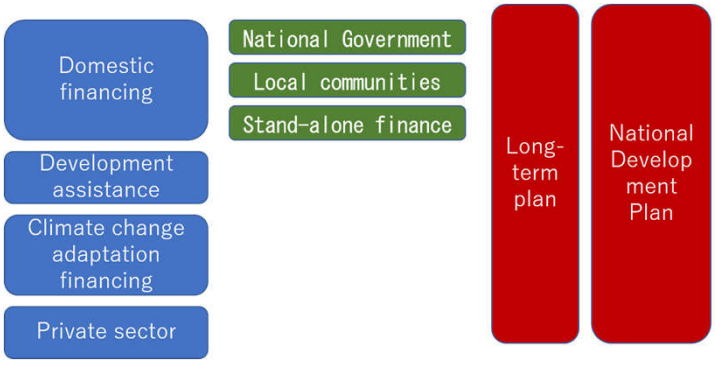






## 2.6 Cost Sharing according to Responsibility and Role (1)

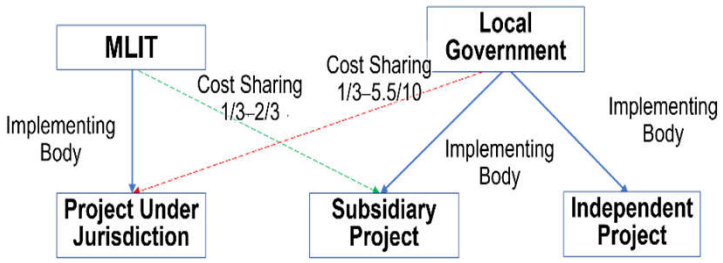
**Governments should provide financing investments and involve the private sector in water resources management.**




**Finance for Water Resources Development and Management**

Source: Ishiwatari, M. and Akhilesh S. "Good enough today is not enough tomorrow: Challenges of increasing investments in disaster risk reduction and climate change adaptation." Progress in Disaster Science 1

## 2.6 Cost Sharing according to Responsibility and Role (2)




**Cost Sharing in Projects under the Jurisdiction and Subsidiary Projects**

Source: Project Research Team







## 2.6 Cost Sharing according to Responsibility and Role (3)

**Investments are arranged by mobilizing various sources.**

- Each partner shares the costs in the construction and maintenance of multipurpose facilities.
- The share of the cost is determined based on the benefit obtained for each purpose.

**The government should also consider public-private partnership (PPP) methods for managing facilities.**

- Outsourcing
- Design Build
- PFI (Conventional method)
- PFI (Concession method)

→

- Water supply systems
- Sewerage systems

## 2.7 Effective Water Pollution Control and Environmental Conservation (1)

**It is necessary to establish a legal system to prevent environmental degradation.**

In High Economic Growth

- Pollution diseases
- Minamata disease, Itai-itai disease

→
- Water Quality Protection Act (1958)
- Industrial Wastewater Act (1958)

**Pollution Diet (1970 )**
to discuss environmental pollution issues

→
- Water Pollution Control Act (1970)
- Revised Sewerage Act (1970)

**Local Governments**
Enacted stricter Standards by **Ordinances**

→
- To conduct on-site inspections on factories
- To advise remedial measures to the private companies

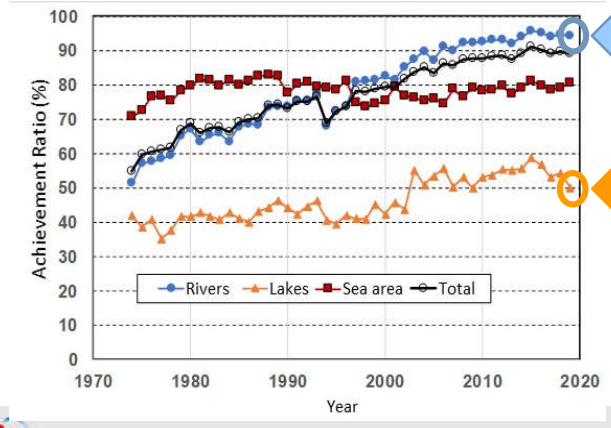






## 2.7 Effective Water Pollution Control and Environmental Conservation (2)

**Treatment facilities are combined and developed according to population density and topographical conditions.**




94.1% (2019)
River

50.0% (2019)
Lake and Marsh

**Improvement of Water Quality in Rivers, Lakes, Sea and total**

Source: Ministry of Environment

## 2.7 Effective Water Pollution Control and Environmental Conservation (3)

**The degradation of water quality in closed water bodies requires measures against non-point source loads, where pollution discharge sources cannot be specifically identified.**

Non-point source

- The source areas of loads such as urban areas, farmland, and forests
- The water channels and rivers
- The closed water bodies where the load reaches

- Sewerage systems, cleaning roads, underground infiltration facilities, and rainwater storage (Urban area)
- Improvements in irrigation management, implementation of proper fertilization







## 2.7 Effective Water Pollution Control and Environmental Conservation(4)

**The national government has promoted "Nature-friendly river programs" since the 1990s to conserve and restore the natural environment in rivers.**

Before Construction

After Construction

**Artificial** **Natural**

**Nature-Friendly River Program**

Source: MLIT

## 2.7 Effective Water Pollution Control and Environmental Conservation (5)

**Utilize traditional technique.**

**Water Control Work: Sacred Cows (Groyne)**

**Riverbed and Riverbank Protection (Fascine Mattress)**

Source: Websites of Kouhu River and Road Office Left), and Shinanogawa Downstream Office (Right)

**Traditional Construction Method**







## 2.7 Effective Water Pollution Control and Environmental Conservation (6)

**Yamada Weir (Japan, Material: Stone)**

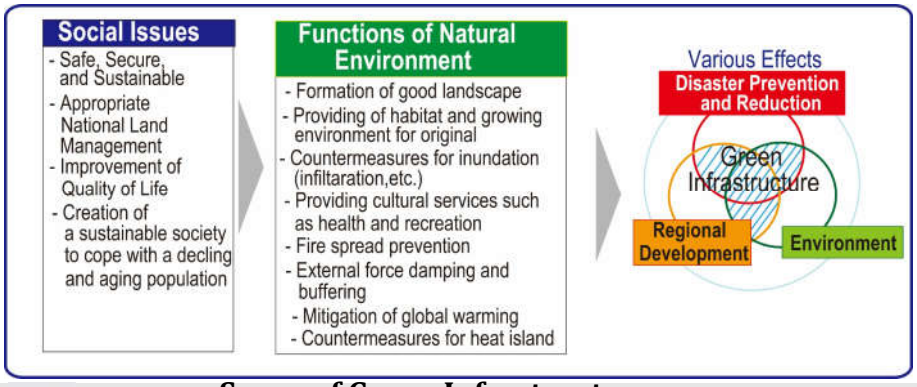

**Kama II Weir (Afghanistan)**

**Traditional Construction Method**

Source: (Left) Asakura City, (Right) Website of Peshawar-kai

## 2.7 Effective Water Pollution Control and Environmental Conservation (7)

**Green infrastructure has diverse effects on disaster mitigation, the environment, and regional development, leading to the achievement of the SDGs.**




**Scope of Green Infrastructure**

Source: Green infrastructure portal site, MLIT







## 2.8 Improvement of the Urban Water Cycle (1)

**The water cycle should be restored to coexistent with the environment to ensure water utilization, flood protection, and environmental conservation.**

| Measures | WU | FP | EN |
|---|---|---|---|
| 1. Water Utilization | | | |
| 1.1 Water fee system | ○ | | |
| 1.2 Water-saving tap | ○ | | |
| 1.3 Reduction of non-revenue water rate | ○ | | |
| 1.4 Rainwater harvesting (water use) | ◎ | ○ | |
| 1.5 Recycled water use | ○ | | |
| 1.6 Sewerage high-treatment water use | ◎ | | ○ |
| 1.7 Use of recovered water for industrial use | ○ | | |
| 1.8 Seawater desalination | ○ | | △ |

Note: WU: Water Utilization, FP: Flood Protection, EN: Environment Conservation
◎Extremely effective, ○Highly effective, △Low effectiveness as a countermeasure

**Measures Related to Water Utilization, Flood Protection and Environment in Urban Areas (1/2)**

## 2.8 Improvement of the Urban Water Cycle (2)

| Measures | WU | FP | EN |
|---|---|---|---|
| 2. Flood Protection | | | |
| 2.1 River improvement (Construction of levee, dredging of riverbed) | | ◎ | ○ |
| 2.2 Retarding basin, multiple retarding basin | | ◎ | ○ |
| 2.3 Permeable pavement and permeable groundwater infiltration | ○ | ◎ | |
| 2.4 Underground storage | | ◎ | |
| 2.5 Underground River | | ◎ | |
| 3. Water environment | | | |
| 3.1 Nature-friendly River program | | ○ | ◎ |
| 3.2 Sewerage system maintenance | | ◎ | ◎ |
| 4. Public awareness campaign | ○ | ○ | ○ |

Note: WU: Water Utilization, FP: Flood Protection, EN: Environment Conservation
◎Extremely effective, ○Highly effective, △Low effectiveness as a countermeasure

**Measures Related to Water Utilization, Flood Protection and Environment in Urban Areas (2/2)**







## 2.8 Improvement of the Urban Water Cycle (3)


Source: MLIT

**Image of Measures for Urban River Basin**

## 2.8 Improvement of the Urban Water Cycle (4)

**Demand management can save water and benefit multiple areas.**

Average leakage ratio of the water distribution system: <5%

| | |
|---|---|
| Industrial Water Use: | Recycle ratio (77.9%: 2015) |
| Miscellaneous Water Use: | Rainwater, Recycled water, Treated sewerage water |

| | |
|---|---|
| Annual Rainwater Utilization: | 11.2 million $m^3$ |

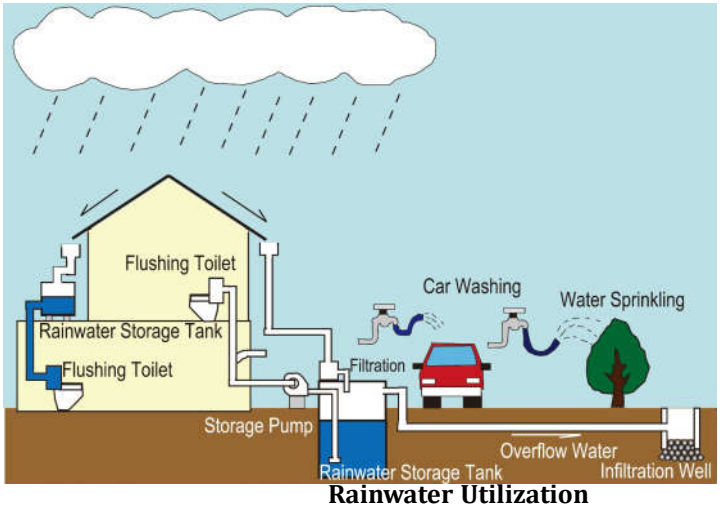






## 2.8 Improvement of the Urban Water Cycle (5)

**Water demand management may save water and benefit multiple areas.**




**Rainwater Utilization**

Source: Website of Sumida-ward

# 2.8 Improvement of the Urban Water Cycle (6)

**Comprehensive measures are required for managing urban floods.**

Green Space Preservation

Control Embankment on Agricultural Land along the River

**Conservation Area**


**Disaster Prevention Pond**

Source: Key points for river development in Tsurumi River, Tsurumi River Management Office MLIT

**Measures in River Basin**

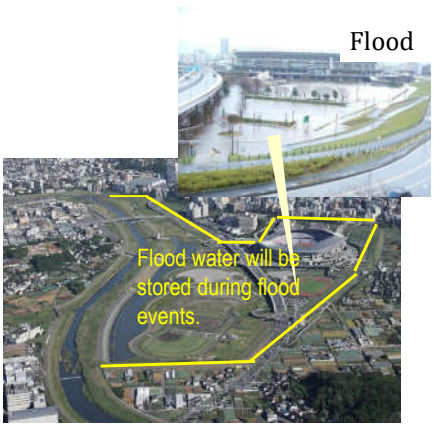






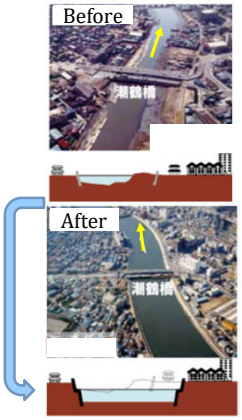
# 2.8 Improvement of the Urban Water Cycle (7)

Increased Flow Capacity: About 2 times




**Multipurpose Retarding Pond**

Source: PRT and Tsurumi River Multipurpose Retarding Basin Pamphlet



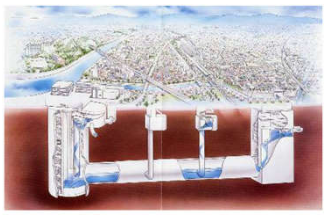

**River Improvement**

Source: PRT and Tsurumi River Management Office MLIT

**Measures in River**

## 2.8 Improvement of the Urban Water Cycle (8)

Internal Drainage Facility
(Pumping Station)



Rainwater Storage Tunnel

Rainwater Infiltration Well & Trench

**Measures by Sewerage System**

Source: MP for Tsurumi River Basin, MLIT







## 2.8 Improvement of the Urban Water Cycle (9)

**Green infrastructure demonstrate a variety of functions in urban areas.**

**Green Infrastructure, Kamisaigo River**
Source: Fukutsu City

**Urban Development Integrated with the River Space, Doutonbori River in Osaka City**

Source: Japan Riverfront Research Center

## 2.9 Management of River Water and Land (1)

**The national government has establishes a legal system and organization to properly maintain and manage river water and land.**

Permissions by River Management Offices

- Occupation of flowing water
- Occupation of land in river area
- Collection of river products
- New construction and renovation of structures
- Excavation of land in river area
- River flow transportation of timbers
- Navigation through locks







## 2.9 Management of River Water and Land (2)

**The national government has establishes a management system for rivers and river structures.**

During Flood

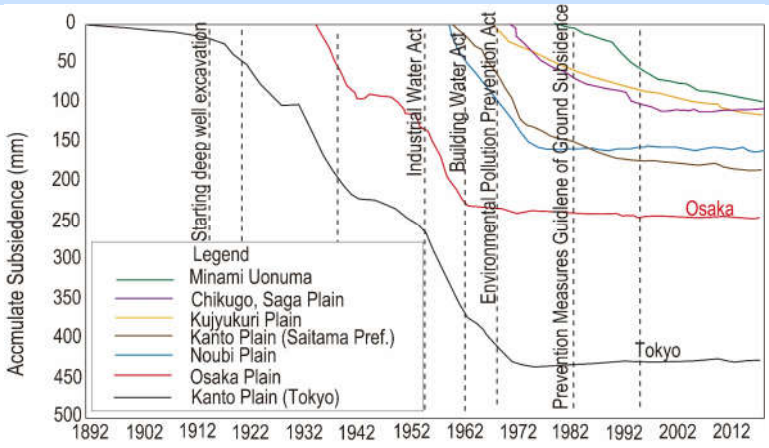
- Patrol of river facilities, and operation of dams and gates
- Announcement of flood forecasts
- Notice of flood information to relevant organizations
- Support to flood protection activities of local community

Maintenance and Management

- Patrol of river facilities
- Weeding
- Removal of obstacles
- Visual inspection
- Operation checks of gates

## 2.10 Management of Groundwater (1)

**Excessive extraction of groundwater lowers the groundwater level, resulting in land subsidence, structural damage, flood damage, and saltwater contamination of the groundwater.**




**Changes in Land Subsidence at Representative Sites**

Source: Subsidence areas in FY 2008, Ministry of the Environment

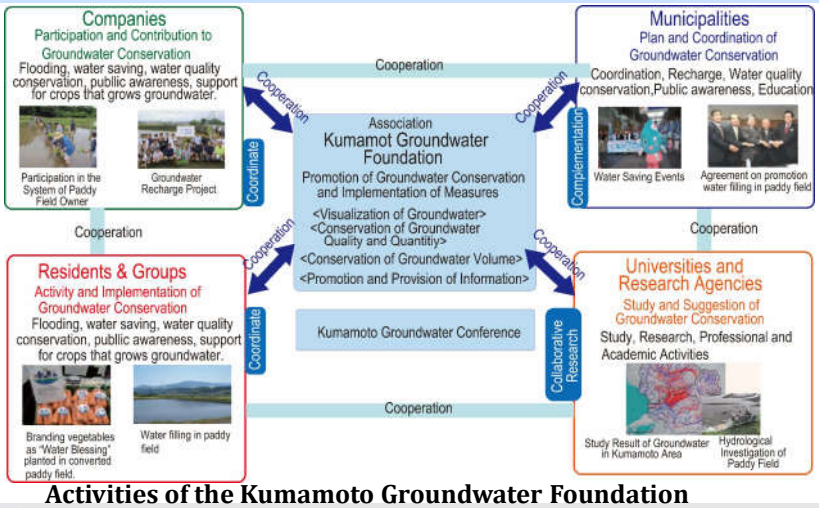






## 2.10 Groundwater Management (2)

**The conservation and management of groundwater are realized by considering regional characteristics.**




**Activities of the Kumamoto Groundwater Foundation**

Source: Case Studies of Watershed Management, Water Cycle Production Headquarters Cabinet Secretary

## 2.10 Groundwater Management (3)

**Groundwater quality management prevents harmful substances from infiltrate into the ground.**

To prevent seepage of harmful substances into the ground

- Standard and guideline
- Regular monitoring
- Action plan against abnormal situation







## 2.11 Dam-Safety Management and Operation (1)

**Because dam failure would cause damage to the downstream areas, strict dam construction and safety management processes are essential.**

**Dam Breaks in Japan**

| Name of Dam | Year of Completion | Year of Accident | Type of Dam | Damages |
|---|---|---|---|---|
| Iruka-ike | 1633 | 1868 | Earth fill dam for irrigation | 941 dead |
| Komoro Power Station | 1927 | 1928 | Buttress type concrete dam for hydropower | 5 dead |
| Horonai Dam | 1939 | 1941 | Gravity type concrete dam for hydropower | 60 dead |
| Heiwa-ike | 1949 | 1951 | Earth fill dam for irrigation | 75 dead |
| Yoake Dam | 1952 | 1953 | Gravity type concrete dam for hydropower | No damage |
| Taisyo-ike | 1949? | 1953 | Earthfill dam for irrigation | 105 dead |
| Wachi Dam | 1968 | 1967 | Gravity type concrete dam for hydropower | 1 dead |
| Fujinuma Dam | 1949 | 2011 | Earthfill dam for irrigation | 8 dead/missing |

Source: PRT based on the documents of No. 21 Expert meeting on future policy and concept of flood management

## 2.11 Dam-Safety Management and Operation(2)

**Dam discharge during flooding should be determined by considering the safety of downstream areas.**

Dam discharges should not cause a sudden rise in the water level on the downstream reaches

D/S water level <30cm in 30minutes

The dam office should notify residents and recreational users of safety issues in the river area via speakers and patrols.



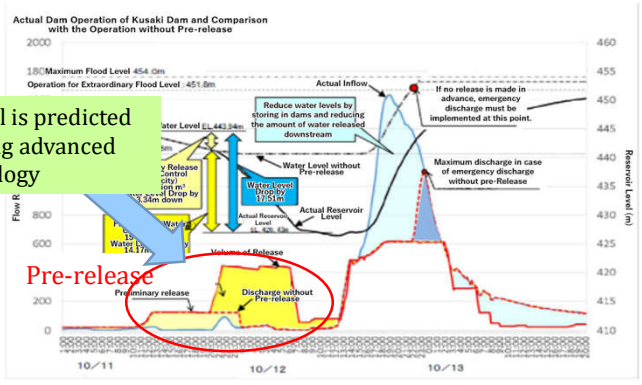




## 2.11 Dam-Safety Management and Operation (3)

**Dams for water supply may also be used for flood protection by improving the dam operation rule.**

Rainfall is predicted by using advanced technology

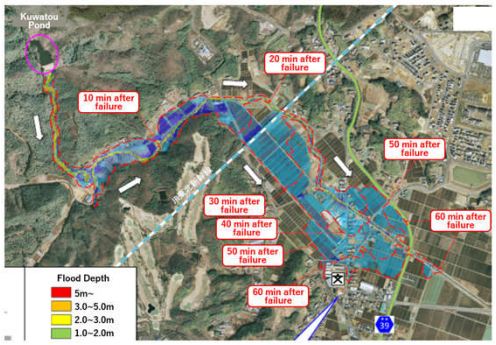



Source: MLIT

**Pre-release Operation of Kusaki Dam at Typhoon No. 18 in 2019 and its Effect**

## 2.11 Dam-Safety Management and Operation (4)

**The farmers' association should inspect and reinforce the aged irrigation ponds**




**Example of Information Disseminated for the Failure of Ponds and Small Reservoirs**

Source: Natori City Office

**Seismic Resistance Reinforcing Works for Sannako Dam**

Source: Agriculture and Rural Area Improvement Plan in Gunma Prefecture, 2020

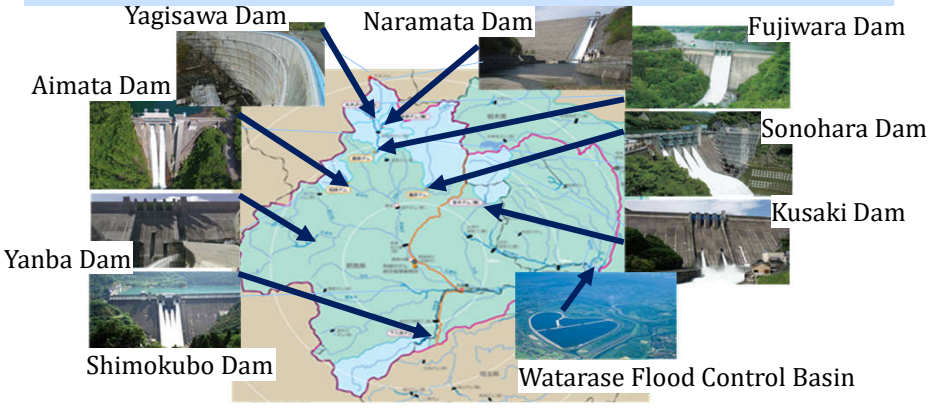






## 2.11 Dam-Safety Management and Operation (5)

**Integrated operation of multiple dams within the same river basin may achieve efficient water resources management.**




**Dams Operated by the Tone River Dams Integrated Management Office**

Source: Tone River Dams Integrated Management Office

## 2.11 Dam-Safety Management and Operation (6)

**Advanced technologies can be effectively utilized in existing dam facilities.**

Dams are enhanced by increasing the reservoir capacity with dam crest raising increasing the dam discharge capacity with additional facilities, installing hydropower equipment, and adding sediment discharge facilities.

**Shin-Katsurazawa Dam for Dam Upgrading**

Source: Sapporo Development and Construction Office, Hokkaido Regional Development Bureau

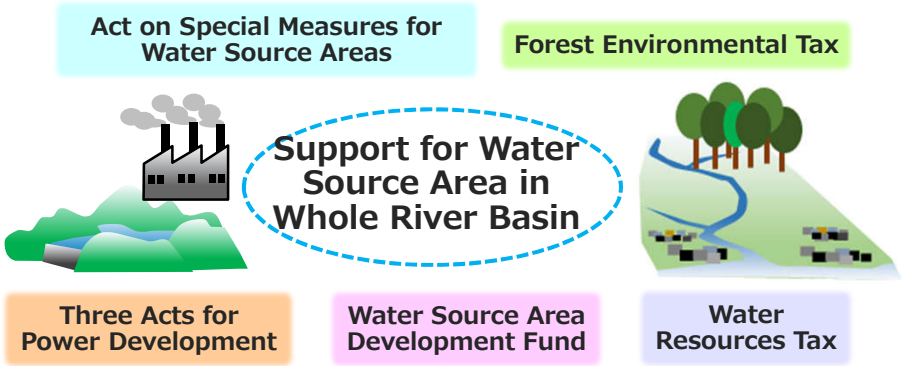






## 2.12 Environmental and Social Considerations of Large-Scale Projects (1)

**The government should support rebuilding of local communities submerged by large-scale project to avoid fracturing or disappearing.**




**Overall Picture of Measures for Water Source Areas in Dam Construction**

## 2.12 Environmental and Social Considerations of Large-Scale Projects (2)

**Various environmental measures are implemented to avoid or mitigate adverse impacts. .**


**Higashizawa Biotope Created in the Miyagase Dam Area**

Source: Website of the Sagami River Wide Area Dam Management Office

**Environmental Measures**

**Fish Ladder of the Pirika Dam**

Source: Website of Hakodate Development and Construction Department, Hokkaido Regional Development Bureau, MLIT







## 2.13 Human Resources Development and Technology Development (1)

**In the Meiji era, the Japanese government promoted technological learning by inviting foreign civil engineers.**

Technology Transfer

- Inviting Foreign Civil Engineer
- Studying Abroad

University advancement rate: 49% (Japan) at present

Human resource development

- Basically, On-the-job Training (OJT)
- Off-JT: training, lectures and seminars, acquisition of technical qualifications, and academic society activities

# 2.13 Human Resources Development and Technology Development (2)

**The national government should develop and disseminate this technology.**

**Mechanisms should be established to utilize the technology developed by private companies.**

Technology Development by the Government

- Promotion of dissemination of technology of own research results.
- National Institute for Land and Infrastructure Management (NILIM)
- Public Works Research Institute (PWRI)

Technology Developed by Private Companies

- Innovative River Management Project
- Public Invitation to research and development in the river works

# Theme1 Governance
# Theme 1-1
# Legislation and Organization



1



# Contents





2

# 1. Introduction

**What is the role of legislation and organization?**

- The cost of the project for the water resources management should be borne by various stakeholders, including the governments, municipalities, water services, private companies and agricultural parties.
- The legal system should stipulate the demarcation of roles and cost allocation of water resources development and management among the related parties.

**Theme 1-1 describes:**

- How Japan established and improved the legal system and organizational structure for water resources management.



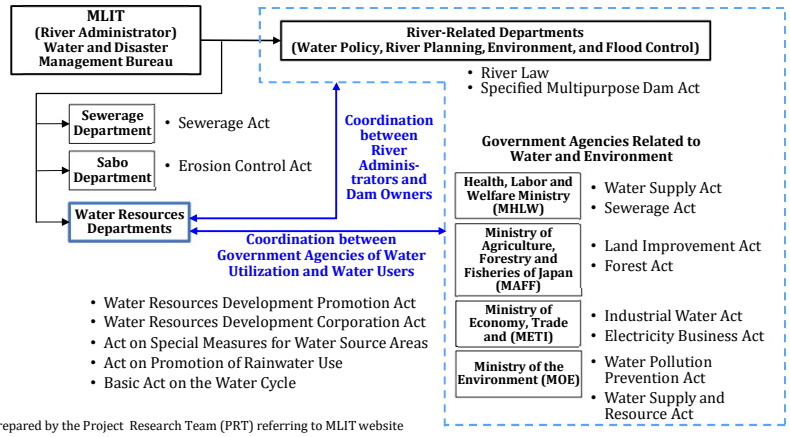
3



# 2. Coordination among Parties

## (1) Organization for Coordination

1) Government Organization for Water Resources Management




Source: Prepared by the Project Research Team (PRT) referring to MLIT website

**Entities Involved in Water Resources Development and Concerned Law and Acts**



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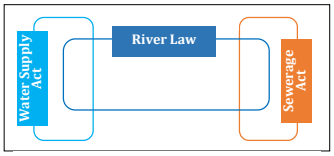
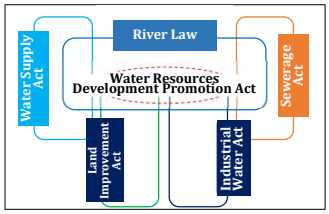
# 2. Coordination among Parties

## (1) Organization for Coordination

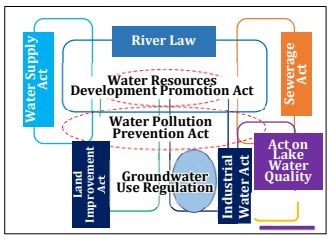
2) Concept and Changes in Legal System




Modernization: End of 19th Century-Mid 20th Century, Flood Prevention and Public health




High Economic Growth: Mid 20th Century to 1970, Water Resources Development




Sustainable Growth :1970-Present, Environment

Source: Modified figure of Water-Japan by PRT

**History of the Legal System related to Water in Japan**



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# 2. Coordination among Parties

## (1) Organization for Coordination

3) Concept and Changes in the Legal System

**Law and Acts which Contributed to Water Resources Management**

| Year | Law and Act |
|---|---|
| 1986 | Old River Law |
| 1957 | Specific Multi-Purpose Dams Act |
| 1961 | Water Resources Development Promotion Act |
| 1961 | Water Resources Development Corporation Act |
| 1964 | New River Law |
| 1997 | Revised River Law |
| 2014 | Basic Act on the Water Cycle |



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# 2. Coordination among Parties

## (1) Organization for Coordination

4) Concept and Changes in the Legal System

**Acts Regulating Water Resources Management with River Law**

| Category | Related Acts |
|---|---|
| Measures for Flood | Flood Control Act, Basic Act on Disaster Management, Flood Prevention Association Act, Act on Erosion and Flood Control Emergency Measures, Flood Control Special Accounting Act |
| Utilization of Water Resources | Water Supply Act, Industrial Water Act, Land Improvement Act, Electricity Business Act |
| Transportation on Water | Act on Port Regulation, Port and Harbor Act |
| Pollution, Effluent, Environmental Conservation | Basic Environment Act, Water Pollution Prevention Act, Act on Special Measures concerning Conservation of Lake Water Quality, Sewage Act, Nature Conservation Act, Natural Parks Act, Waste Management and Public Cleansing Act, Mine Safety Act |
| Water Cycle, Underground Water, Land Subsidence | Basic Act on the Water Cycle, Industrial Water Act, Act on Regulation of Groundwater Extraction for Buildings, Act on Promotion of Rainwater Use |
| Land Conservation | Act on Special Measures for Water Source Area, Water Supply Act, Erosion Control Act, Building Stander Act, Forest Act, Landslide Prevention Act, Act on Prevention of Disasters Caused by Steep Slope Failure |
| Mining of Riverbed Material | Mining Act, Quarrying Act, Gravel Gathering Act |

Source: Main Report on Water Right System in People's Republic of China, 2006, JICA



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# 2. Coordination among Parties

## (2) History of River Law and the Role of River Administrators

1) History of Water Use in Japan before Modern Age

**Ancient Time**

- People developed their agricultural land and irrigation system.

**7th Century**

- Rivers were **administrated by local governments**.
- Water in rivers was considered as **public property**.

**8th Century**

- The government allowed **private ownership** of agricultural land and water use.

**17th~19th Century**

- Developed **Civil Engineering Technology.**



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## 2. Coordination among Parties

### (2) History of River Law and the Role of River Administrators

2) Implementation of Integrated River System Management by River Administrators under New River Law

**Old River Law**

- Three Acts for flood protection: River Law, Forest Act and Erosion Control Act
- Conventional and customary irrigation water system
- Based on the "section principle"

Note: "section principle" is that the prefectural governors had the primary responsibility for flood protection

**New River Law in 1964**

- Abolish the "section principle"
- Manage important rivers directly by the River Administrator of national government
- Regulation for river water utilization
- Flood protection by using dam reservoirs



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## 2. Coordination among Parties

### (2) History of River Law and the Role of River Administrators

3) Characteristics of the River Law in Japan compared to the Water Laws in foreign Countries

**Japan**

- The River Law
- Flood protection, river water utilization, and the river environment
- Comprehensive and basin-based water management
- No international river

**Foreign Countries**

- Water Law
- Provisions of water quality, purification, drainage, replenishment, groundwater, rainwater, or navigation
- Riparian Rights
- International River



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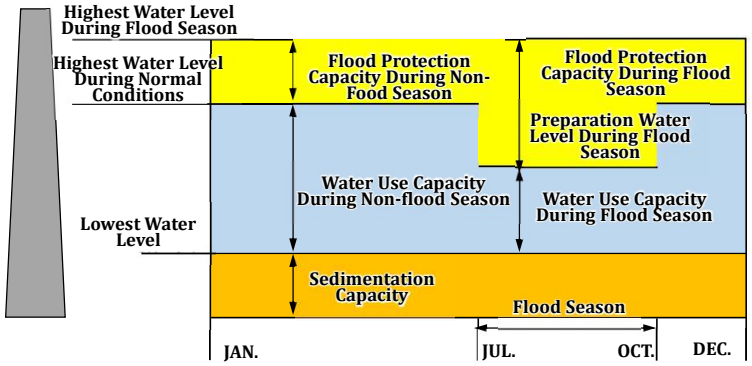
# 2. Coordination among Parties

## (3) Water Resources Management by Multi-purpose Dams

1) History of Multi-purpose Dams in Japan




Source: Disaster Information for River, MLIT

**Operation of Multi-purpose Dam which Store River Water in Flood Season and Supply Water in Non-flood Season**



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# 2. Coordination among Parties

## (3) Water Resources Management by Multi-purpose Dams

2) Specific Multi-Purpose Dams Act

**Purpose**

The Specific Multi-Purpose Dams Act stipulate the method of **cost allocation**, **the responsibility** for the facility management, **the ownership** of the facilities and **the rights for using the dam**.

**Responsibility**

- Minister of Minister of Land, Infrastructure, Transport and Tourism

**The Dam Utilization Right**

- Power generation and water supply companies who shared the construction cost

**Ownership of Dam**

- Minister of Minister of Land, Infrastructure, Transport and Tourism



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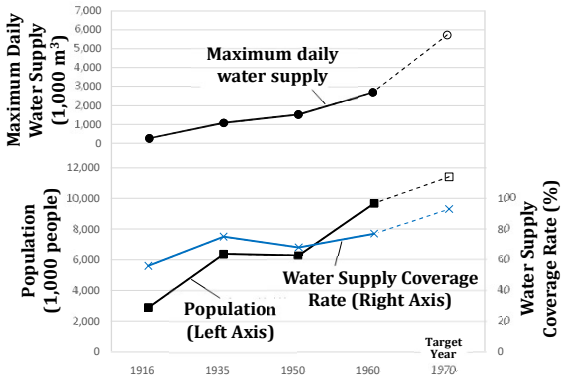
# 2. Coordination among Parties

## (4) Coordination for Water Resource Development

1) Coping with Water Shortages in Tokyo during the Period of High Economic Growth




Source: A Historical Study of Modern River Projects Leading to the Comprehensive Revision of the River Law, Saburo Yamamoto

**Amount of Water Supply in Tokyo**

Source: Water Cycle Policy 2017

**Ogouchi Dam Reservoir during the Olympic Drought**

Source: Water Cycle Policy 2017

**Emergency Water Supply**



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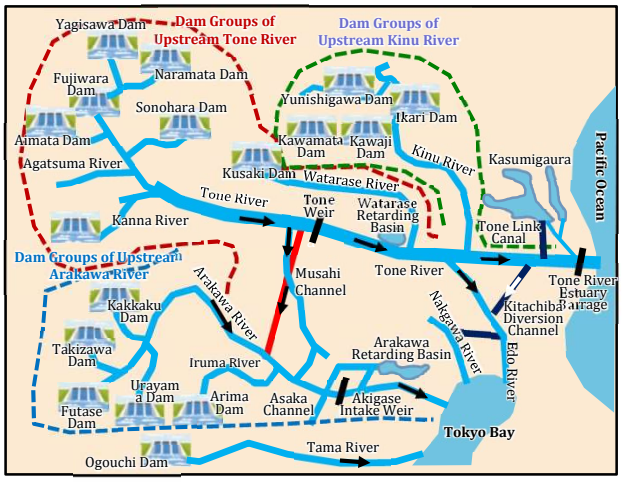
# 2. Coordination among Parties

## (4) Coordination for Water Resource Development

2) Institutional Problems in the Development of Water Resources in a Wide Area




Source: Prepared by PRT based on Summary of drought in 2009, MLIT

**Major Dams and Water Networks in the Tokyo Metropolitan Area, Centering on the Tone and Arakawa Rivers**



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# 2. Coordination among Parties

## (4) Coordination for Water Resource Development

3) Water Resources Development Promotion Act and Water Resources Development Corporation Act

**Water Resources Development Promotion Act**

- The act promote projects according to evidence-based plans.
- **Designate Water systems** that is required to be developed comprehensively from the perspective of **water supply** and **demand** for the entire basin.

**Water Resources Development Corporation Act**

- The Water Resources Development Corporation implemented **construction projects based on the Basic Plan for Water Resources Development**.
- The Act stipulates the organization, operations, and government supervision for the public corporation



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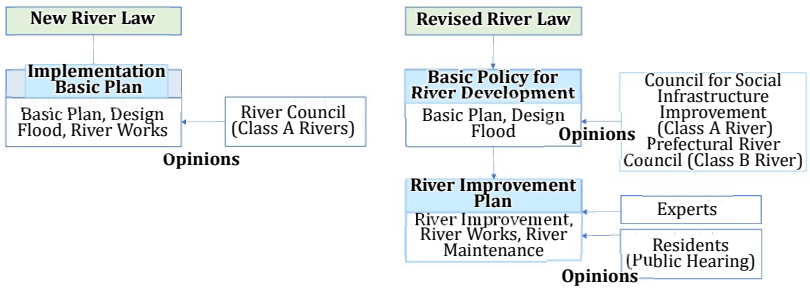
# 2. Coordination among Parties

## (5) Response to Diversifying Needs

1) Revision of the River Law for the Conservation of River Environment




Source: Project Research Team

**Difference in River Planning under the New River Law and the Revised River Law**



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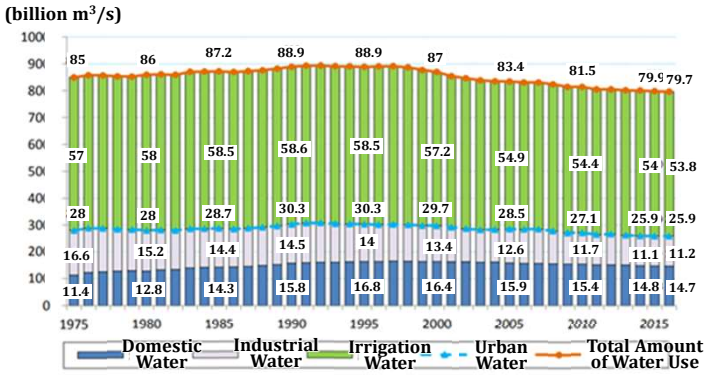
# 2. Coordination among Parties

## (5) Response to Diversifying Needs

2) Transition from Water Resources Development Organization to the Japan Water Agency




Source: Current Water Resource in Japan 2019

**Water Use Trend in Japan**



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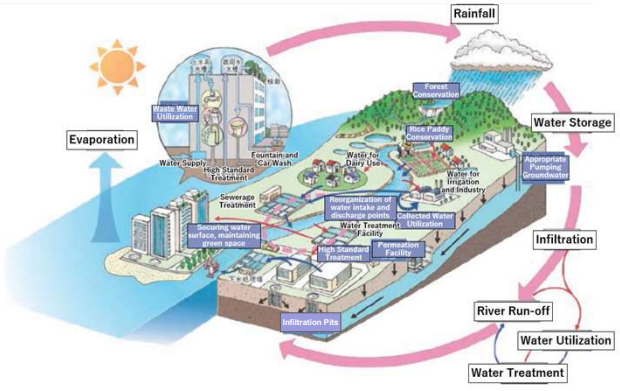
# 2. Coordination among Parties

## (6) Initiatives for a Healthy Water Cycle

1) Necessity for the Comprehensive Management of Water Systems




Source: Water Cycle White Paper 2018, Cabinet Secretariat

**Concept of Water Cycle**



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# 2. Coordination among Parties

## (6) Initiatives for a Healthy Water Cycle

2) Basic Act on the Water Cycle

**Purpose**

The Basic Act on the Water Cycle aims to **maintain or restore a healthy water cycle** and contribute to the healthy development of Japan's economy and society and the stable improvement of people's lives.

**Definition**

The **"Healthy Water Cycle"** is defined as a state in which the functions of water for human activities and environmental conservation are properly maintained.

**Measures**

Facilities for water storage, recharge for water source, and underground infiltration, as well as the rationalization or regulation of water use



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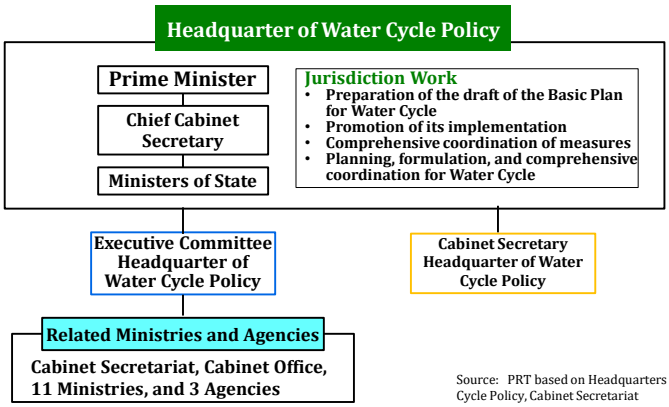
# 2. Coordination among Parties

## (6) Initiatives for a Healthy Water Cycle

3) Basic Plan for the Water Cycle




Source: PRT based on Headquarters for Water Cycle Policy, Cabinet Secretariat

**Relationship Between the Water Recycling Policy Headquarters and Ministries and Agencies**



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# 3. Countermeasures against Climate Change

## (1) Climate Change and Legal Systems

**Abstract of the Climate Change Adaptation Act**

| Items | Contents |
|---|---|
| Promotion of Comprehensive Adaptation | ● Clarify the roles of each parties<br>● Formulate a climate change adaptation plan.<br>● Assess the impact of climate change every five years |
| Development of Information Platform | ● Provide information on climate change impacts and adaptation<br>● Technical assistance |
| Intensifying Regional Adaptation | ● Formulate regional climate change adaptation plans<br>● Collect information on climate change impacts<br>● Organize a Regional Council for Climate Change Adaptation |
| International expansion of adaptation, etc. | ● Promotion of international cooperation on climate change adaptation and project activities |



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# 3. Countermeasures against Climate Change

## (2) Impacts of Climate Change on the Water Resources

**Impacts of Climate Change on the Water Resources and Disaster Departments in Japan**

| Department | Evaluation | Impacts |
|---|---|---|
| Water Resources | Current Evaluation | Drought, shortage of irrigation water, shrinking freshwater lenses on small islands |
| | Future Prediction | Worsening of drought, increase in river flow, shortage of agricultural water, saltwater intrusion, increasing polarization of drought and flood risk, increase in slope failure |
| Disaster | Current Evaluation | Upward trend in sea level, large-scale complex disasters, changes in typhoon intensity and path, increase in insurance payments due to natural disasters |
| | Future Prediction | Increase in extraordinary rainfall, number of affected people, rising sea level, and storm surge |



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# 4. Lessons Learned (1)

(1) Stakeholders should be coordinated by establishing a legal system.

Various stakeholders are involved in water resources management. These are the users of agricultural, domestic, and industrial water, as well as hydropower companies. It is necessary to resolve inter-sectoral conflicts regarding water use and environmental conservation, and between water sources and beneficiary areas. The River Law and related Acts aim to integrate river basin and water use management in Japan.

(2) Various acts should be implemented to cope with the increased water demand.

The establishment of a legal system facilitated coordination among stakeholders and enabled water resource development to cope with the rapidly increasing demand in Japan. The Specific Multi-Purpose Dams Act stipulates the roles and authorities of dam owners and users and promotes the construction of multi-purpose dams. The Water Resources Development Promotion Act and the Water Resources Corporation Act coordinate the relevant ministries, departments, and parties involved in water use, prepare of the basic plan for water resource development, and promote a comprehensive and systematic development of water resources over a wide area, including major cities.



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# 4. Lessons Learned (2)

(3) The legal system should be revised as needs change.

Various acts and regulations have been revised in accordance with changing needs and values in Japan. When the country stated modernization, related acts aimed at mainly flood protection and water supply. To reconstruct national lands devastated by WWII and supply urban water during the high growth, legislation was developed to generate hydroelectricity and to supply irrigation and urban water. When the economy matured, the growth in water demand ceased, and the demands for and values of rivers and water resources became more diverse. The River Law was revised in 1997 to address the needs of the river environment and include public participation. The Basic Act on the Water Cycle of 2014 promoted comprehensive measures to maintain and restore a healthy water cycle.

(4) The roles and measures should be clarified to respond to climate change.

The roles of national and local governments, the private sector, and citizens in climate change mitigation and adaptation measures were clarified through legislation. Japan is implementing countermeasures in collaboration with its stakeholders.



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# Theme1-2
# Water Rights
## Establishing the Order of Water Use Based on Regional Practices and Characteristics



1



# Contents





2

## 1. Introduction (1)

Each country, region, and river basin has different water issues, distinctive and individual circumstances, and practices and history of water use. Thus, they should **build a water rights system** to establish an order for water use based on this background.

**Water Resources Utilization**

**Water use by human**

- Irrigation, Domestic water supply, Industrial water supply, Hydroelectric power generation
- Navigation, Dilution of domestic wastewater, Recreation

**Preservation of ecosystem**



3



## 1. Introduction (2)

**Disorderly water intake by individual users**

**Water shortage**

**Water does not reach downstream**

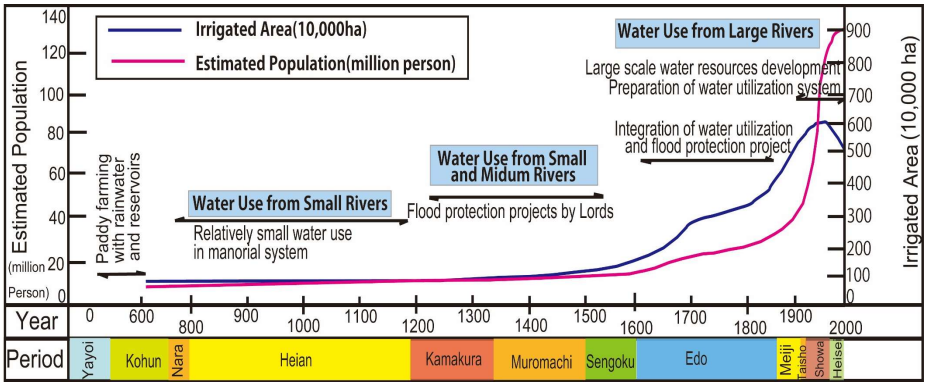
**Impact to ecosystem**

**Disorderly intake should be regulated to establish effective and appropriate use by controlling the amount of water intake**

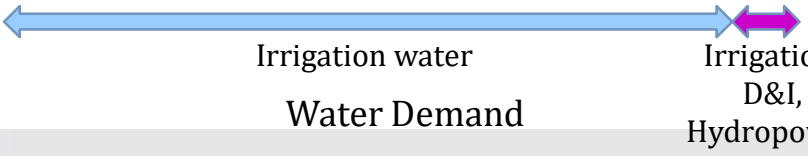


4

## 2. The Change of Water Use (1)




Source: Partial excerpt and revision of "Farm Land and Water in Japan, Ministry of Agriculture, Forestry and Fisheries






5



## 2. The Change of Water Use (2)

**Before 19th century**

**Farmers and agriculture-based communities managed the irrigation water for a long time.**

**Water right**

**1896 Old River Law**

**1964 New River Law**



6

## 3. Water Right System (1)

### (1) Water Rights Licensing System

Applicant → Licensee (River Management Office)

Submission of Required Documents

(Newly applied intake water discharge) < (Standard drought discharge)-(Normal function flow discharge)

↓

Applicant may take required water.

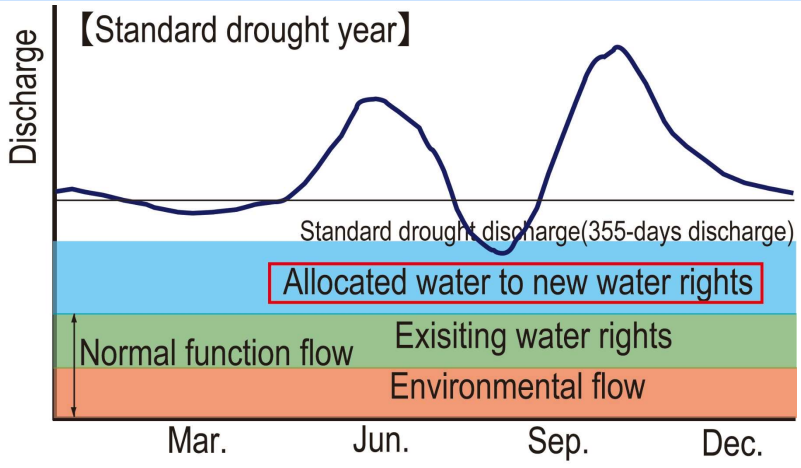


7



## 3. Water Right System (2)

### (1) Water Rights Licensing System




Source: PRT



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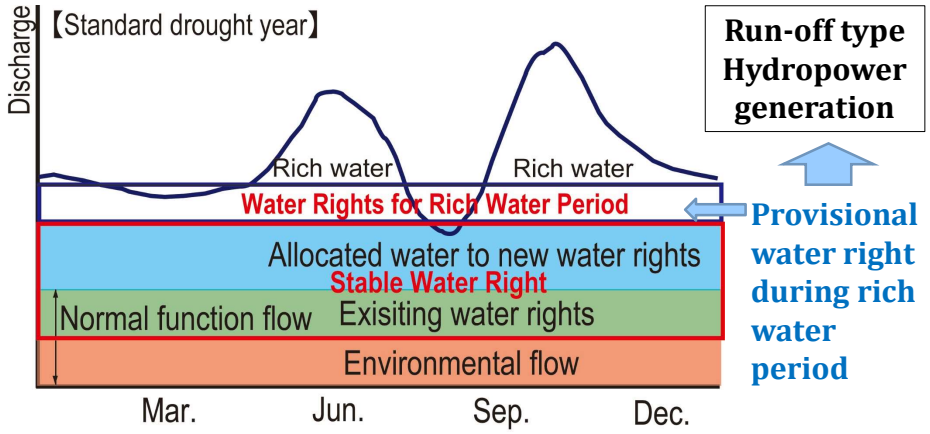
## 3. Water Right System(3)

### (1) Water Rights Licensing System

#### 1) Classification of Water Right




Source: PRT







## 3. Water Right System (4)

### (1) Water Rights Licensing System

#### 2) Required Documents and Actions by the Applicant to Obtain Water Rights

Requirement: To obtain the consent of other river water users by taking measures as necessary

**Application documents**

- Outline of implementation program
- Evidence for water demands
- Evidence for the amount of water used from the river
- Records of river water level and runoff discharge for the past 10 years
- Explanation of the predicted impacts on other users and necessary countermeasures

## 3. Water Right System (5)

### (1) Water Rights Licensing System

**Estimation method, if there is no record of actual discharge measurement**

- The discharge was estimated using data from other river basins where topography, geology, and rainfall characteristics are most similar to those of the intake basin.
- If the discharge data are available in the river basin, where the rainfall conditions are very similar to the intake basin, simultaneous discharge observation at the existing observation point and the planned water intake point is carried out throughout the year.
- The discharge is estimated by applying a simulation model







## 3. Water Right System (6)

### (1) Water Rights Licensing System

#### 3) Criteria for Granting the Water Rights

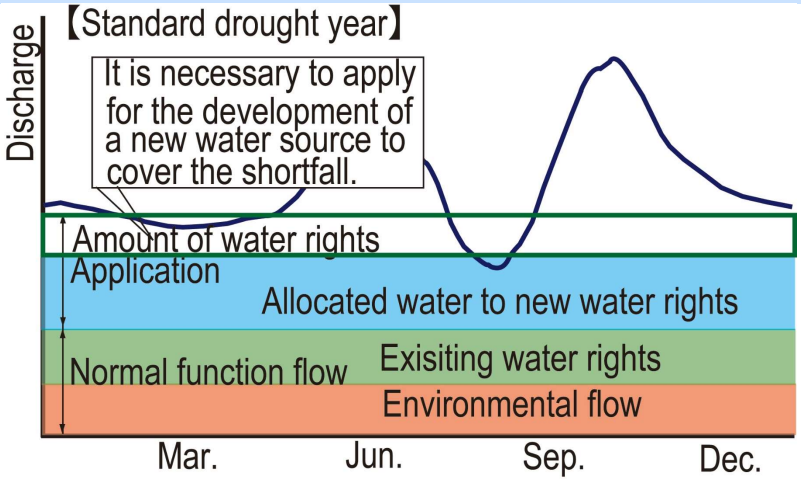
- Promotion of public welfare
- Certainty of execution
- Relation between discharge of river flow and water intake
- Hindrance to the public interest

#### 4) Valid Period of Permission

- Hydropower generation: approx. 20 years
- Other water use: approx. 10 years

## 3. Water Right System (7)

### (1) Water Rights Licensing System




Source: PRT



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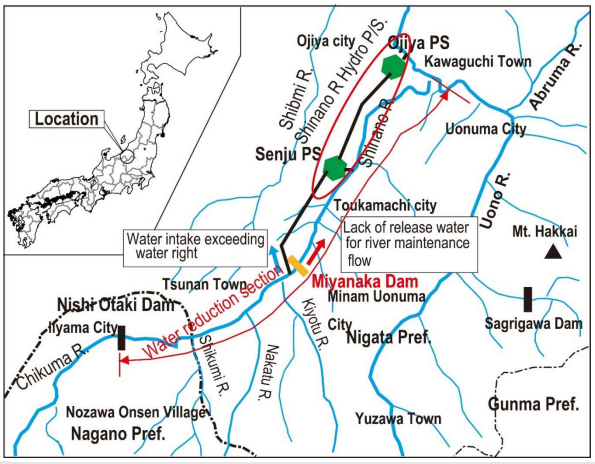
## 3. Water Right System (8)

### (1) Water Rights Licensing System

#### 4) Penalties for Illegal Water Intake




Violation of
1) Water intake exceeding the water right
2) Insufficient minimum environmental flow discharge released from Miyanaka Dam

⇩

Revoking water right

Source: PRT



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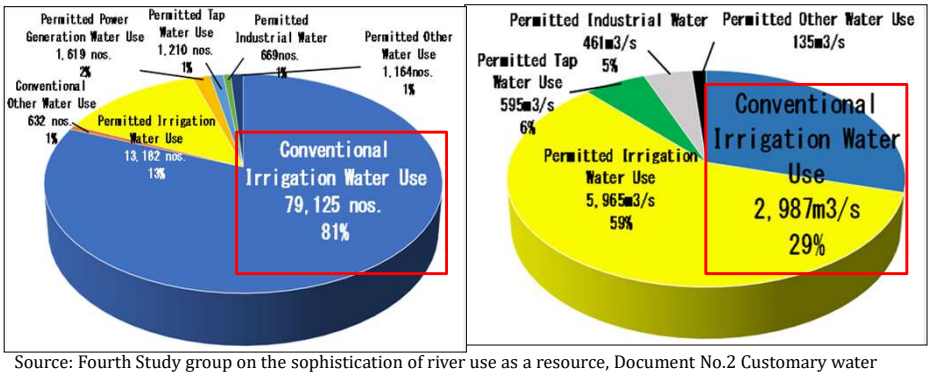
## 3. Water Right System (9)

### (2) Prioritized Customary Water Rights

Japan has given the customary water rights to the traditional water uses made before establishing water right system.




Source: Fourth Study group on the sophistication of river use as a resource, Document No.2 Customary water right MLIT

**Total Number of Water Right** **Total Maximum Intake Water**







## 3. Water Right System (10)

### (3) Transfer and Trade of Water Rights

**Urbanization**

**1965 to 2017: 78 nos. transfer water about 46m3/s**

**Decreasing paddy field** → **Decreasing irrigation water demand**

↓ To change land use

↓ Domestic water allocates from irrigation water.

**Housing land and other lands** → **Increasing domestic water demand**

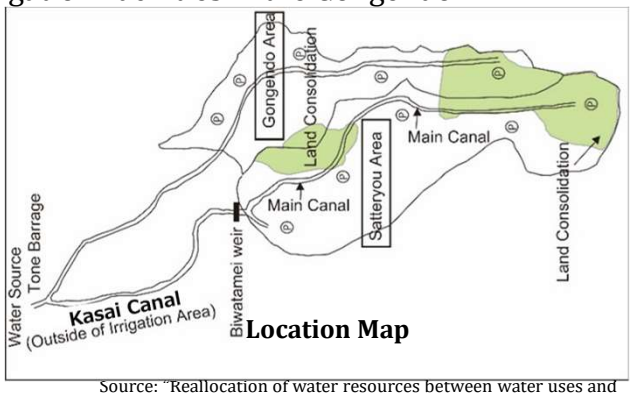
## 3. Water Right System (11)

### (3) Transfer and Trade of Water Rights

**Example: Irrigation Water Rationalization Project in Saitama Pref.**

Renovation of Irrigation Facilities in the Gongendo-Satteryou Area

- Installation of Pumping Station
- Pipeline of irrigation water supply




Location Map

Source: "Reallocation of water resources between water uses and cost sharing (I) -Case study on agricultural water rationalization project in Saitama Prefecture" Takeda Mari, Water Science

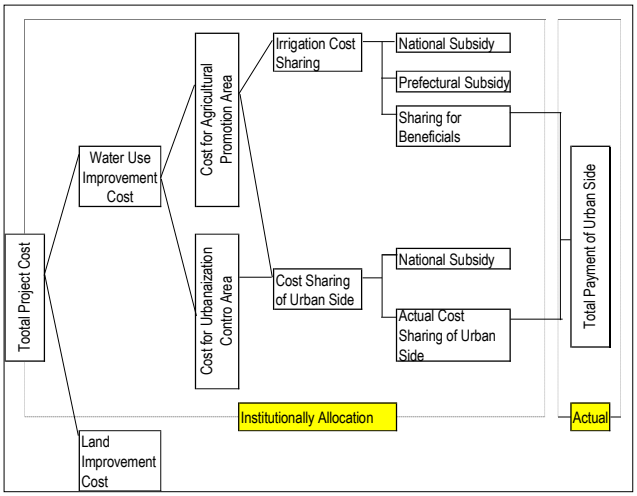






## 3. Water Right System (12)

### (3) Transfer and Trade of Water Rights

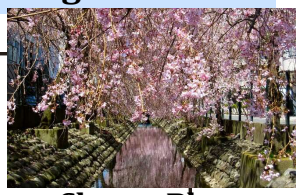



**Allocation of Costs in Irrigation Water Rationalization Project and Actual Share after Negotiations**

## 3. Water Right System(13)

### (3) Transfer and Trade of Water Rights

**Nikaryo Canal**



**Cherry Blossom along Nikaryou Canal**




**Location Map of Nikaryou Water Canal**







## 3. Water Right System(14)

### (3) Transfer and Trade of Water Rights

**Nikaryo Canal**

**Changing Water Intake (Unit: m3/s)**

| Year | Industry | Irrigation | Environment | Total |
|---|---|---|---|---|
| 1957 | 0.00 | 9.35 | 0.00 | 9.35 |
| 1958 | 2.35 | 7.00 | 0.00 | 9.35 |
| 1982 | 2.35 | 3.50 | 0.00 | 5.85 |
| 1991 | 2.35 | 1.30 | 0.00 | 3.65 |
| 1995 | 2.35 | 1.30 | 1.40 | 5.05 |

Source: Corrected location map of History of Nikaryou Canal from agricultural water to environmental water from the viewpoint of water quality survey Takagi Masahiro, Komazawa Geography No.47"

## 3. Water Right System (15)

### (3) Transfer and Trade of Water Rights

**Nikaryo Canal (Lessons Learned)**

- Water resources development facilities are valuable community assets that can contribute to society by changing their roles, and the environment in the midst of social changes.
- The transfer of water rights for irrigation use and required coordination among related stakeholders were promoted by ensuring the order of water use.
- Short-term measures such as the use of irrigation canals for roads and sewers do not always lead to long-term benefits

- Community participation is essential for improving and protecting the water environment.







## 3. Water Right System (16)

**Local governments (prefectures) collect water rights fee from hydropower generation and industrial water.**

- Hydropower generation: MLIT established a calculation formula for water right fee.
- Water right fee of industrial water are decided by each local government.

**Industrial Water Fee**

| Local Government | Tokyo | Nagano | Saga | Fukui | Tochigi |
|---|---|---|---|---|---|
| Unit Price (Japanese Yen) per litter/s) | 6,288 | 3,900 | 1,550 | 2,970 | 3,800 |

Source: The River Law Enforcement Ordinance at each prefecture

# 4. Water Distribution during Drought (1)

## (1) Drought Coordinating Committee

**Drought Coordination Committee**

Water User | Water User | Water User | Water User | Water User | Water User

**"Everyone decides a rule and uses river water according to the rule"**

**River Management Office**

- Information necessary for discussion
- Draft drought adjustment proposal

**Each River Basin**



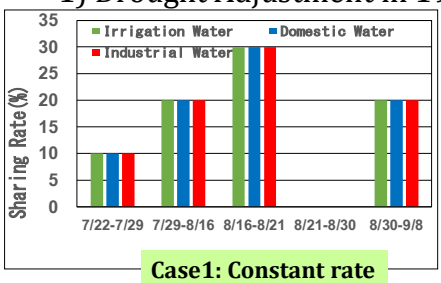




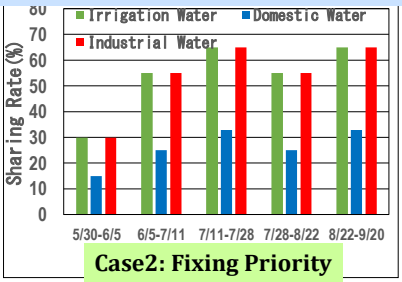
# 4. Water Allocation during Drought (2)

## (2) Example of Drought Adjustment

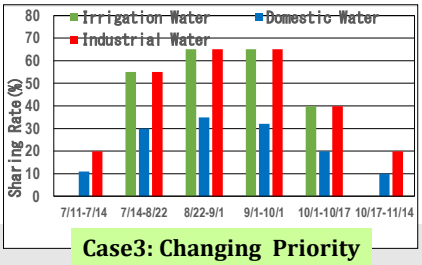
1) Drought Adjustment in 1994




**Case1: Constant rate**




**Case2: Fixing Priority**



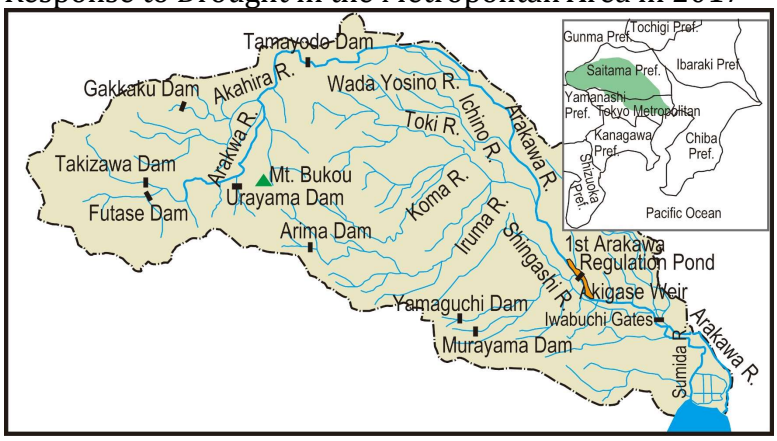

**Case3: Changing Priority**

Source: a table in "Agricultural Water Management during Abnormal Drought, especially the Actual Condition of Water Distribution-Case of Drought in Western Japan in 1994" Nakagiri Takao, Ando Taichi, Hirayama Syusaku, Ishikawa Sigeo, Mauyama Syoich, Journal of Japan Society of Hydrology and Water Resources Vol.12, No.3(1999)

# 4. Water Allocation during Drought (3)

## (2) Example of Drought Adjustment

2) Response to Drought in the Metropolitan Area in 2017




Source: Prepared from "Outline of Arakawa River Basin and Rivers," MLIT

**Arakawa River is located at Tokyo and Saitama**







# 4. Water Allocation during Drought (4)

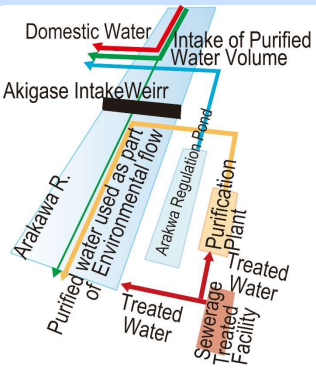
## (2) Case Study of Drought Adjustment

Countermeasure for Drought

- Operation of purification facility
- Increasing amount of stored water (4.7 times)
- Multiplex of water sources by wide area network (Tone River, Tama River)
- PR to promote water saving (Dam Card, Banner, display board, public car, TV show)


**Display Board**


**Dam Card**

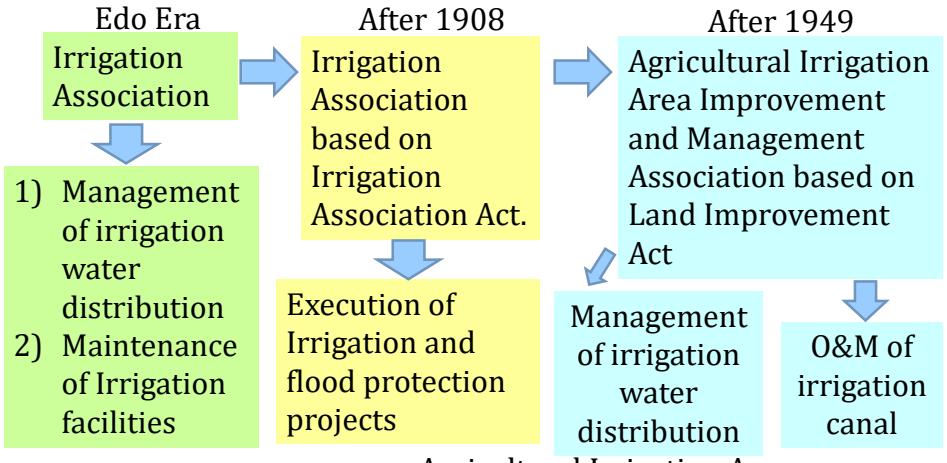



Source: Prepared based on "Outline of Arakawa Reservoir MLIT"

**Operation of Purification Facility**

## 6. Operation and Maintenance of Irrigation Facility (1)

### (1) History of Irrigation Water Management




Agricultural Irrigation Area Improvement and Management Association: 5,040 nos. (2010)







## 6. Operation and Maintenance of Irrigation Facility(2)

### (2) Operation and Maintenance of Irrigation Facilities and Water Distribution by the Farmers' Association

- To manage Irrigation facilities
- To perform facility and maintenance and renovation
- Member: farmers in the irrigation area
- Required Cost: Levy from the members
- Projects by the Farmers' Association: subsidies from governments and some cost pay by farmers
- Tax exempted due to highly public organization

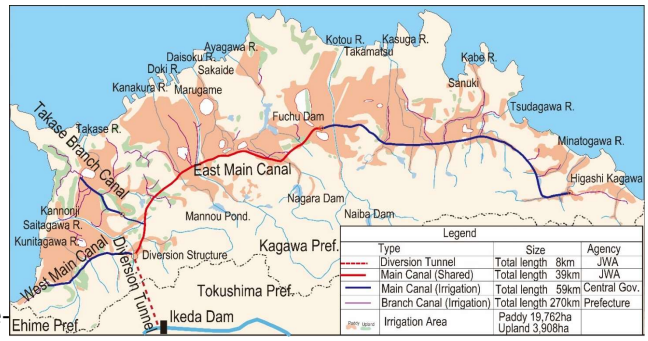
## 6. Operation and Maintenance of Irrigation Facility(3)

### (3) Distribution of Irrigation Water

**Example: Farmer's Association of Kagawa Canal**

Role :

1) Maintenance of Levy system
2) Collection of Levey
3) Water distribution management
4) Facility management
5) Implementation of contracted projects
6) Coordination of state-owned land improvement project




Source: Project Research Team prepared based on "Yoshino River Comprehensive Development, Location Map of Kagawa Canal, Kagawa Prefecture"

**Location Map of Beneficiary Area of the Kagawa Canal**





## 6. Operation and Maintenance of Irrigation Facility(4)

### (3) Water Distribution of Irrigation Water

**Example: Farmer's Association of Kagawa Canal**

- Management area is a wide area and number of patrol staff is not enough.

⇨

- Patrol system was introduced in 2007 (Provision of information from residents)
  Registered Patrol group: 17 groups
  (164 local residents, 12 agricultural civil engineering design associations, 5 fire-fighting organizations)

## 7. Lessons Learned (1)

(1) To ensure an orderly water use based on the history and practices of water resource management, each country should establish a water rights system.

Water distribution could induce an increase in tension and conflict between areas and users. In the past, Japan had experienced violent disputes over the distribution of irrigation water. At the time of the establishment of the modern legal system, the government recognized irrigation water as a customary water right and permitted it continue as before. A new licensed water right was granted according to the potential of the water resources. If new water is not available, development of a storage facility is required to acquire new water rights.





## 7. Lessons Learned (2)

(2) Institutions should be developed to manage the water rights.

It is ideal for one organization to manage the water for the entire river basin. Management organizations must formulate procedures, criteria, and guidelines for permitting water rights. The organization also needs to monitor licensed water intake. The Minister of Land, Infrastructure, Transport and Tourism and prefectural governors are responsible for managing water rights in Japan.

(3) Governments should manage the water rights for water use that change over time.

Water use changes by increasing domestic and industrial water due to urbanization and industrialization and by decreasing irrigation water. In addition, people's concerns have changed from development to environmental conservation. Governments must revise policies to respond to these changes.

## 7. Lessons Learned (3)

(4) Water resources can be used effectively by establishing a system for the transfer of water rights.

The demand for irrigation water is decreasing, and urban water use is increasing as the economy develops. Water rights can be transferred from irrigation users to urban users, expecting the efficient use of water resources. Water rights trading with financial compensation is not practiced in Japan because river water is treated as a public good.

(5) To adjust water intake during drought, coordinating mechanisms are required.

In Japan, a coordinating committee composed of water users was established for each river basin. This committee determines the rules of intake reduction rates for every user based on the consensus formed among water users with the spirit of mutual concession. The rules vary by river basin, depending on the history and practices of water management. River management offices can provide the necessary information on meteorological and hydrological data and storage facilities, as well as facilitate discussions among water users.







## 7. Lessons Learned (4)

(6) Farmers' associations are indispensable to distribute irrigation water and maintain irrigation facilities.

Members of farmers' associations decide the rules for water distribution in the irrigation area and carry out maintenance and management activities independently in Japan. Farmers' associations also spend their money on maintaining and developing facilities, in addition to subsidies from the national and local governments.

# Theme1-3
# Public Participation and Decision-Making Process

## Meeting Diverse Needs by Building Water Governance




1



# Contents





2

# 1. Introduction

## What is Water Governance?

- The water governance includes ;
- Water management for flood protection and water utilization, and
- Basic values and visions of the organizations and communities such as the idea of respecting the will and human rights of people, legality, reliability, and transparency.

## Theme 1-3 describes:

- Movement against dams by residents
- Laws, policies, and systems related to public involvement
- Necessity of project's transparency (information disclosure, project re-evaluation)
- Environmental conservation activities in cooperate with the government and the people







# 2. Transparency in the Public Works Progress

## (1) Public Works Projects that affected Water Governance Reform

- Three major projects became a turning point of water governance in Japan.

**1953 to 1973 Matsubara and Shimouke Dams**
- Act on Special Measures for Water Source Area
- Effected the rebuilding and restoration of residents' lives in the construction of the Kawabegawa and Yanba Dams

**1968 to 1995 Nagaragawa River Mouth Barrage**
- Improvement of the transparency and accountability of public works projects
- Effected residents' participation, such as the River Basin Committee

**1970 to 2020 Yanba Dam**
- Controversy on Policy, Science, and Technology
- Special measures bill to promote specific areas accompanying the abolition of dam projects
- Project re-evaluation involving experts

**Three Major Public Works Projects Affected on Water Governance**

Source: Project Research Team (PRT)

# 2. Transparency of Public Works Progress

## (1) Public Works Projects that affected Water Governance Reform

1) Opposition Movement against Matsubara and Shimouke Dams

<1958> The explanation of **compensation** was insufficient. The residents came to have **doubts for the construction project.**

<1973> Dam was completed through the **13 years of protest movement.**

Emphasized importance of measures for water resource areas

<1973> **The Act on Special Measures for Water Sources Areas**


**Shimouke Dam**


**Matsubara Dam**

Source: Chikugo River Dams Integrated Management Office



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# 2. Transparency of Public Works Progress

## (1) Public Works Projects that affected Water Governance Reform

2) Problems of Nagaragawa River Mouth Barrage

<1968> construction plan was decided.

**Nationwide** opposition movement by **various stakeholders**

<1995> Construction completed.

Necessity of **information disclosure** and building consensus **at the planning stage**

Source: Japan Water Agency (JWA)

**Nagaragawa River Mouth Barrage**

<1997> **Revision of River Law**

Public opinions started to be reflected in the formulation of river improvement plans.



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# 2. Transparency of Public Works Progress

## (1) Public Works Projects that affected Water Governance Reform

3) Political and Scientific Argument on Yanba Dam Project

<1949> Construction plan was decided.

<1985> Residents accepted the project with **Reconstruction Plan of Livelihood**.

<2009> The construction of the main body was **suspended** due to the change of government.

<2010> **Re-examination** of Yanba Dam started **in terms of science.**

The MLIT concluded **the most advantageous plan is Yanba Dam** in terms of science.

<2020> Construction completed.

Source: Gunma prefecture

**Yanba Dam**



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# 2. Transparency of Public Works Progress

## (1) Public Works Projects that affected Water Governance Reform

4) Rebuilding Livelihood Measures of Yanba Dam Project

Submerged area is supported in various ways.

- Relocation Lands for Submerged Residents
- Regional Development Facilities
- Infrastructure Tourism Initiatives

Relocation land and financial source are described in Themes 3 and 9.

**Souvenir Shop**

**Roadside Station**

**Amphibious Bus**

Source: Visit Gunma, Gunma prefecture



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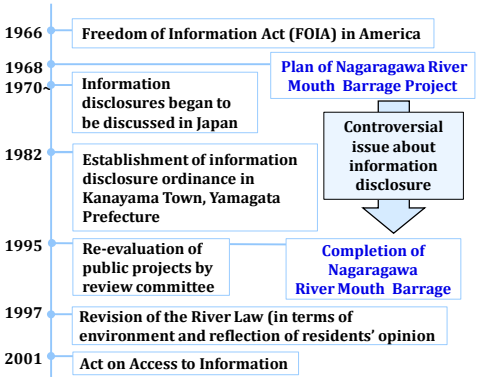
# 2. Transparency of Public Works Progress

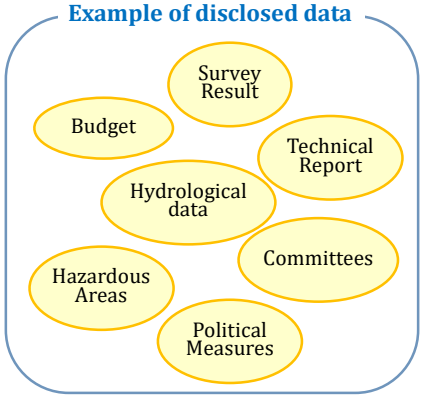
## (2) Information Disclosure




Source: PRT

**Background of Information Disclosure**

Various information are disclosed to the public in a various way.




Source: PRT



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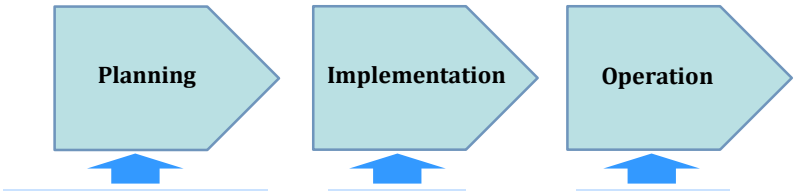
# 2. Transparency of Public Works Progress

## (3) Evaluation of Policies and Projects

1) System of Project Re-evaluation

- Through project re-evaluation, projects with high effectiveness and efficiency are implemented.
- Projects are to be re-evaluated to decide whether to "continue" or "stop".

The viewpoints in re-evaluating are:
1) project necessity
2) project progress forecast
3) possibility of cost reduction and alternative planning




**Planning-phase Evaluation**

**Re-evaluation**
**Every 3 or 5 years**

**Post Evaluation**
**within 5 years after completion**

Source: PRT



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# 2. Transparency of Public Works Progress

## (3) Evaluation of Policies and Projects

2) Reigniting the Debate on the Kawabe River Dam

Strong opposition movement by residents on compensation, necessity, flood, water utilization, environment

<2001~2017> Project Re-evaluation was conducted 5 times.

<2008> Policy change to dam-free flood protection

<2009> Construction of dam body was suspended.

<2020> The Flood in Kuma River caused serious damage.

Requested to construct a dam of water-flowing type.

Source: Japan Dam Foundation

Completion Image of Kawabe River Dam



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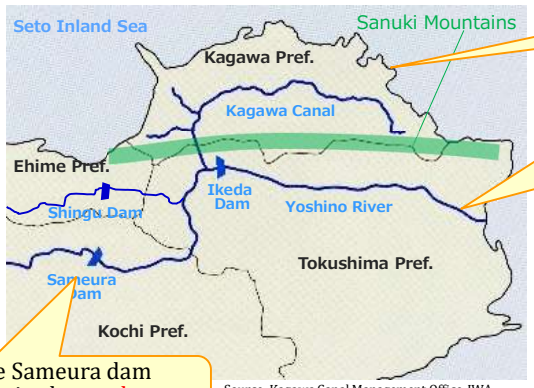
# 2. Transparency of Public Works Progress

## (4) Turning Conflict to Cooperation: Consensus Building in Inter-basin Water Supply

1) Conflict among Prefectures over Water Diversion Project




Source: Kagawa Canal Management Office, JWA

Yoshino River Comprehensive Development Plan

Kagawa Pref. had suffered from water shortages.

Water diversion from Yoshino River running through Tokushima Pref. was required to Kagawa Pref.

The Kagawa Water Canal Project

Conflicts between prefectures

The Sameura dam required resettlement in Kochi Pref.



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## 2. Transparency of Public Works Progress

### (4) Turning Conflict to Cooperation: Consensus Building in Inter-basin Water Supply

2) Issues for the Realization of Kagawa Canal Construction Project

Agreement for the construction of the Sameura Dam

- Tokushima Pref. agreed with the construction of the Sameura Dam because Tokushima Pref. was designated to locate New Industrial City and required abundant water resources.
- The compensation negotiation by Kochi Pref took over ten years. The agreement was finally reached by replacement of roads, construct. of resettlement land, compensation, financial supporting measures, etc.

Farmers' agreement in Kagawa Pref. to the Project

- Kagawa Prefecture explained to the farmers and irrigation associations about 400 times over a period of about two years to obtain their consent.

Some farmers in Kagawa Pref. didn't require the Project because they had ponds.







## 3. Reflecting the Will of the Residents in Projects

### (1) Establishment of Water Governance for Each River Basin

Water governance should be built according to the local conditions for each river basin and river system.


Source: Japan Water Forum

**Vertically Divided Administrative Functions**

- Water governance should be built depending on the region.
- No single model exists because circumstances differ from river basin to basin .

It is difficult to meet all needs for vertically divided administrative functions.

## 3. Reflecting the Will of the Residents in Projects

### (1) Establishment of Water Governance for Each River Basin

Water governance should be built according to the regional condition.

- The River Law was revised.
  - ✓ To reflect feedback of opinions of the people concerned and others to the River Improvement Plan.
  - ✓ To hear the opinions of experts and residents.
  - ✓ To hold public hearings.

- River Basin Committees are established.







## 3. Reflecting the Will of the Residents in Projects

### (1) Establishment of Water Governance for Each River Basin

1) Yodo River Basin Committee — Catchment area: 8,240 $km^2$

- Involved various parties concerned from the early stage of drafting river improvement plan.
- Kept transparency and objectivity.
- Adopted approach for the participants to recognize issues in the basin and consider and discuss potential solutions.

- The opinions were in conflict especially on the dam construction.
- Even six years after the start of the deliberation, the policy and plan were not formulated.

Source: Yodo River Basin Committee

**The 85th Committee**

# 3. Reflecting the Will of the Residents in Projects

## (1) Establishment of Water Governance for Each River Basin

2) Muko River Basin Committee — Catchment area: 496km$^2$

- Discussed from the beginning stage of formulating the basic policy including the Muko River dam construction.
- Established with academic experts and publicly recruited residents as the members.
- Held committee meetings 49 times in total.

- In the end, a part of the plan were not accepted completely and alternative one was prepared.
- Through the continuous discussion, a great majority of participants agreed.

Source: Muko River Basin Committee News 32

**The 68th Committee**







# 3. Reflecting the Will of the Residents in Projects

## (2) Trial and Error to Improve Decision-making

Various consultation systems and methods should be pursued to achieve better water resources management.

**(1) Points of Consensus Building**

- Pursue a consensus that everybody can accept.
- Ask people to think about the benefit of whole region

**(2) Consultation Methods**

Explanatory Meeting | Public Hearing | Committee | Workshop | Task Force | Orientation | Mediation

# 4. Community and Private Sector Participation

## (1) Water Environment Conservation Activities

The public and private sectors should cooperate in water environment conservation activities.

- Designation of Private organizations as River Partner Organization
- Citizen Participation through Workshops such as Good-river and River-improving Workshop
- CSR Activities by Private Companies such as Water Stewardship (water environment conservation activities)


Source: MLIT

**Logo of River Partner Organizations**


Source: Alliance for Water Stewardship

**Logo of Water Stewardship**







# 4. Community and Private Sector Participation

## (2) Recent Notable Activities for Water-Environment Conservation

- Forest-Village-River-Sea Project contributes to local society and economy by promoting the conservation and restoration of the natural environment.


Source: The Ministry of the Environment

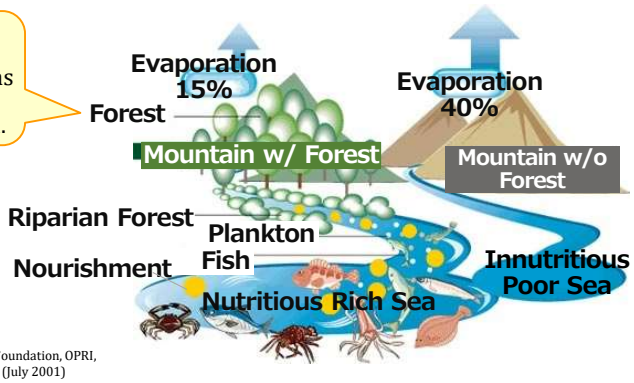
**Forest-Village-River-Sea Project**

# 4. Community and Private Sector Participation

## (2) Recent Notable Activities for Water-Environment Conservation

- Forest for Fish Breeding is one of the protection forests designated in accordance with the Forest Act.

Forests of about 60,000 ha have been designated as Forest for Fish Breeding in Japan.




Source: UMI & NAGISA Foundation, OPRI, Ocean Newsletter No.23 (July 2001)

**Fish Breeding Functions of Forest**







# 4. Community and Private Sector Participation

## (3) Roles of Individuals and Companies in Disaster Measures

It is important to promote efforts so that every single citizen can regard the disaster as "my own event" and make action voluntarily.

- Rebuilding Flood-Conscious Societies through making My Timeline

The individual disaster prevention plan

- Disaster Prevention Activity by Flood Fighting Teams

Source: MLIT

**My Timeline Preparation Course**

Source: MLIT

**Flood Protection Activities and Drill**

# 4. Community and Private Sector Participation

## (4) Establishment of an Award System

It is expected to increase the motivation by giving commendations to the activities of private organizations and individuals.

- Flood-fighting-related Awards
- River Contributor Awards
- Japan Water Prize and Japan Stockholm Junior Water Prize

Source: MLIT

**The Vice Minister Presenting the Award**







# 5. Lessons Learned (1)

(1) Water resources could be managed by establishing water governance that involves local communities and stakeholders from the planning stage.

Japanese experience shows that a top-down approach driven by government organizations cannot respond to various needs of local communities. A legal framework also needs to be established to arrange governance. The River Act was revised to promote public participation in the decision-making processes of policies and plans for river basin improvement in Japan. Access to information through a variety of means is a prerequisite for the consensus building process.

## 5. Lessons Learned (2)

(2) Governance should be established in each river basin according to local conditions.

To reflect a wide range of opinions from academic experts and residents, a committee or forum should be formulated. It may take a long time to reach a consensus among a wide range of stakeholders. There is no single right answer for how to reach a consensus. The Yodo River Basin Committee and other river committees took innovative approaches. A comprehensive understanding of the situation and issues is needed.







## 5. Lessons Learned (3)

(3) Mechanism of reviewing projects may improve transparency and accountability.

Changes in socioeconomic conditions may reduce the necessity of projects. Governments need to review and revise project activities according to changes.

(4) It is important to strengthen cooperation among the public and private sectors and local communities for environmental conservation and disaster management.

Local communities and residents need to prepare for disasters in accordance with local conditions. The private sector may provide solutions to various issues by utilizing its resources. The government may support these activities through financial support, training, and awards.

# Theme2-1
# MANAGEMENT PLANNING
## FORMULATING THROUGH COORDINATION AMONG SECTORS & REGIONS WITH LONG-TERM PERSPECTIVES




1



# Contents





2

# 1. Introduction

**How to conduct water resources management properly**

- Water resources management is critical for achieving a robust, sustainable, and inclusive society and achieving quality growth.
- A long-term perspective is needed.
- Coordination with other sectors' development is necessary.

**This theme describes**

- How Japan positioned and coordinated the water sector in National Comprehensive Development Plan.
- How Japan promoted the project from a long-term perspective.
- Challenges for these measures.



3



# 2. National Development Plan and Water Resources Management Plan

**(1) Consistency between National Development Plan and Water Resources Management**

- Projects for water resources development and management require a very long time from planning to construction and operation.
- The effects and impacts are also long-lasting.

- Project plans should be consistent with policies such as National Development Plans, SDGs, climate change strategies.



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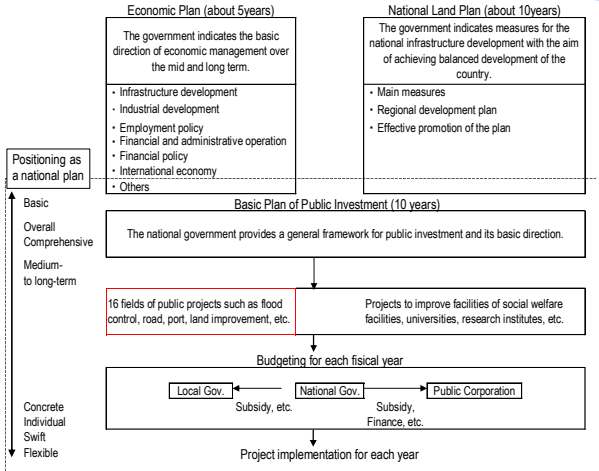
# 2. National Development Plan and Water Resources Management Plan

## (1) Consistency between National Development Plan (NDP) and Water Resources Management




Source: "Maintenance System of Social Infrastructure," Committee on Overseas Activities, Japan Society of Civil Engineers (Ed.), 1997

**Consistency between Public Works and Macroeconomic Planning**



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# 2. National Development Plan and Water Resources Management Plan

## (2) Linkage with National Development Plans

1) Specific Regional Comprehensive Development Plans for Post-war Reconstruction

- **Development of power, food and industry**
- **Land conservation and disaster prevention**

- **The Council for the Study of Comprehensive River Development and surveys for 24 rivers**
- **The National Agricultural Water Use Project on 4 rivers**
- **The Specific Area Comprehensive Development Plan**



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# 2. National Development Plan and Water Resources Management Plan

## (2) Linkage with National Development Plan

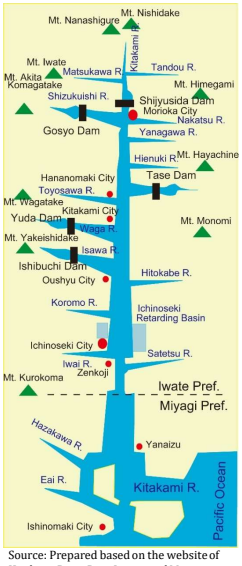
1) Specific Regional Comprehensive Development Plans for Post-war Reconstruction

### The Kitakami River Development Plan

**Needs for flood protection and power generation**

**Five multipurpose dam were constructed**

- ✓ 40-50% of the prefecture's electricity in 1975-1984 supplied by hydropower
- ✓ Expansion of farmland and increased food production
- ✓ Flood damage was reduced
- ✓ Land use along the Kitakami River increased




Source: Prepared based on the website of Kitakami River Dam Integrated Management Office, MLIT

Location of Five Large Dams



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# 2. National Development Plan and Water Resources Management Plan

## (2) Linkage with National Development Plan

2) National Comprehensive Development Plan (NCDP)

**Important issues for NCDP**

- Urban concentration of population and Urban-rural disparities in income
- Balanced development in the country, National land safety, and Harmonization of socioeconomic activities and natural environment

**Development goals**

1. Building a national land structure
2. Ensuring equity
3. Reducing overcrowding
4. Efficient investment
5. Spatial support for industrial policy
6. Effective use of resources
7. National land conservation



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## 2. National Development Plan and Water Resources Management Plan

### (2) Linkage with National Development Plan

2) National Comprehensive Development Plan (NCDP)

- 1st NCDP (1962)
- New NCDP (1969)
- 3rd NCDP (1977)
- 4th NCDP (1987)
- Grand Design for the 21st Century (1998)



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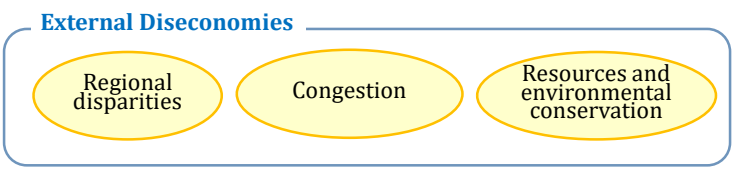
## 2. National Development Plan and Water Resources Management Plan

### (2) Linkage with National Development Plan

3) Required Timing for the National Comprehensive Development Plan

- NCDP is required when **sustained or high economic growth is expected**, to prevent or mitigate **external diseconomies:**



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# 2. National Development Plan and Water Resources Management Plan

## (2) Linkage with National Development Plan

4) Long-Term Flood Protection Plan

| | |
|---|---|
| since 1870s | • Flood protection projects based on modern flood protection plans |
| 1910 | • First Long-term Flood Protection Plan<br>• The Special Account for Flood Protection Fund was established |
| 1921 | • The Second Flood Protection Plan |
| 1933 | • The Third Flood Protection Plan<br>• Small- and medium-sized rivers were funded by government subsidies and bonds |
| 1960 | • The Erosion and Flood Protection Emergency Measures Act<br>• Long-term Flood Protection Plan<br>• The Special Account for Flood Protection |
| 2008 | • Special Account for Social Capital Improvement Projects |



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# 2. National Development Plan and Water Resources Management Plan

## (3) National Water Resources Management Plan

1) Water Plan

**The National Comprehensive Water Resources Plan** (Water Plan) was developed in line with the NCDP.

a guideline for various comprehensive measures concerning water resources

**Water Plan including:**

1. The long-term water demand outlook for the nation
2. The basic goals for the development of water resources
3. The basic goals for the conservation of water resources
4. The basic goals for the use of water resources



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# 2. National Development Plan and Water Resources Management Plan

## (3) National Water Resources Management Plan

1) Water Plan

- Long-term Water Demand and Supply Plan (1978)
- Water Plan 2000 (1987)
- Water Plan 21 (2000)



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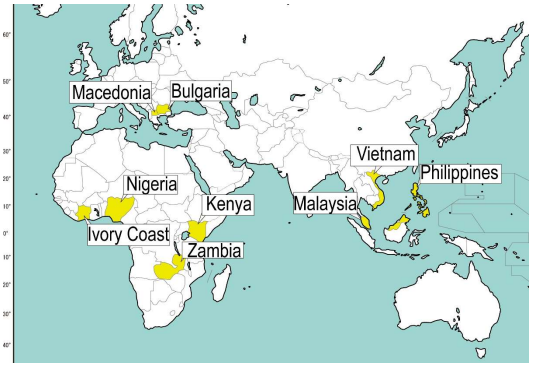
# 2. National Development Plan and Water Resources Management Plan

## (3) National Water Resources Management Plan

2) JICA's National Master Plans for Water Resources Development




Target countries provided with National Water Resources Development Plans, prepared with JICA Technical Cooperation



Source: Prepared based on "Study on Approach for Integrated Water Resources Management – Review of the JICA Master Plan of National Water Resources Management – Final Report," July 2011, JICA



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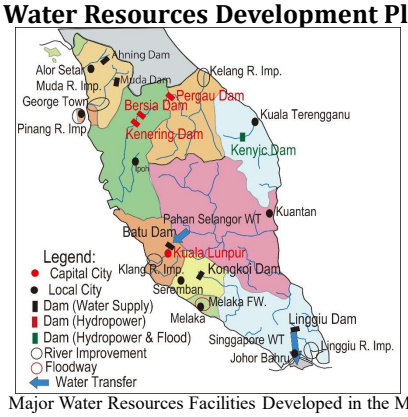
# 2. National Development Plan and Water Resources Management Plan

## (3) National Water Resources Management Plan

2) JICA's National Master Plans for Water Resources Development

**National Water Resources Development Plan in Malaysia**




Major Water Resources Facilities Developed in the Malay Peninsula

Source: Prepared based on "Study on Approach for Integrated Water Resources Management – Review of the JICA Master Plan of National Water Resources Management – Final Report," July 2011, JICA



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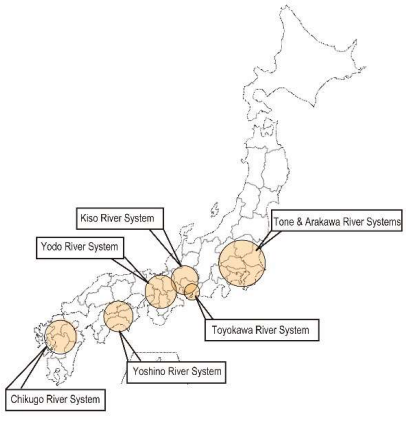
# 3. Water- Resources Development Plans for Important River Basins

**Background:**
- Water supply measures are necessary in wide area.

**Water Development Promotion Act:**
- The Basic Plan for Water Resources Development (the Full Plan) for designated river systems




Source: Prepared based on website of MLIT

**Location of River Systems for Water-Resources Development over Wide Area**



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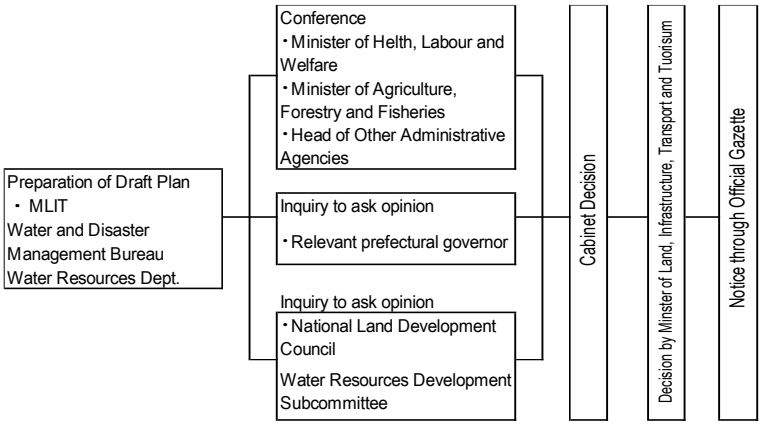
## 3. Water- Resources Development Plans for Important River Basins




Source: MLIT Website

**Flow of Procedures for Formulating the Basic Plan for Water Resources Development**



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## 4. Adaptation Planning to Climate Change

### (1) River Basin Disaster Resilience and Sustainability by All

**Change of Rainfall, Discharge and Frequency of Flood due to Climate Change**

| Climate Change Scenario | Amount of Rainfall | Discharge | Frequency of Flood |
|---|---|---|---|
| At 2 degrees rise | About 1.1 times | About 1.2 times | About 2 times |
| At 4 degrees rise | About 1.3 times | About 1.4 times | About 4 times |

Source: Proposal for Flood Protection Planning in the light of Climate Change, Revised Edition, MLIT, April 2021

A comprehensive and multi-layered approach for the entire basin

2020,7 "**Water-related Disaster Measures in Light of Climate Change**"

**1) Three Important Points of Measures**

1. Resilience of the Land
2. Sustainability
3. Inclusivity



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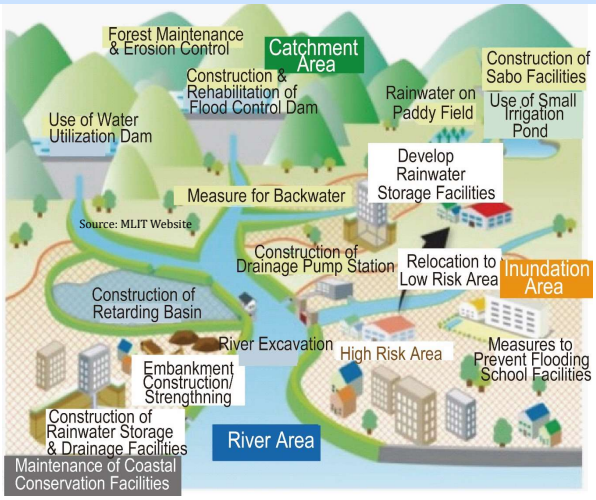
# 4. Adaptation Planning to Climate Change

## (1) River Basin Disaster Resilience and Sustainability by All




Source: MLIT Website

Image of "River Basin Disaster Resilience and Sustainability by all"



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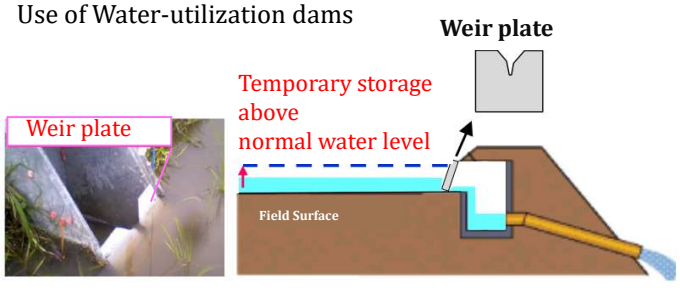
# 4. Adaptation Planning to Climate Change

## (1) River Basin Disaster Resilience and Sustainability by All

### Example

- Use of Paddy fields (Rice field dams)
- Use of Water-utilization dams




Source: Cabinet Office

Rice Paddy Dam



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# 4. Adaptation Planning to Climate Change

## (2) Shift from Development Promotion to Risk Management

- The water resources policy is shifting from "Promoting water resources development" to "Stable water supply".

**Basic Principles:**
- To manage risks surrounding water supply
- To comprehensively ensure the security level of water supply

**Method:**
- To utilize existing facilities
- To coordinate hard and soft measures



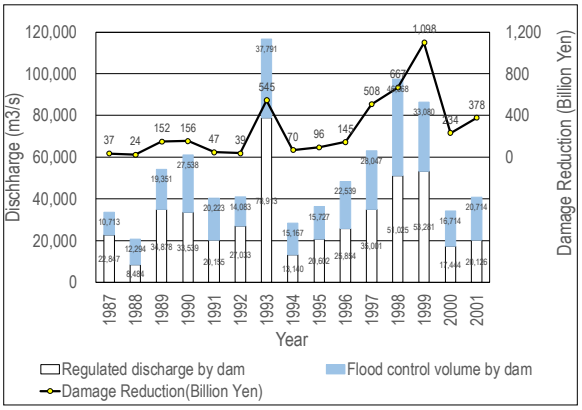




# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

1) Flood Protection Effect




Source: Water resources in Japan (2008) MLIT

**Actual Flood Protection by Dams and Estimated Damage Reduction**

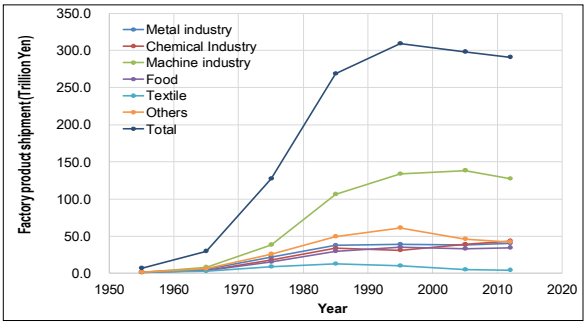
# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

2) Water Use Effect

**Industrial Water**

- Industrial water contributed to the large increase in the shipment value of industrial products.




Source: Industrial statistical survey

**Growth of Shipping Value of Industrial Products**



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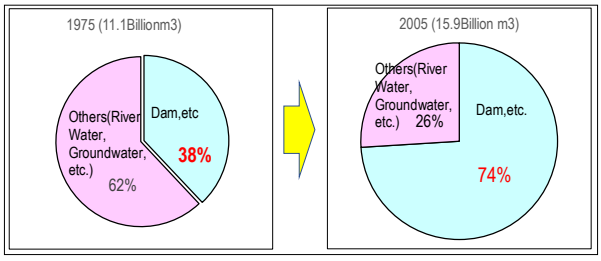
# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

2) Water Use Effect

**Domestic Water Supply**

- In 2005, 74% (15.9 billion $m^3$) of the domestic water was supplied by dams and other water resources facilities.
- The supply from the dam is about 2.7 times the one in 1975




Source: "The Role of Dams and Hydropower" Japan Commission of Large Dam

**Effect of Dams on Domestic Water Supply**



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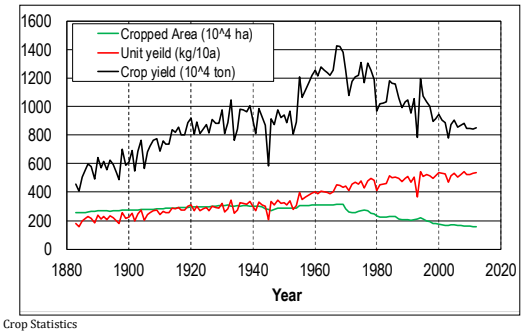
# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

### 2) Water Use Effect

**Irrigation Water**

- Cropped areas and rice harvests increased until around 1970.
- Irrigation water contributed greatly to the irrigation development.




Source: Crop Statistics

**Trends in Paddy Rice Yield**



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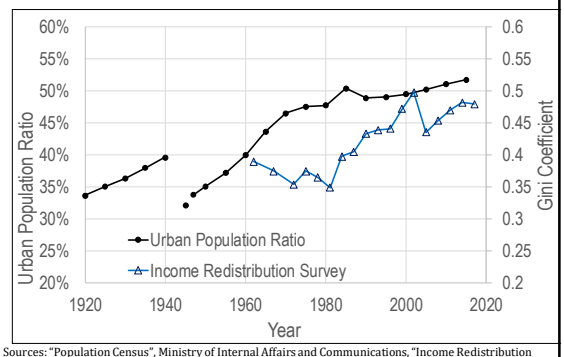
# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

### 3) Reduction of Disparity and Poverty

- Urbanization rapidly progressed after WWII.
- Gini coefficient by "original income" rose in 1980-2000. It became stagnant after 2000.
- The one after the income redistribution remained almost constant at about 0.36-0.37, with no further change in income disparity beyond 2000.




Sources: "Population Census", Ministry of Internal Affairs and Communications, "Income Redistribution Survey", Ministry of Health, Labor and Welfare and data in "Income disparity in Japan – Factors for Increasing Disparity," Yugami Kazufumi, JIL Labor Policy Report Vol. 3, 2003.

**Ratio of Urban Population to Total and Gini Coefficient**



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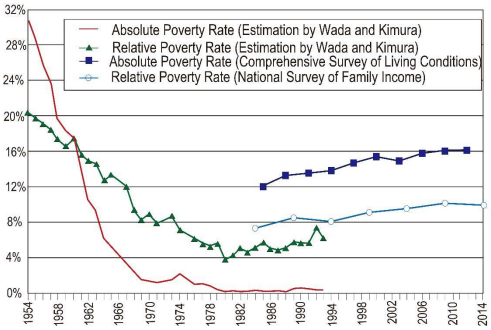
# 5. Contribution to Society through Water Resources Development

## (1) Effects of Water Resources Development in Japan

### 3) Reduction of Disparity and Poverty

- Disparity and poverty ratios in urban area were reduced and productivity in rural area was improved.
- Wada-Kimura's poverty line was set at average consumption per capita of welfare-recipient households in 1960.
- The other two surveys set the poverty line at 50% of the median of equivalized disposable income.




Source: Did Japan become an Unequal Society?: Japan's Income Disparity in Comparative Historical Perspective," Moriguchi Chiaki, Economic Studies Vol. 68, No. 2, Apr. 2017.

**Lowering Trends in Poverty Ratios in Japan**



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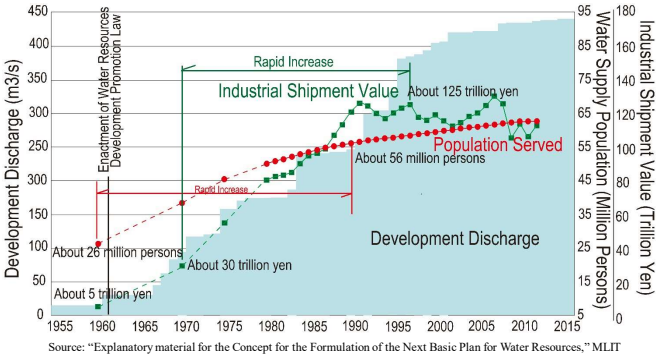
# 5. Contribution to Society through Water Resources Development

## (2) Development Effect in the River System under the Full-Plan

- Supported the growth of population and industrial shipments.
- The household income increased and per capita water use increased.




Source: "Explanatory material for the Concept for the Formulation of the Next Basic Plan for Water Resources," MLIT

**Volume of Water Developed, Industrial Shipment Value and Population Served with Water in the Full-Plan River System**



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## 6. Lessons Learned (1)

(1) Consistent planning could guide disaster risk reduction and water resource management, leading to quality growth.

Water resources management is essential in achieving resilient, sustainable, and inclusive quality growth. Poor management of water resources causes improper utilization and may exacerbate the risk of floods, droughts, and deterioration of water quality. This may affect the nation's growth. Japan could manage water resources effectively based on national land development plans, national water management plans, and long-term flood protection plans. the government should include water resources management in national development plans in coordination with other sectors. Also the governments should position water resources management plans above the ministry-level plans as a "higher-level plan".

(2) To address issues in the water sector, water resource management plans should be prepared based on scientific data, clarifying the goals, effects, and inputs.

To support the implementation of the water policy, the plans should be prepared based on sound evidence. If the plan looks a single list of projects, implementing agencies face difficulties in securing resources and budgets.



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## 8. Lessons Learned (2)

(3) To obtain commitment to the budget required to implement the water policy and planned projects, a long-term plan may be prepared to support implementation.

Since water resource projects are by nature long-term projects, a multiyear commitment is required to steadily promote projects rather than allocating budgets year by year. The Japanese government has formulated long-term plans for flood protection and water resource management. A special account for these projects was then established, independent of the general account.



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## 8. Lessons Learned (3)

(4) A review system should be created and maintained to continually review the relevance of projects.

Socioeconomic changes and technological progress may affect water demand and the relevance of planned projects. At the end of Japan's high economic growth period, the reuse of industrial water and water-saving efforts led to a large gap between predicted and actual demand. A long-term sector plan, like the flood protection plan in Japan, tends to cause rigid allocation of financial resources, which makes it difficult for the project to adapt timeously to economic trends and fiscal conditions.



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## 8. Lessons Learned (4)

(5) To cope with an increase in the flood flow due to climate change, a "River Basin Disaster Resilience and Sustainability by all" approach should be considered.

Conventional structural measures such as levees and dams alone cannot cope with the increasing severity of flood damage under climate change. Relevant organizations in the river basin should cooperate in reducing flood risks and be engaged in multi-layered measures, such as land use plans, relocation from risk areas, urban facilities, and storing flood water in paddy fields and irrigation ponds.



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# Theme 2-2
# River Basin Planning
## Optimizing Management Using River Basin as a Planning Unit




1



# Contents





2

# 1. Introduction

**Consequences of Development Without River Basin Plan:**

- Uncontrolled deforestation and agricultural development
- Degradation of basin's water-retaining function
- Increase of surface soil erosion
- Uncontrolled water intake
- Degradation of ecosystem, water quality and quantity
- In return, the above would affect the water abstraction and flood damages

**Theme 2-2 describes:**

- Methods used for the development and management of water resources needed to ensure a healthy water cycle in Japan.



3



# 2. Planning for the River Improvement and Management of Rivers

## (1) Management of Meteorological and Hydrological Observation Data and Inclusion in Planning

- It is necessary to gather and manage the basic meteorological and hydrological observation data.
- Japan Meteorological Agency (JMA) has 1,300 rainfall stations.
- MLIT has regulations on observation:
  - ✓ Rules for Hydrological Observation Services
  - ✓ Detailed Rules for Hydrological Observation Services
  - ✓ Guidelines for Quality Verification of Hydrological Observation Data
- MLIT has the database of observed data registering more than 6,000 stations for rainfall, water level and discharge, etc.



4

## 2. Planning for the River Improvement and Management of Rivers

### (2) Basic Policy for River Improvement Plans

- In Japan, a long-term "**Basic Policy for River Development**" is established.
- Based on this Policy, "**River Improvement Plan** (RIP)" is formulated for each river system,
- RIP sets goals for the immediate future (20-30 years) on details of RIP and maintenance.



5



## 2. Planning for the River Improvement and Management of Rivers

### (2) Basic Policy for River Improvement Plans

| Item | Basic Policy of River Development | River Improvement Plan |
|---|---|---|
| Composer | River Administrator | River Administrator |
| Procedure | • Hearings of opinions of the Social Infrastructure Development Council (prefectural river councils for Class B river systems)<br>• To be published after Policy formulation | • Hearings of opinions of relevant local governments<br>• Hearings of opinions of academic experts and concerned residents<br>• To be published after Plan formulation |
| Contents | • Basic Policy of river improvement from a long-term perspective<br>• Concept of river improvement without specifying details such as individual projects | • Goals of river improvement in 20~30 years<br>• Specific details of river improvement including individual projects planned |

Note: Small rivers managed by municipalities (locally designated rivers and ordinary rivers) are excluded from the table.
Source: MLIT, Technical Criteria for River Works, Practical Guide for Planning (March 2008)



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## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

1) Safety Level of Flood Protection

**Importance of Rivers and Safety Level of Flood Protection Plan**

| River Importance | Design Flood Scale (Return Period) | River Administrator | Planning Conditions (e.g., Land Use) |
|---|---|---|---|
| A | More than 200 years | National government | Major cities, nature restoration projects, major dam projects, rivers crossing prefecture boundary |
| B | 100 – 200 years | Ditto | ditto |
| C | 50 – 100 years | Prefecture government | Cities |
| D | 10 – 50 years | ditto | Others |
| E | Equal to or less than 10 years | ditto | Others |



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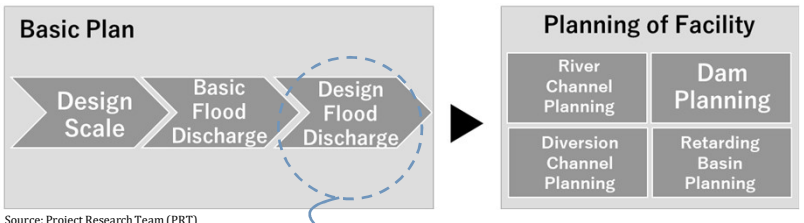
## 2. Planning for the River Improvement and Management of Rivers

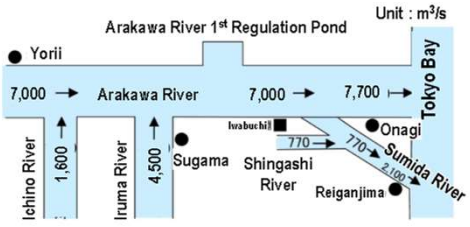
### (3) Flood Protection

2) Basic Flood Protection Plan




Source: Project Research Team (PRT)

**Workflow from Flood Protection Plan to Facility Planning**




Source: MLIT website

**Example of Design Flood Discharge Distribution**



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## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

3) River Channel Planning

- Quantitative safety (discharge capacity)
- Qualitative safety (safety of river management facilities)
- Minimizing the total cost (including maintenance costs)
- Development and conservation of river environment (conservation and restoration of the environment and harmonization with river use)
- Land use along river
- History and culture of river and region



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## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

4) Flood Protection of Arakawa River

- The Arakawa River is an important river in the Tokyo Metropolitan Area.
- Catchment area is 2,940 $km^2$.
- The population within the river basin is 9.3 million.
- The assets in the potential inundation area is estimated at about JPY 78 trillion.
- The safety level or design discharge for flood protection is set at once in 200 years (1/200).



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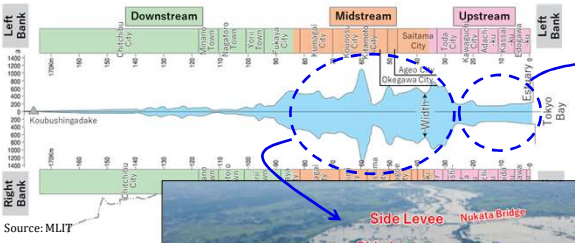
## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

4) Flood Protection of Arakawa River

Narrow manmade bypass for quick water-discharging from retarding area




Source: MLIT


Source: MLIT website

Wide middle reaches for retarding flood to protect downstream cities


Source: MLIT



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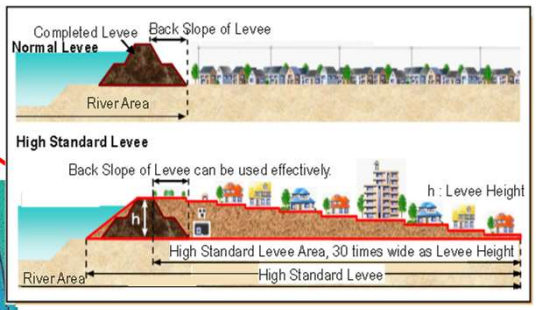
## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

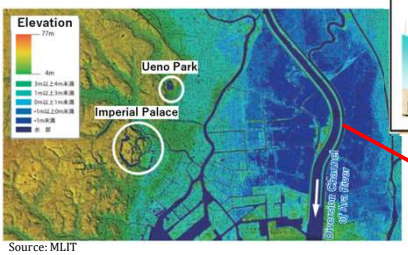
4) Flood Protection of Arakawa River

High Standard Levee to avoid catastrophic damage in case of floods exceeding design scale




Source: MLIT

**Concept of High Standard Levee**




Source: MLIT

**Ground Level around the Bypass of Arakawa River**

Ground subsided by 4 m and levee height raised



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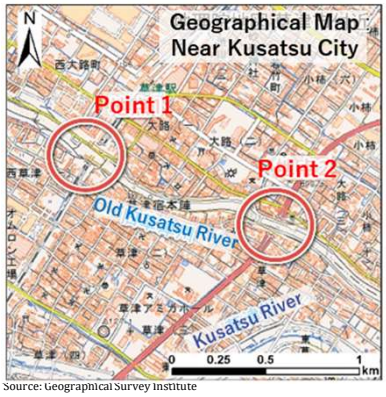
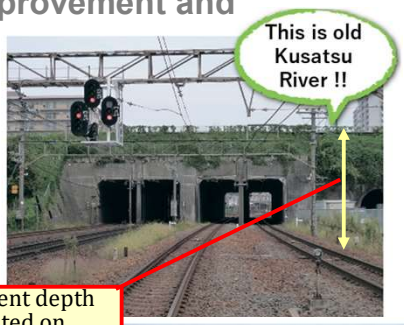
## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

5) "Ceiling River" in Japan




Source: Geographical Survey Institute




Sediment depth deposited on riverbed, viewed at Point 1

Railroad runs underneath the river at Point 1

Source: Geographical Survey Institute

**Example of Ceiling River**



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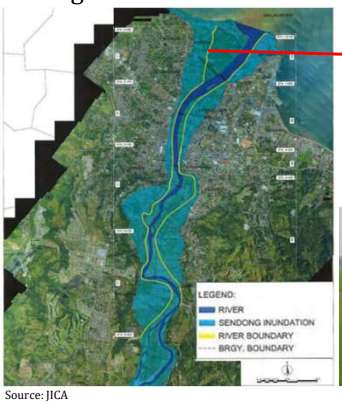
## 2. Planning for the River Improvement and Management of Rivers

### (3) Flood Protection

6) Application of the Japanese Flood Protection Technology in Foreign Countries




Source: JICA

**Floodplain and Riverine Areas (Cagayan de Oro River in Philippines)**

Levees are in the middle of the floodplain.

Levees protects paddy from flooding until the harvest completed

Source: JICA

**A submerged Levee Protects Paddy from Flooding (Hoar District, Bangladesh)**



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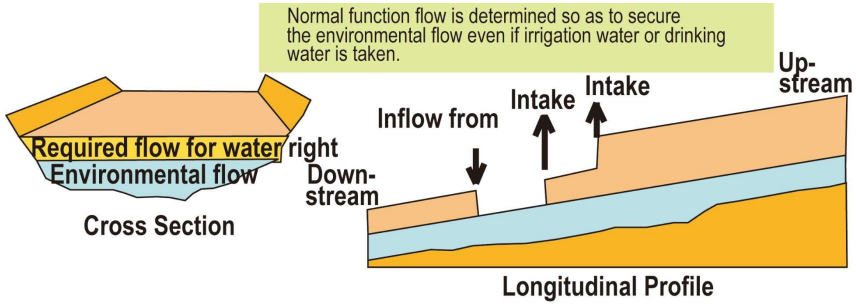
## 2. Planning for the River Improvement and Management of Rivers

### (4) Water Use and Drought Management

1) Normal Function Flow




Source: Prepared by Project Research Team based on Hyogo Prefecture website

**Image of Defining Normal Function Flow**



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## 2. Planning for the River Improvement and Management of Rivers

### (4) Water Use and Drought Management

2) Safety Level

- Target frequency of Drought is once in ten years (1/10) in Japan.
- USA (California, San Francisco, New York): The severest drought in history.
- Australia (Southeast Queensland): Once in 100 years.
- United Kingdom (UK: London): Once in 50 years.



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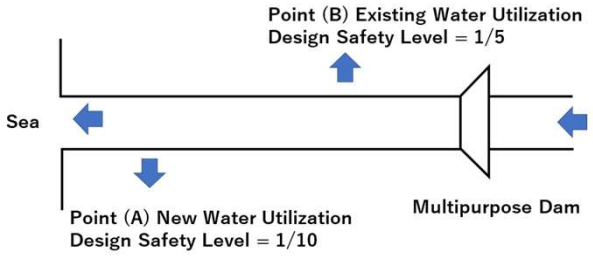
## 2. Planning for the River Improvement and Management of Rivers

### (4) Water Use and Drought Management

3) Coverage of Costs by the Government for Supplying Water to Existing Irrigation Users

- A multipurpose dam may be constructed to supply water to a new water user at Point A with a planned safety level (1/10).
- An existing water right holder for irrigation at Point B. Water may be abstracted with a safety level (1/5).




Source: PRT

**Diagram of the Water Use Point**



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## 2. Planning for the River Improvement and Management of Rivers

### (5) Conservation of the Water Environment

- "**Nature-friendly river works**" as the basis for all river development
- It aims at preserving and restoring a good river environment while ensuring the necessary flood-protection safety and minimizing the impacts on the good habitat and growth environment of living things.

Source: MLIT website

**Nature-friendly River Works on Iga River**



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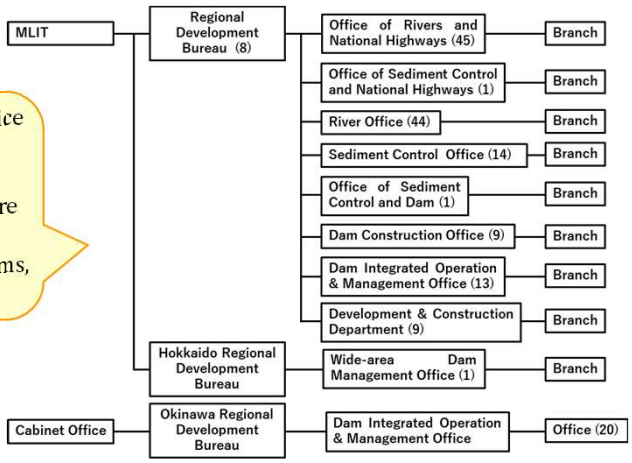
## 2. Planning for the River Improvement and Management of Rivers

### (6) Institutional Arrangement

MLIT has a river office for each river basin, and a branch office thereunder. There are about 140 offices related to rivers, dams, and Sabo works.




Source: Project Research Team based on Cabinet Secretariat Documents

**National River-related Offices**



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## 3. Plans for Water Cycle Recovery

### (1) Promotion of Basin Management

The River Basin Water Cycle Plan includes

- Current and future issues
- Principles and future goals
- Goals for maintaining or restoring the sound water cycle
- Measures to achieve the goals
- Indicators to show current status of the water cycle and progress of the Plan



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# 3. Plans for Water Cycle Recovery

## (2) River Basin Water Cycle Plan

An example of Healthy Water Cycle Plan of Lake Inba Basin

- Projects for water quality improvement and conservation
- Regulations for water quality conservation
- Cleanup of rivers flowing to the Lake
- Cleanup of the Lake
- Runoff management in the basin


Source: Lake Inba Basin Healthy Water Cycle Conference

**Location of Lake Inba**



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# 3. Plans for Water Cycle Recovery

## (3) Example of the River Basin Water Cycle Plan

"Healthy Water Cycle Plan of the Lake Inba Basin" in Chiba Prefecture is introduced. It is located to the east of Tokyo.

- Lake Inba is an aquatic habitat characterized by rich and pure water, supporting agriculture and fishery.
- Urbanization gave rise to an increase in the pollution load from domestic wastewater.
- In 2016, "Plan for Healthy Water Cycle in the Lake Inba Basin" was formulated with a target of 2030.
- The plan has five goals as shown below:

**Basic Concept "The Lake of Blessing Again"**

| Goal 1 | Goal 2 | Goal 3 | Goal 4 | Goal 5 |
|---|---|---|---|---|
| Source of Good Drinking Water | Possible to Play and Swim | Hometown of Creatures | Resistant to Flood Damage | People Gather and Live Together |

Source: Healthy Water Cycle Conference of Lake Inba Basin, March 2017



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# 3. Plans for Water Cycle Recovery

## (3) Example of the River Basin Water Cycle Plan

The following countermeasures are being implemented:

1) Improving sewerage systems (install combined treatment septic tanks) and agricultural drainage facilities (livestock waste treatment facilities).
2) Tightened effluent standards, pollution load control, effluent control, and guidance for small businesses.
3) Purification of inflowing river water by nature-friendly river works, river cleaning, and channel dredging.
4) Purification of lakes using aquatic plants, maintenance of vegetation zones, and lake cleaning.
5) Installation of infiltration and storage facilities for urban effluent (permeable pavement), and control of fertilizer in the drainage from farmland.



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# 4. Lessons Learned (1)

(1) Water resources should be managed using a river basin as the planning unit.

A water resource management plan should be developed according to the individual characteristics and customary practices in the basin. The plan should also ensure consistency among sectors throughout the basin, set management goals, and optimize facility development and environmental management throughout the river basin. An extensive database of hydrological data is needed to develop this plan.

(2) Master and action plans are crucial for effectively managing a river.

In Japan, the River Law stipulates that river management offices should formulate the Basic Policy for River Improvement as a master plan for the comprehensive conservation and use of water resources, and the River Improvement Plan as an action plan with a timeline of for 20–30 years, specifying actions including individual projects.



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## 4. Lessons Learned (2)

(3) To manage drought and flood disasters, targets of safety levels should be set for their development.

In Japan, the drought safety level has been generally set at 1/10, and the flood protection safety level is determined based on the importance of the target river basin. Storage facilities and levees are planned to satisfy these requirements.

(4) Local offices are needed to respond to local needs in the field.

The RMOs should be established to help understand key local issues and the needs of water resources management. In addition, given the need to collaborate with various related organizations and local communities, it is important to build trusting relationships with these organizations.



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## 8. Lessons Learned (4)

(5) Collaboration among various stakeholders is needed to recover from water cycle deterioration.

Urbanization has resulted in increased basin damage in the water cycle of river flow and groundwater in a river basin. Additionally, an increased water demand has increased groundwater exploitation and subsequent surface water rise, causing environmental function to decline, depleting spring water, and exacerbating water pollution. Japan began formulating river basin plans and management systems by engaging multiple stakeholders to establish a healthy water cycle.



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# Theme3
# Finance
## Sharing Responsibilities and Costs among Stakeholders




1



# Contents

1. Introduction
2. Financial Framework of Water Resources
3. Cost Allocation in Water Resources Development
4. Lessons Learned



2

# 1. Introduction

**Why is funding essential for water resource project?**

- Water resources projects require a huge cost and a long period of time.
- Financial support well-balanced development of national land and water resources.



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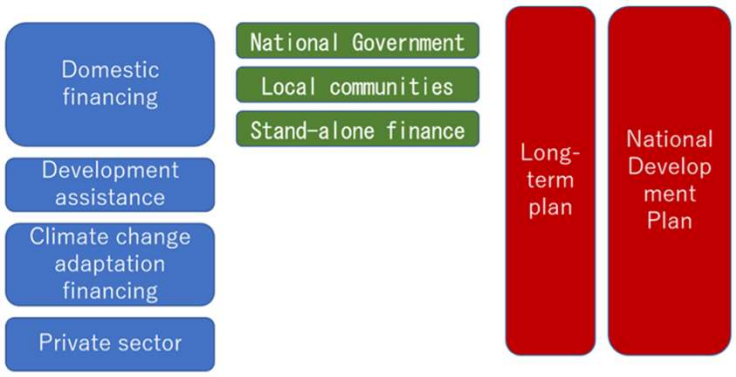
# 2. Financial Framework of Water Resources

## (1) Legal Systems

1) Financial Arrangement




Source: Ishiwatari, M. and Akhilesh S. "Good enough today is not enough tomorrow: Challenges of increasing investments in disaster risk reduction and climate change adaptation." Progress in Disaster Science 1

**Financial for Water Resources Development and Management**



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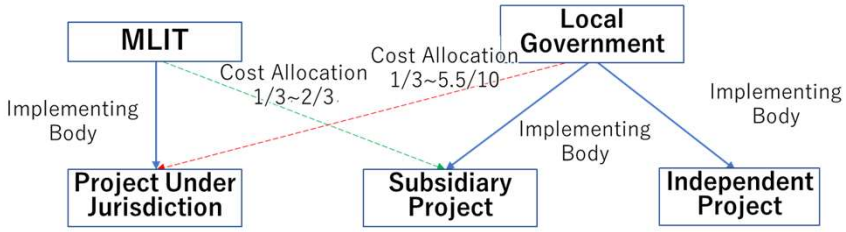
# 2. Financial Framework of Water Resources

## (1) Legal Systems

2) Legal System of Cost Sharing for Water Resources Projects in Japan




Source: Project Research Team

**Cost Sharing in Projects under the Jurisdiction and Subsidiary Projects**



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# 2. Financial Framework of Water Resources

## (1) Legal Systems

2) Legal System of Cost Sharing for Water Resources Projects in Japan

**Sharing of Project Costs**

| Purpose | River Type | Cost Sharing |
|---|---|---|
| River Administrator (Flood Protection) | Class-A River | MLIT 2/3, Prefecture 1/3 |
| | Class-B River | MLIT 1/2, Prefecture 1/2 |
| Irrigation | | Beneficiaries 1/10, of the rest, National Government (MAFF) 3/4, Prefecture ¼ |
| Water Supply | | 1/2 – 1/3 of government subsidy (MHLW) |
| Sewerage | | Public Sewerage : Main Culverts 1/2, Final treatment plant 1/2 or 5.5/10<br>Basin Sewerage : Main Culverts 1/2, Final treatment plant 1/2 or 2/3) |
| Industrial Water Supply | | Government subsidy within 40% (METI) |
| Power Generation | | In principle the cost is to be borne by the power company (charges from the electricity consumers) |



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# 2. Financial Framework of Water Resources

## (1) Legal Systems

3) History of Financial Systems

**History of Act and Subsidy**

| Year | Act or Subsidy |
|---|---|
| 1896 | The River Law |
| 1899 | Act for Agricultural Land Improvement |
| 1908 | Subsidies for individual land improvement works |
| 1911 | Special Account Act for Flood Protection, Electricity Business Act |
| 1940 | Subsidy for river-water control projects related to Dam and reservoir |
| 1957 | Multi-Purpose Dams Act |
| 1961 | Water Resources Development Promotion Act<br>Water Resources Development Corporation Act |
| 1962 | Act on Emergency Measures for Erosion and Flood Protection<br>A special account for flood protection |
| 1966 | The government bonds for construction |



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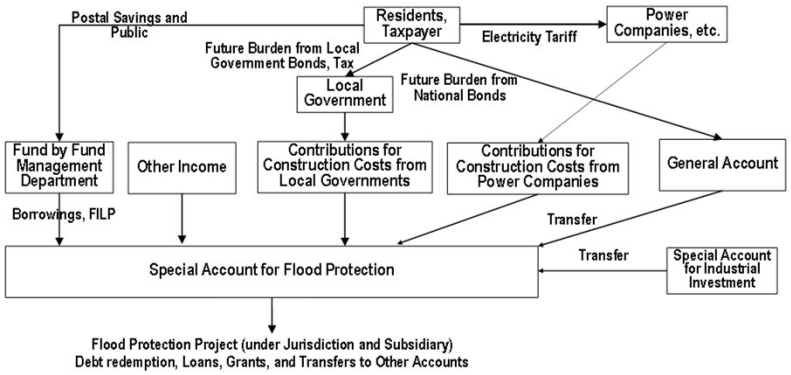
# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

1) Special Accounts

1) Framework of Special Account for Flood Protection




Source: "Problems of Flood Protection Projects and Flood Protection Policy" (Toshiyuki Kamimura, Toyo University)

**Revenue Sources of the Special Account for Flood Protection**



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## 2. Financial Framework of Water Resources

### (2) Framework of Diverse Funding

2) Removal of Special Accounts

**The Special Account had an issues;**

1) Blocked clarity of public finance
2) Implementation of Projects with low need and low urgency
3) Waning the significance of the special account
4) Unused or carried-over funds
5) Unclear benefits and costs in transfers and borrowing from the general national account
6) Difficult monitoring

**The special account for social infrastructure promotion projects was abolished and included in the general national account.**



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## 2. Financial Framework of Water Resources

### (2) Framework of Diverse Funding

2) Government Bonds for Construction

- Public works are financed by issuing government bonds or by borrowing.
- As future generations will also benefit from public facilities, they should also bear the costs as well.
- Government bonds for construction are issued within the amounts decided by the National Diet.



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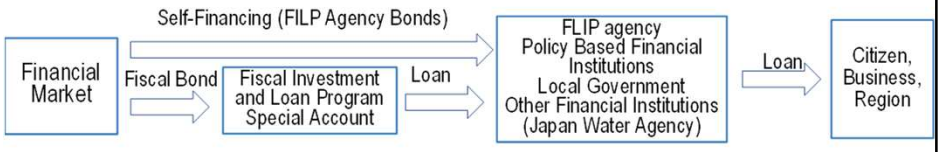
# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

3) Fiscal Investment and Loan Program (FILP)




Source: Prepared by simplifying " Structure of Fiscal Investment and Loan Program" by the Ministry of Finance.

**The FILP Framework**



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# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

4) Charges for Use of River Water (Water Rights Fees)

- Prefectural governments collect charges for river water use.
- These charges are exempted for use in domestic water supply, public power generation, and irrigation.
- Most of these charges are collected from private companies operating in power generation and industrial water supply.



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# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

5) Subsidies for Urgent Disaster Rehabilitation Works

1) It covers various public facilities of rivers, coasts, landslide protection, roads, ports, fishery ports, sewerage, and parks.

2) It assesses project costs immediately after disasters and promptly secures supplementary budgets.

3) It helps starting work promptly, often on the day of the disaster, before cost estimation by providing subsidies retroactively.

4) It aims at functional rehabilitation, and not necessarily reviving the original forms.

5) It provides a package budget to each prefecture covering all rehabilitation works so that prefectural governments have flexibility in project implementation.



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# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

6) Farmers are Responsible for Irrigation Facilities

**Example of Subsidy-Responsibility Ratio for Land Improvement**

| Projects | Nation | Prefecture | Municipality | Local |
|---|---|---|---|---|
| National Projects for Irrigation and Drainage | 75 | 25 | 5 | 0 |
| Prefectural Project for Irrigation and Drainage | 50 | 25 | 10 | 15 |
| Prefectural Projects for Farmland-Disaster Prevention | 55 | 37 | 8 | 0 |



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# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

7) Public Private Partnership for Supply and Sewerage Services

**Types and Number of PPP for Water Supply and Sewerage Services**

| Type | Details of Privatization |
|---|---|
| Business Outsourcing | ● Outsource the entire operation and management of the water purification plant<br>● Private companies undertake overall operation and maintenance. |
| DB (design, build)or DBO (design, build, operation) method | ● Performance-based contract<br>● Private sector utilize its knowhow and complement the human resources for more efficient operations compared with normal outsourcing. |
| PFI (conventional method) | ● In addition to the DBO method, outsource to the private sector including financing. |
| PFI (Concession method) | ● Private contractors can participate in the operation of the water supply business as well as to set charge rates flexibly within certain range. |



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# 2. Financial Framework of Water Resources

## (2) Framework of Diverse Funding

8) Cost Bearing by the Private Sector

**"River Basin Disaster Resilience and Sustainability by all"**
in which all parties involved in the basin, that is, the national government, local governments, private sector, and residents jointly implement countermeasures.

↓

**Rainwater-storing** and **infiltration facilities** are necessary

↓

The public sector provides **subsidies** for **facility construction and exempts taxes** to reduce the maintenance and management costs.



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## 3. Cost Allocation in Water Resources Development

### (1) Cost Allocation by Specific Multi-Purpose Dams Act

**River administrators, the Minister of MLIT or prefectural governments, have unified responsibility** for construction and management of multipurpose dams.

**Co-ownership is not provided to the water users** regardless of their allocation in the construction cost. Instead, the right to use the dam is provided.

**The calculation method to allocate the construction and management costs** is established for the water users.



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## 3. Cost Allocation in Water Resources Development

### (2) Public Finance and Advanced Investment

- Upon completion of multipurpose dams, Water Resources Development Corporation (WRDC) can recover the funds on instalment basis from the local governments and beneficiaries.
- In the case of Muroo Dam,

Muroo Dam

Muroo Reservoir

Storage capacity is 14.3 million $m^3$

**6.45 million $m^3$** was for new irrigation water use.

**301/1,000** of the construction cost was allocated to water use.



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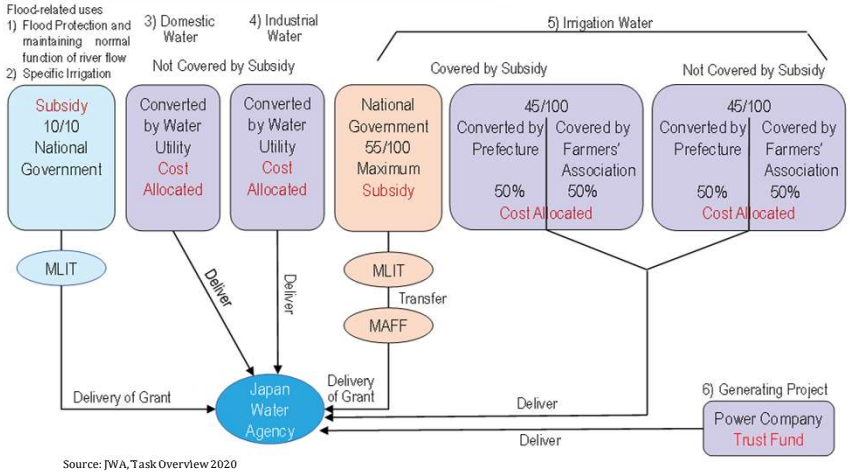
# 3. Cost Allocation in Water Resources Development

## (3) Allocation of Maintenance Cost




Source: JWA, Task Overview 2020

**Cost Allocation for Management of Multi-purpose Dams Managed by the Japan Water Agency**



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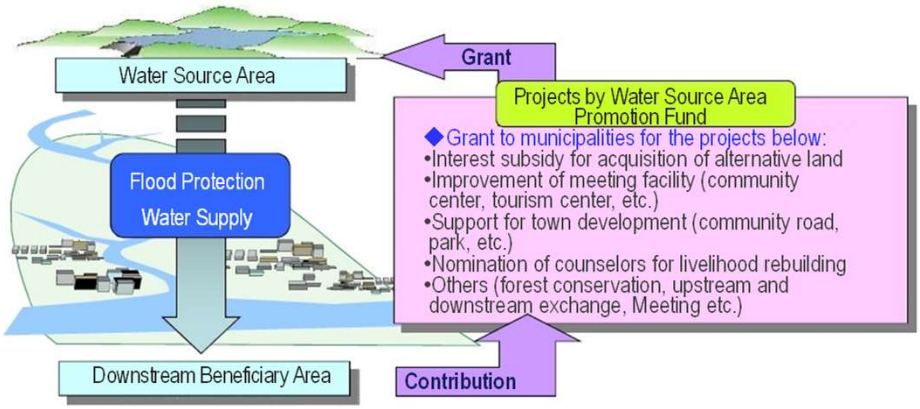
# 3. Cost Allocation in Water Resources Development

## (4) Support to Communities Affected by Large-scale Projects




Source: Japan Water Resources 2014 Ver.

**Overview of Water-Source-Area Promotion Fund**



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## 4. Lessons Learned (1)

(1) To secure sustainable budgeting over a long construction period, a legal framework should be established.

Water resources management often involves large-scale construction projects that require considerable budgets and long construction periods. Thus, it is necessary to secure stable budgeting regardless of the nation's short-term economic and financial situation. In Japan, the development plan was established through legislation, and the budget was secured via measures such as the special account for flood protection.



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## 4. Lessons Learned (2)

(2) Diverse mechanisms should be established to increase financial resources.

Water resources development involves various stakeholders, including the national and local governments as well as the private sector. Fiscal frameworks such as special accounts, construction bonds, subsidies, and loan programs contributed to the development of water resources to meet the rapidly growing water demand driven by high economic growth in Japan. To provide loans to local governments and organizations that have difficulty managing construction costs in a lump sum, Japan introduced a system of loans program (i.e., FILP) and water resources development bonds. These local governments repay the loans after the completion of projects.



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## 4. Lessons Learned (3)

(3) To implement water resources development involving multiple water users, a cost-allocation system should be established.

It is difficult to determine the cost allocation for each project through negotiating among stakeholders, including water users. In Japan, an act clarifies the method of cost allocation and the division of roles among water users.

(4) PPPs can improve water management.

Since Japan is facing difficulties in managing water facilities because of its aging and decreasing population, the government introduced PPPs to improve financial and technical situations using the technical know-how of the private sector.



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## 4. Lessons Learned (4)

(4) Beneficiary farmers should pay levies and provide compulsory worker services to develop and manage irrigation facilities.

Farmers' associations historically play a significant role in developing and maintaining water sources and water utilization facilities in Japan. These associations require their member farmers to pay a levy or engage in compulsory labor services.



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# Theme 4
# Water Pollution and Environmental Management

## Preventing damage to human health and lives and creating Sustainable Environment



1



# Contents





2

# 1. Introduction

**Why is water pollution control important?**

Prioritize Economy over Environment and Water Pollution

↓

Destruction of Environment and Severe Pollution

**Need to Establish Legal System to Regulate and Improve Quality of Wastewater Discharge**



3



# 2. Water Pollution

**(1) Water Pollution Diseases and Legal System in Japan**

**"Polluting Industry"**

- After the World War II, to achieve heavy industrialization was promoted.
- The Government prioritized infrastructure development for industry over living facilities.
- Large-scale industrial complexes were built in the coastal areas and pollution intensified and spread spatially.

↓

**Four major pollution-related diseases** emerged because of wastewater from factories and air pollution

| | |
|---|---|
| Minamata | Itai-Itai |
| 2nd Minamata | Yokkaichi Asthma |



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## 2. Water Pollution

### (1) Water Pollution Diseases and Legal System in Japan

Local Governments faced the brunt of criticism regarding environmental issues, and had to solve the problems on their own before the national government could act.

From early 1950s, movement to establish pollution-related regulations began, however, it was difficult due to opposition from the industry sector, especially from the mining industry.

From 1953 to 1957, MHW held 20 conferences with the relevant ministry. In 1970, "Pollution Diet" enacted 14 pollution-related laws.

MHW: Ministry of Health and Welfare



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## 2. Water Pollution

### (1) Water Pollution Diseases and Legal System in Japan

1) Legal Systems for Dealing with Water Pollution

Water Pollution Prevention Act (1970)

Basic Environment Act (1993)

2) Organization Development

- Central Environment Council dealt with environmental policy in general.
- Environmental Agency integrally control pollution regulations under the jurisdiction of 13 ministries.
- Local governments given the responsibility to formulate and implement measures



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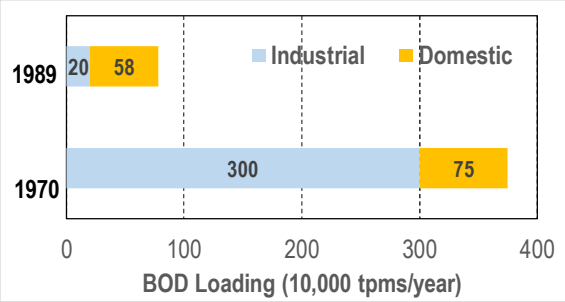
# 2. Water Pollution

## (2) Wastewater Regulation

2) Factory Effluents




Source: Environmental Strategy of Water, Nakanishi Junko, Iwanami Publications

**BOD Loading**



7

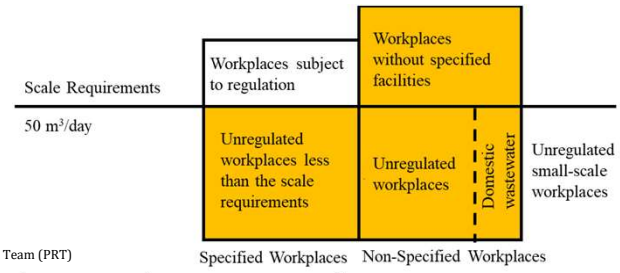


# 2. Water Pollution

## (2) Wastewater Regulation

2)Factory Effluents

- Regulated by effluent standards and total pollutant load control.
- Obligation to measure and on-site inspection.
- Factories have own treatment facilities before discharging wastewater into public waters, or they are connected to sewerage systems.




Source: Project Research Team (PRT)

**Specified Factory Subject to Water Pollution Prevention Act**



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# 2. Water Pollution

## (2) Wastewater Regulation

3) Agricultural Wastewater

Domestic water treatment:
- Johkasou (On-site wastewater treatment)
- Rural Sewerege Systems

Regulation for Pesticides:
- Manufacture, import sell, use only registered pesticides by MAFF.
- Standard for applicable type of crops, time of use, amount of use.



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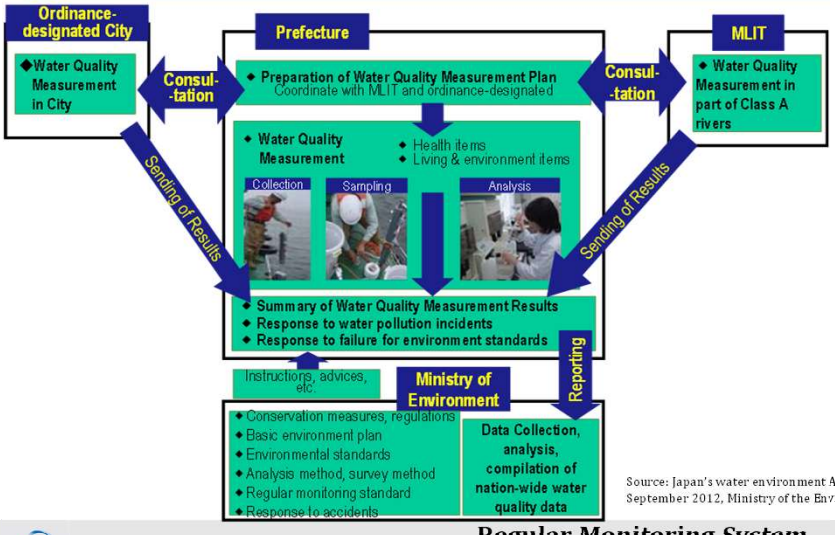
# 2. Water Pollution

## (3) Water Quality Monitoring to Ensure Clean Water




Source: Japan's water environment Administration, September 2012, Ministry of the Environment

Regular Monitoring System



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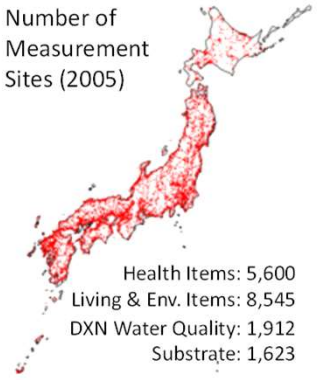
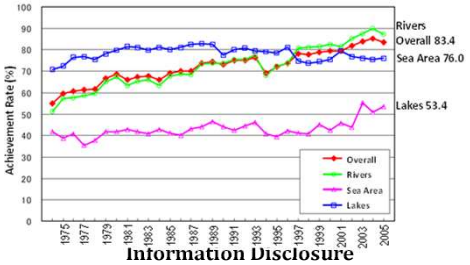
# 2. Water Pollution

## (3) Water Quality Monitoring to Ensure Clean Water




**Measurement Site in Japan**

Source: Japan's water environment Administration, September 2012, Ministry of the Environment


**Information Disclosure**



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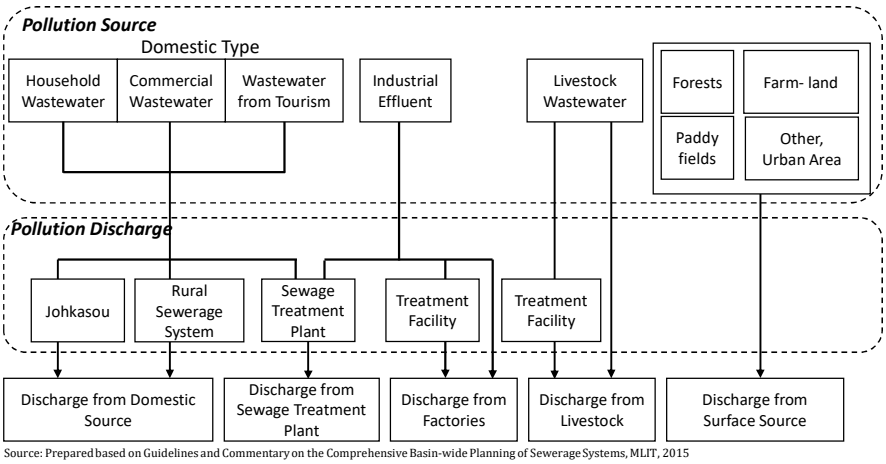
# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

### 1) Pollution Sources




Source: Prepared based on Guidelines and Commentary on the Comprehensive Basin-wide Planning of Sewerage Systems, MLIT, 2015

**Sources of Pollution and Discharge**



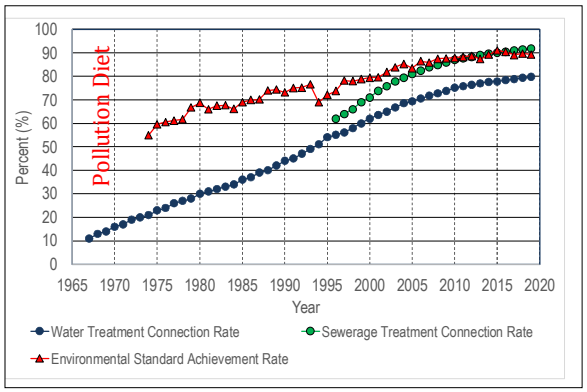
12

# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

2) Domestic Wastewater Treatment in Japan

- Wastewater treatment connection rate was 90.9% in 2017.




Source: Promotion of Sewerage Development, MLIT, with additions and corrections

**Wastewater Treatment Connection Ratio**



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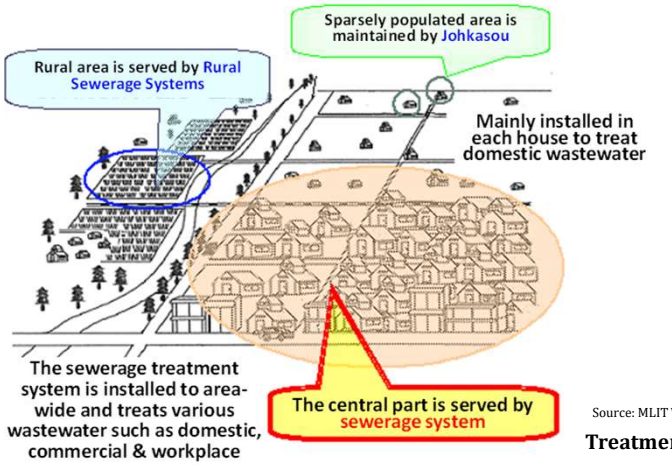
# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

2) Domestic Wastewater Treatment in Japan




Source: MLIT Website

**Treatment Facility Development**



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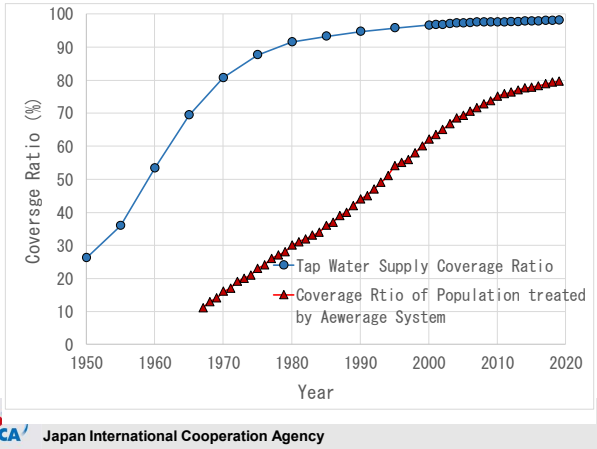
# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

2) Sewerage Treatment

- Sewerage Treatment Coverage Ratio is 79.7% as of 2019. It has increased by 70% in 50 years since 1965.




Source: MLIT Website

**Changes in Water Supply and Sewerage Treatment Coverage Ratio**



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# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

3) Category of Sewerage System

**Public Sewerage System**
Treats sewage in urban areas

**River Basin-wide Sewerage System**
Receives & treats sewage from sewerage systems managed by multiple local governments

**Urban Sewerage System**
Drain sewage mainly from rainwater in urban areas



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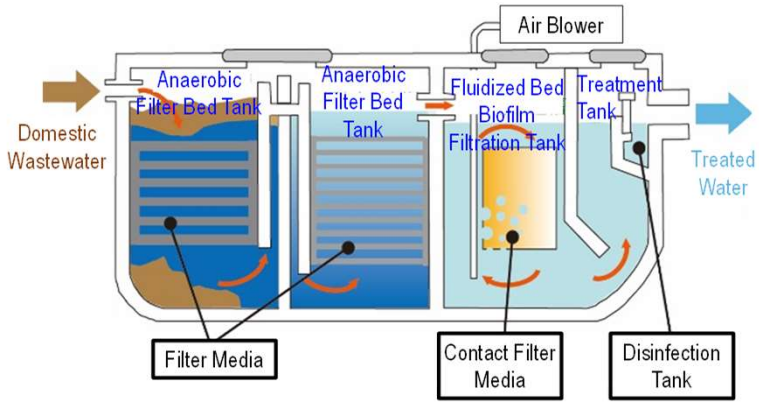
# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

4) Domestic Water Treatment in Rural Area




Source: Website of Cleanup Federation in Wakayama Prefecture

**Domestic Water Treatment by Johkasou**



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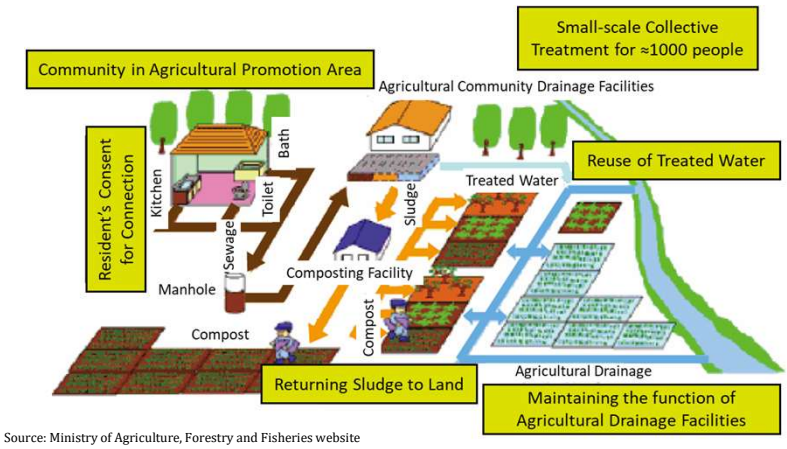
# 3. Securing Clean Surface Water

## (1) Improving Water Quality Discharged into Public Water Bodies

5) Rural Sewerage System and Drainage




Source: Ministry of Agriculture, Forestry and Fisheries website

**Rural Sewerage System and Drainage**



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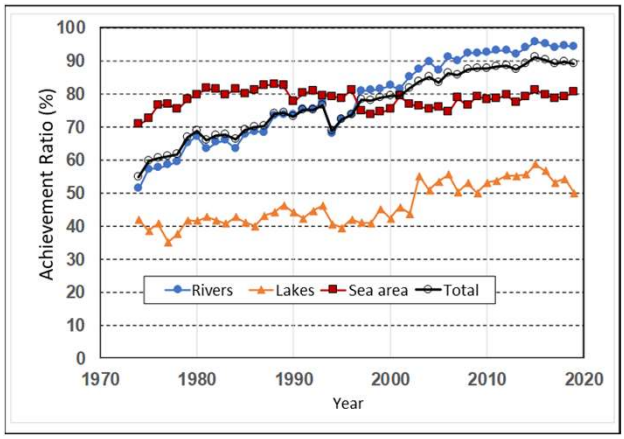
# 3. Securing Clean Surface Water

## (2) Improving Water Quality in Closed Water Bodies Prone to Water Quality Degradation

1) Achievement of Environmental Standard




Source: 2019 Water Quality Measurements of Public Waters, Ministry of the Environment

**Ratio of Environmental Standards Achievement (BOD or COD)**



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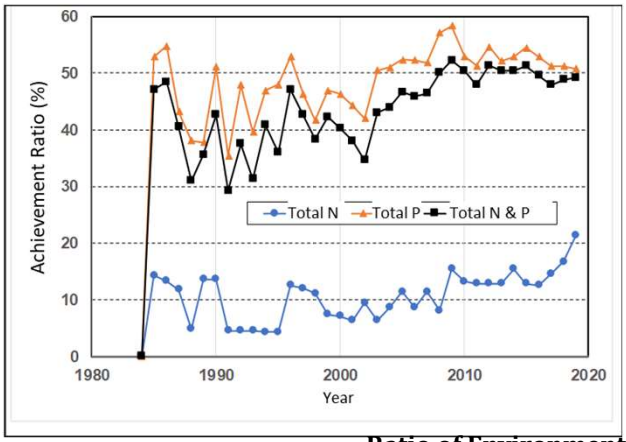
# 3. Securing Clean Surface Water

## (2) Improving Water Quality in Closed Water Bodies Prone to Water Quality Degradation

1) Achievement of Environmental Standard




Source: 2019 Water Quality Measurements of Public Waters, Ministry of the Environment

**Ratio of Environmental Standards Achievement for T-N and T-P in Lakes**



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## 3. Securing Clean Surface Water

### (2) Improving Water Quality in Closed Water Bodies Prone to Water Quality Degradation

2) Runoff Water Improvement Promotion Plan

**Point Source Loads**

- Increase coverage area of sewerage system, Johkasou (on-site wastewater treatment).

**Non-point Source Loads**

- Measures for Load Source: Preventing load generation by human activities, removing load substances accumulated in source area.
- Measures for Discharged Load: Controlling rainwater runoff and purifying discharged water.
- Measures at Water Area to be Conserved: Prevent pollution runoff flowing into rivers by purification.



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## 4. Financial Resources for Measure Against Water Pollution

### (1) Cost Sharing

- Sewerage Facilities: publicly owned company financially independent
- Construction cost: borrowing through local government bond
- Beneficiaries pay principle

| Type | Construction Costs | |
|---|---|---|
| Public Sewerage | Government Funds (Grant Rate: ½ of major pipes, ½ or 5.5/10 of treatment plants) | |
| | Local Funds | Local government bonds (Appropriation rate 100%)<br>Contribution from users<br>Prefectural subsidies |
| River-basin Sewerage | Government Funds (Grant Rate: ½ of major pipes, ½ or 2/3 of treatment plants) | |
| | Local Funds | Local government bonds (Subsidies: Appropriation rate 60%, Local government finance: Appropriate rate 90%)<br>Local government cost: Local Government bonds (Subsidies: Appropriation rate 60%, Local government finance: Appropriation rate 90%)<br>Transfer to General Account (cities, towns, villages)<br>Transfer to General Account (Prefectures) |



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## 4. Financial Resources for Measure Against Water Pollution

### (2) Financial Resources for Facility Development

Key issues for sewerage facility development:

- Principle of public fund for rainwater treatment and users fee for sewerage.
- Improving financial management of publicly owned companies for sewerage system.
- Financial support for developing sewerage system in rural areas (subsidies, grants, other incentives).
- Collect sewerage usage fees at same time as water usage bills.



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## 4. Financial Resources for Measure Against Water Pollution

### (3) Polluter-Pays Principle

The Polluter-Pays Principle

- Countries where the government bears cost of pollution control is unfair in international competition.
- "Guiding Principles concerning International Economic Aspects of Environmental Policies" OECD, 1972.

Basic Environment Law

Water Pollution Prevention Act

- Private businesses were required to invest in water pollution control measures.
- Government provided loans for these facilities.



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# 5. River Environmental Management

## (1) Trends in River Environment Improvement

- 1958- River water quality survey for addressing water pollution
- 1975 River Council report on River Environment Management
- 1983 Start formulating Basic Plan of River Environment Management
- 1990 Initiative of "Nature-friendly River Work"
- 1990 National Survey on Natural Environment in River and Water Shore
- 1997 Revision of the River Law (include river environment)
- 2002 Formulating and promoting Nature Restoration Projects
- 2013 Formulating and promoting Nature Restoration Projects
- 2013 River Cooperation Organization System (people's participant)



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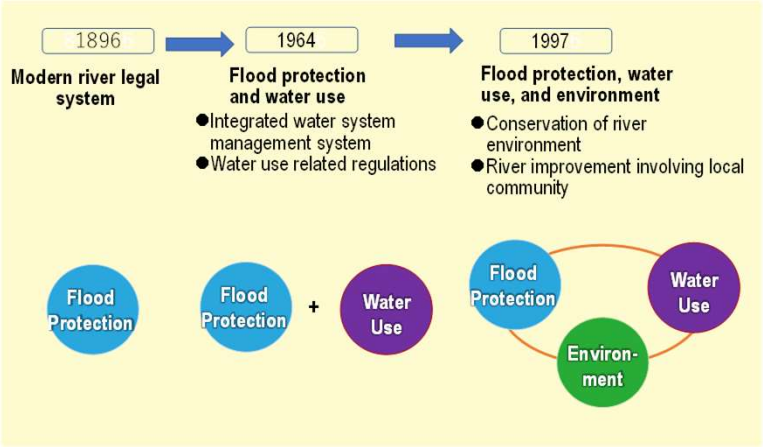
# 5. River Environmental Management

## (2) Revision of the River Law




Source: New developments in river environment administration, MLIT

History of River Law Revision



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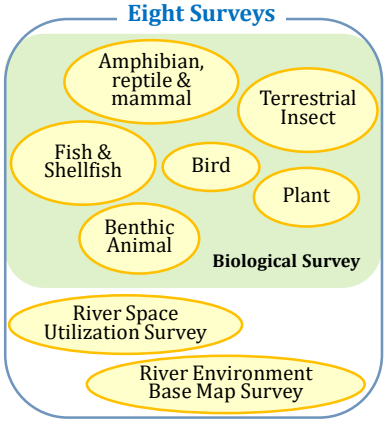
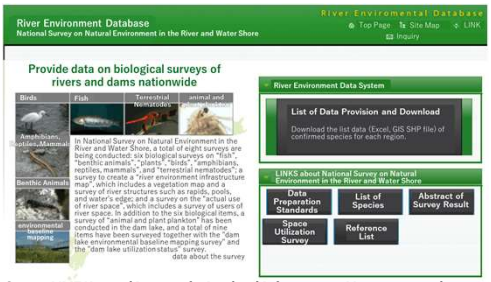
# 5. River Environmental Management

## (3) River Environment Survey

National Survey on Natural Environment in the River and Water Shore




- Results made public as a database
- Used for river development and maintenance plan study




Source: MLIT National Institute for Land and Infrastructure Management website



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# 5. River Environmental Management

## (4) Plan to Manage the River Environment

Tama River Environmental Management Plan – Space Management

A. Development Improvement Zone
Developments such as sports facilities and recreational facilities will be actively provided.
B. Facility Utilization Zone
A zone primarily for development, but also for educational facilities.
C. Improvement and Nature Zone
A zone used half for development and half for nature-oriented purposes.
D. Nature Utilization Zone
A zone primarily for nature-oriented facilities, but with some development also included.
E. Nature Preservation Zone
A zone for preserving natural ecosystems. Facilities for active use by humans will not, in principle, be constructed.




Source: Guidebook to the Plan to Manage the Natural Environment of the Tama River, MLIT, March 2002



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# 5. River Environmental Management

## (4) Plan to Manage the River Environment

Tama River Environmental Management Plan –Water Surface Management

**Waterside Spaces**

**1) Waterside Activities Space**

The waterside zone is located adjacent to area designated as 2)local facility-based recreational spaces, 3)regional facility-based recreational spaces, and 4)sports and health promotion spaces, where people can safely fish, play in the water, and so on

**2) Waterside Nature Utilization Space**

This zone is located adjacent to areas designated as 5)nature-oriented recreational spaces, 6)educational spaces, and 7)sensitivity development spaces, where people can safely observe nature and go on nature walks.

**3) Waterside Nature Preservation Space**

This zone is located adjacent to areas designated as 8)ecosystem preservation spaces, where a sound natural environment is protected to sustain plant and animal habitants.

Source: Guidebook to the Plan to Manage the Natural Environment of the Tama River, MLIT, March 2002



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# 5. River Environmental Management

## (5) Management of River Water Quality

River Law (1964)

- Maintaining and improving water quality by diluting or purifying wastewater and preventing saltwater intrusion,
- Maintaining river channels and prevention of blockage of river mouth,
- Maintaining water level for water intake and navigation, and
- Growth and breeding of aquatic animals and plants.

River Water Purification Methods

- Purification using gravel
- Purification using rapids and pools
- Thin laminar flow purification method
- Vegetation purification method



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# 5. River Environmental Management

## (5) Management of River Water Quality

Sumida River Water Quality Improvement

- In 1940, chemical plants and dyeing factories increased. BOD increased to 5-10 mg/l.
- By 1952, the river became so polluted that fish could no longer thrive.
- Toxic gases and malodors caused mild coughing, red eyes, loss of appetite and headaches in peoples living nearby.

Efforts to improve water quality through legislation

- Sewerage system development
- Pipeline from the Tone River via the Arakawa River to secure the water supply, and as diluted water to purify the Sumida River.
- Dredging since 1958 which continues to this day.



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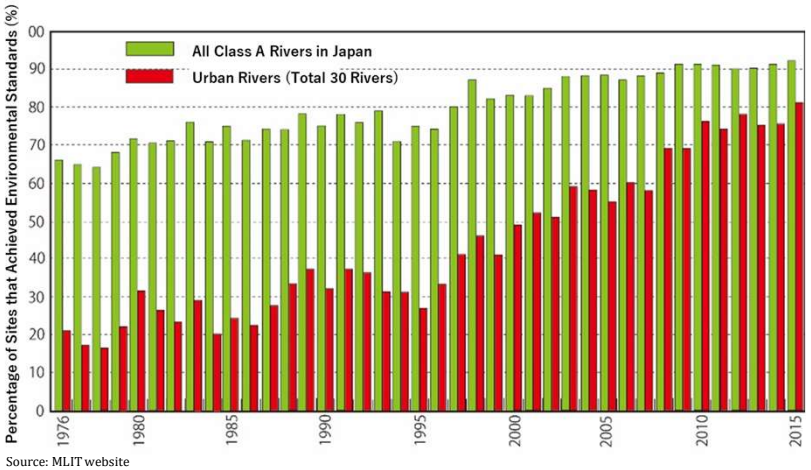
# 5. River Environmental Management

## (6) Efforts to Improve Water Quality in Urban Rivers




Source: MLIT website

**Achievement Percentage of Environmental Standards in Class A Rivers and Urban Rivers**



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# 5. River Environmental Management

## (6) Efforts to Improve Water Quality in Urban Rivers

Clean Stream Renaissance 21 (1993) and the stage 2 (2001)

- Water quality improvement goals by local governments, river management offices (RMOs), sewerage offices, and related organizations.
- Water quality improvement targets according to condition of each river.



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# 5. River Environmental Management

## (7) Water Quality Improvement in Ayase River

- The dirtiest river in Japan since 1980s for 15 years.
- Collaboration with local communities, no longer the worst in 2000.

**1973**

Source: MLIT Edogawa River Office Website

**2021**


Source: Edogawa River Office Website

**Collaboration & Education with Local Residents**



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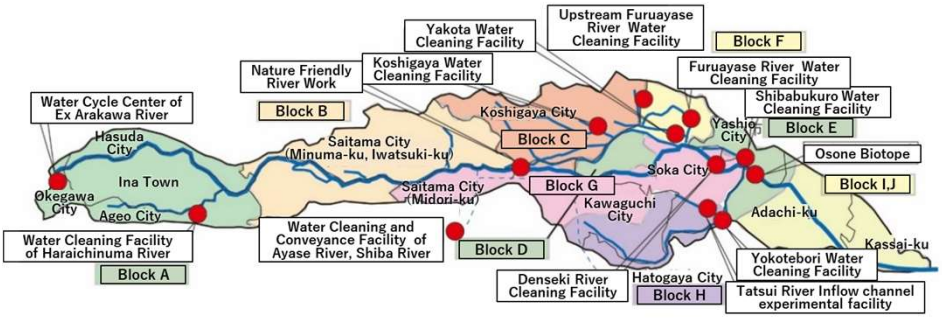
# 5. River Environmental Management

## (7) Water Quality Improvement in Ayase River

- Divide the river basin into 10 blocks to plan and implement measures respectively for improving water quality according to the standard.




Source: Based on MLIT Edogawa River Office Website; and Ayase River Seiryu Renaissance II Annual Report 2011, Ayase River Seiryu Renaissance II Regional Council, November 2011

**Countermeasures by Blocks in the Ayase River Basin**



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# 5. River Environmental Management

## (8) Nature-Friendly River Work

Public needs for restoring natural environment in early 1990s

"Nature-Friendly River Works" Initiative by MLIT

- "Nature-friendly River Works" initiative (MLIT, 1990)
- "Basic Guidelines for Creating Nature-friendly Rivers" (2006)
- "Technical Standards for River Channel Planning for Small and Medium Rivers" (2008)


Source: MLIT

**Nature-Friendly River Works (Before and After Construction)**



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# 5. River Environmental Management

## (9) Use of Traditional Construction Methods

- Nature-friendly materials that blend in with surroundings
- Highly adaptable to waterfront topography

**Seigyu (water control)**
Source: Kofu Rivers and National Highways Office website

**Fascine Mattress (erosion control)**
Source: Shinano River Downstream Office website



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# 5. River Environmental Management

## (9) Use of Traditional Construction Methods

Source: Hokkaido Development Bureau website

**Riparian Forest (flow control)**



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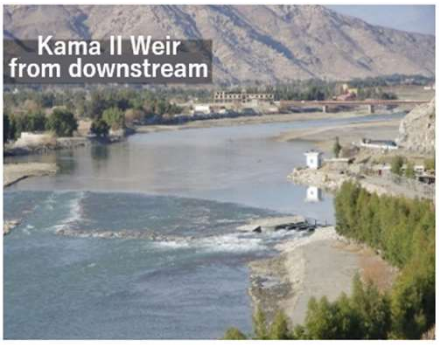
# 5. River Environmental Management

## (9) Use of Traditional Construction Methods

- Weir using traditional construction method and apply to overseas.




**Kama II Weir (Afghanistan)**

**Yamada Weir (Japan)**

Source: Peshawar Association website, Provided by Asakura City



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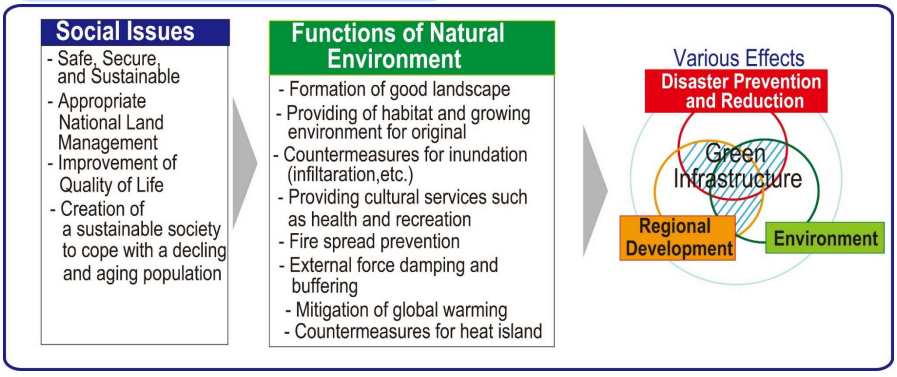
# 5. River Environmental Management

## (10) Green Infrastructure Initiatives

- Disaster management
- Environmental improvement
- Regions' attractiveness
- Carbon-neutral society




Source: Green Infrastructure Portal Site, MLIT



**Green Infrastructure**



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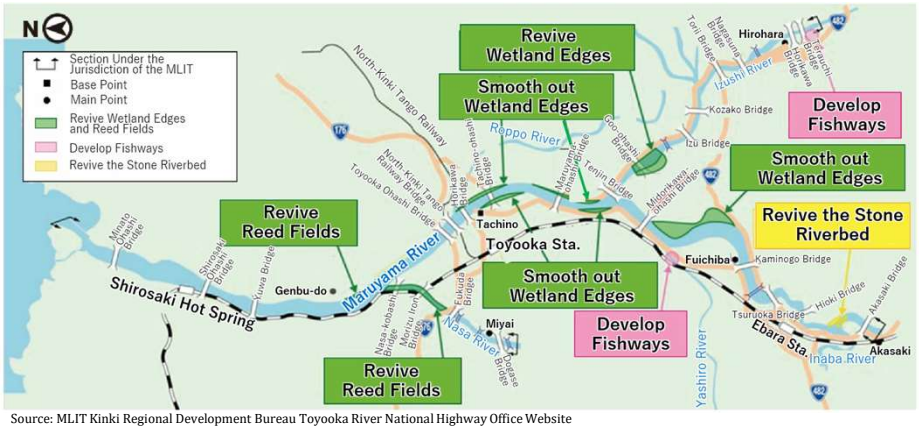
# 5. River Environmental Management

## (11) Efforts in Maruyama River

- Ecological network based on the river formed in cooperation with local community.




Source: MLIT Kinki Regional Development Bureau Toyooka River National Highway Office Website

**Efforts in Maruyama River**

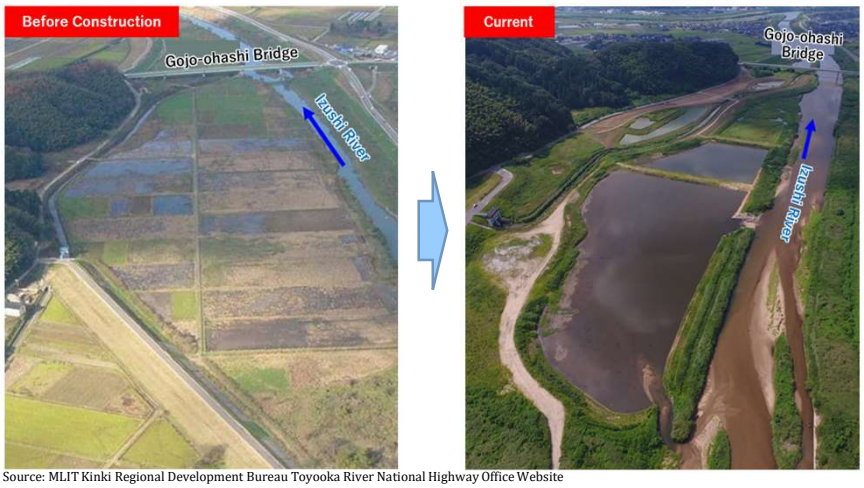






# 5. River Environmental Management

## (11) Efforts in Maruyama River

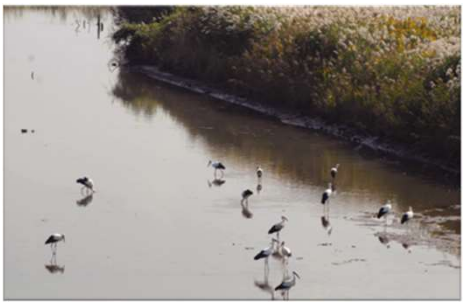



Source: MLIT Kinki Regional Development Bureau Toyooka River National Highway Office Website

**Wetlands revived in Kayo area**

# 5. River Environmental Management

## (11) Efforts in Maruyama River



Source: MLIT Kinki Regional Development Bureau Toyooka River National Highway Office Website

**Ecological survey with children**

**Stocks feeding in the wetlands**



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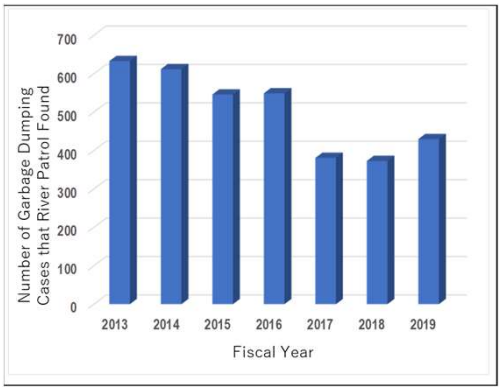
# 5. River Environmental Management

## (12) Measures against Illegal Dumping of Waste

- River administrators work with NPOs & local governments for "trash pickup" activities, daily river patrols, reporting illegal dumping to police & public relations.




Source: Created based on the Arakawa-Karyu River Office website

**Number of Garbage Dumping Cases in Lower Reaches of Arakawa River**



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## 6. Lessons Learned (1)

(1) Establishing a legal system and enforcement mechanisms can regulate adverse environmental effects.

Water pollution affects human health and lives and may destroy ecosystems and the environment. In Japan, government policies prioritizing economic growth resulted in the emergence and spread of disastrous pollution-related diseases. During the high economic growth, water pollution caused by effluents from factories led to the outbreak of pollution-related diseases, such as Minamata and Itai-itai, affecting tens of thousands of people. The legal systems and local government ordinances cover water quality standards, monitoring, and penalties. Local governments can conduct on-site inspections of factories and impose on penalty for illegal actions.

(2) Pesticide use should be regulated as they deteriorate the quality of river water and groundwater.

In Japan, various standards have been established to regulate pesticide use. The permissible pesticides should also be registered, and crops for which the pesticides can be used, the time when they can be used, and the permissible amount for use are specified.



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## 6. Lessons Learned (2)

(3) Domestic wastewater should be treated to achieve quality that meets the standard values.

In Japan, local governments have formulated basic plans to develop basin-wide sewage systems. Treatment methods can be optimized by the conventional sewerage system and Johksou, on-site treatment facility at the household level, taking into account the population density, topographic conditions, and economic efficiency.

(4) For closed water bodies such as lakes and marshes, more stringent measures are essential for preserving water quality.

In lakes, marshes, inland bays, land-locked seas, and other closed water areas, improving water quality is difficult once deteriorated. There are two types of pollution loads: point and non-point sources. For the latter, improvement measures are required over large areas because the discharge points of pollutants are difficult to be identified. The act was enacted, followed by the setting of long-term targets, formulation of short-term plans, and implementation of water quality improvement for lakes and marshes in Japan.



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# 6. Lessons Learned (3)

(5) Green infrastructure can contribute to the creation of a carbon-neutral society and resolution of various social issues.

Green Infrastructure or nature-based solutions, which utilize the diverse environmental functions, highlight the region's attractiveness based on the river's characteristics, local nature, and culture as well as mitigating disaster damage. In Japan, the River Law was revised to make the environment an internal objective for river improvement projects.

# Theme 5
# Urban Water Management
## Integrated Response to Complex Problems



1



# Contents





2

# 1. Introduction

## What is urban water management?

- Solving water-related problems such as flood damage, tight water supply, and deterioration of environment, which are becoming more serious due to urbanization, via strengthening governance with various related organizations and stakeholders, and implementing structural and non-structural measures based on scientific grounds.

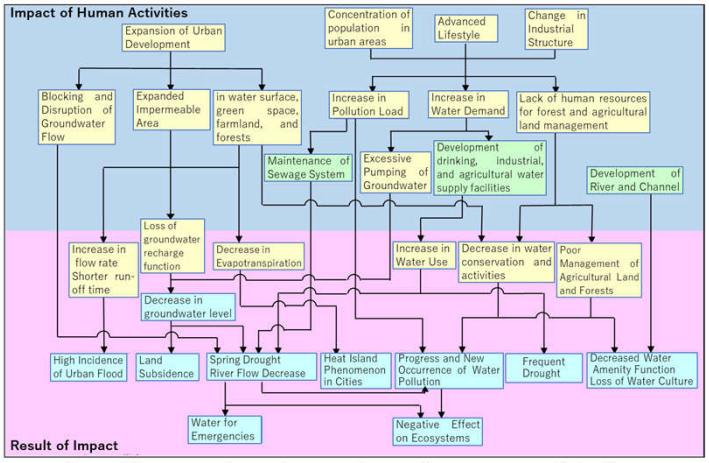






# 2. Water Cycle in Urban Area

## Impacts of Human Activities on the Water Cycle

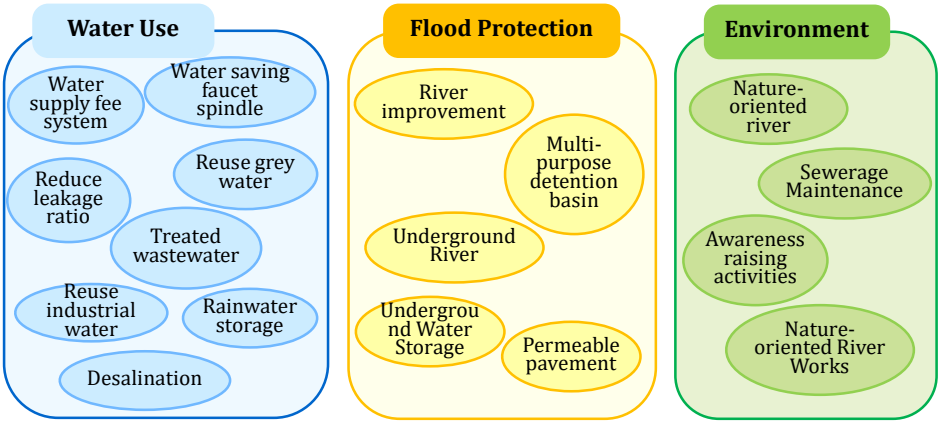



Source: "Toward the Creation of a Sound Water Cycle System", Liaison meeting of related ministries and agencies regarding the development of a healthy water environment, October 2003

**Impacts of Human Activities on the Water Cycle**

# 2. Water Cycle in Urban Area

## Measures to address Problems related to Water Sources



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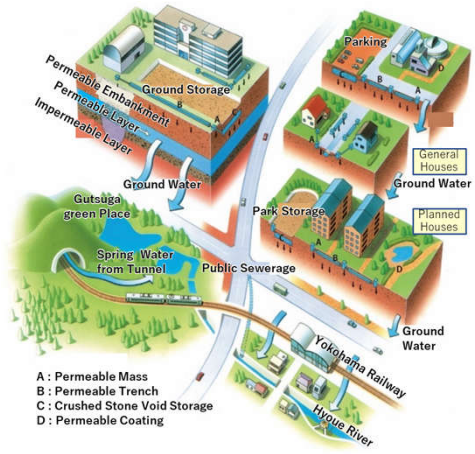
# 2. Water Cycle in Urban Area

## Development of Hachioji Minamino City




Source: UR x Green Infrastructure Case Studies UR Agency

**Hachioji Minamino City Water Cycle Regeneration System**

Flood peak discharge reduced by 20~40%

Drought discharge increased by 1.5 ~ 2 times



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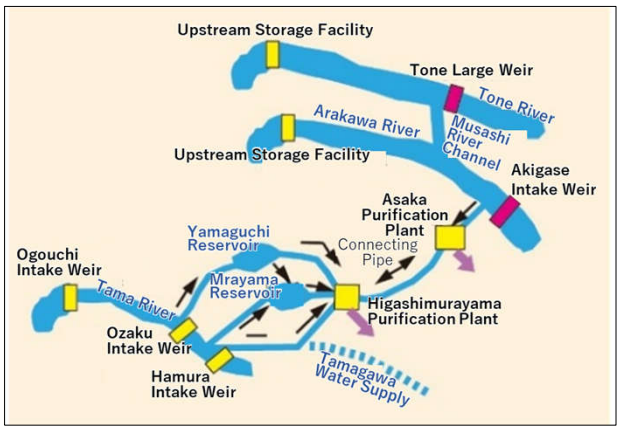
# 3. Water Utilization Efforts

## (1) Controlling Water Use




Source: Tokyo Metropolitan Government Bureau of Waterworks website

**Wide-area Water Resources Utilization**

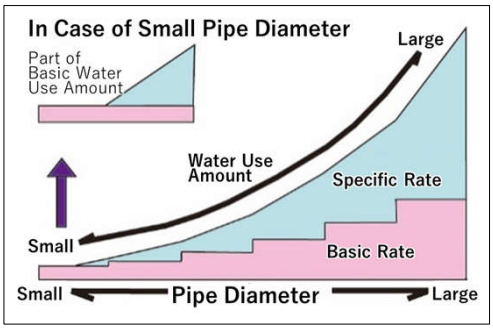






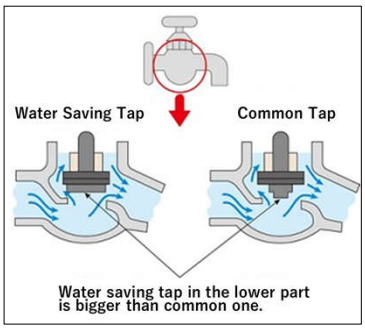
# 3. Water Utilization Efforts

## (1) Controlling Water Use




Source: PRT

**Two-part Tariff System**

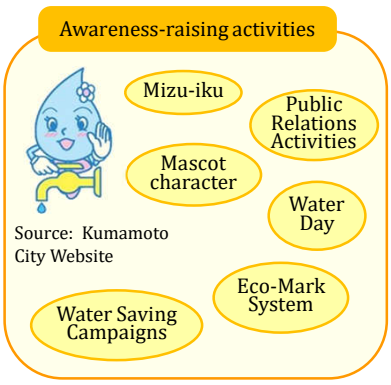



Source: Tokyo Metropolitan Government, Bureau of Waterworks

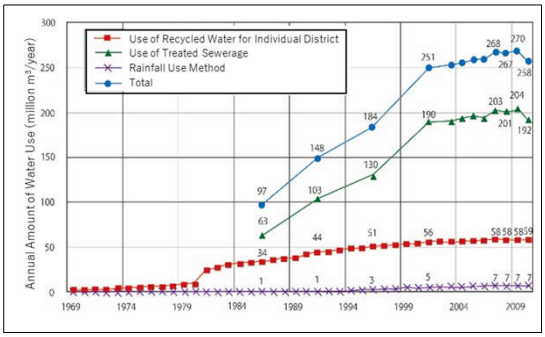
**Water Saving Tap**

# 3. Water Utilization Efforts

## (1) Controlling Water Use




Source: Kumamoto City Website




Source: Japan's Water Resources (2013), MLIT

**Trends in Rainwater and Recycled Water Use**



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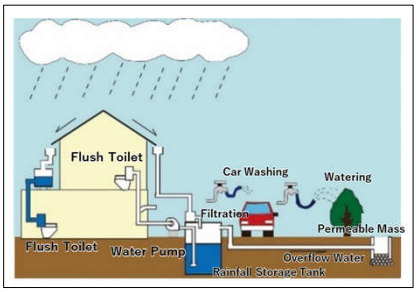
# 3. Water Utilization Efforts

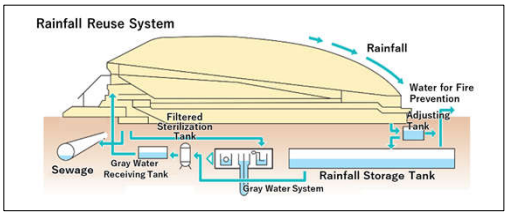
## (1) Controlling Water Use

### Using Miscellaneous Water




Source: Sumida Ward Website

**Rainwater Reuse**




Source: Rainwater Use Case Studies, MLIT

**Rainwater Use at Tokyo Dome**

- Underground storage tank (3,000 $m^3$)
- Toilet flushing, firefighting
- 30% rainwater utilization rate

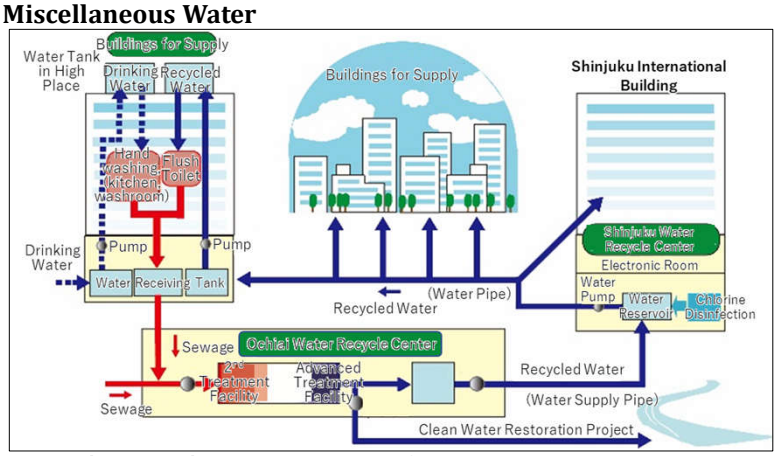


10

# 3. Water Utilization Efforts

## (1) Controlling Water Use

**Using Miscellaneous Water**




Source: Tokyo Metropolitan Government Bureau of Sewerage

**Recycled Water Supply System (Nishi-Shinjuku and Nakano-Sakaue Area)**

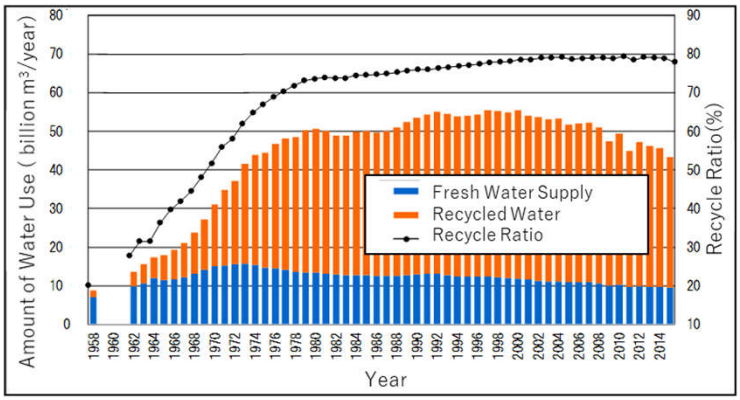






# 3. Water Utilization Efforts

## (1) Controlling Water Use

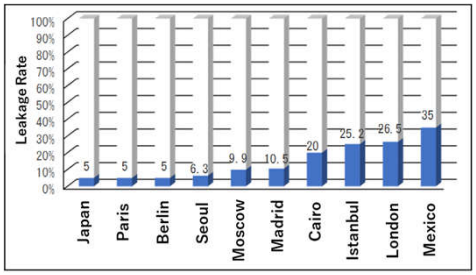



Source: Statistics from the Ministry of Economy, Trade and Industry

**Changes in Industrial Water Usage**

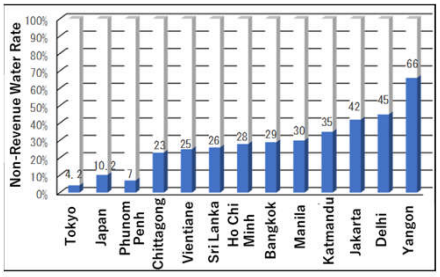
# 3. Water Utilization Efforts

## (2) Improvement in Leakage in Water Supply




Source: Japan's Approach to Global Water Problems (2012),, House of Representatives Research Office, Legislation and Survey No. 332

**Leakage Ratio in World's Major Cities**




Source: Tokyo: Japan Water Research Center (Public Interest Incorporated Foundation), Water Services Hot News No. 543, December 16, 2016

**Comparison of Non-Revenue Water Ratio in Cities in Japan and Developing Counties**





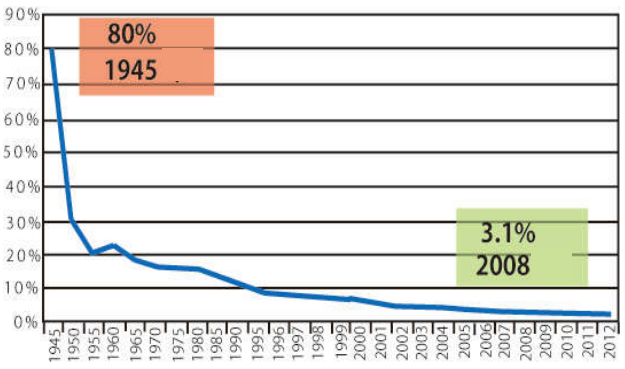


# 3. Water Utilization Efforts

## (2) Improvement in Leakage in Water Supply

**Prevent leakage by:**

- Setting specific goals to reduce the leakage rate
- Formulate a comprehensive plan that is feasible & effective in medium to long term




Source: Experience of Japanese Water Supply Projects Created based on JICA

**Leakage Ratio in Tokyo**

# 3. Water Utilization Efforts

## (3) Utilization of Non-conventional Water Resources

Countries & regions with scare water resources -> **desalination** is viable option

**Cost**
- For 10,000 $m^3$/day capacity or more:
- Construction cost: 100-200 1000 yen per 1$m^3$/day
- Production cost: 100~150 yen /$m^3$

**Japan:**
- 682 desalination plants
- 60% industrial use, and rest 219 for consumer use mainly on small islands





# 4. Flood Protection Efforts

## (1) Implementation of Comprehensive Flood Protection

During period of high economic growth, urban planning was done without considering flood risks

- Increased surface runoff
- Degradation of water retention capacity & natural spring

**Increase in flood damages**

- Flooding: runoff volume exceeding sewerage system capacity
- 17.6 billion yen flooding damage in 10 years in Tokyo
- 42.9 billion yen inundation damage

Inundation damage account for 71% of total damage

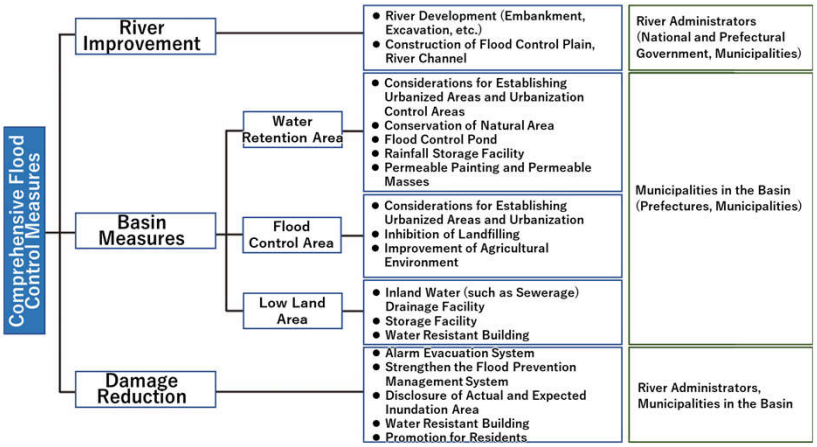
**Comprehensive Flood Protection Measure**

Act on Countermeasures against Flood Damage of Specified Rivers running across Cities

# 4. Flood Protection Efforts

## (1) Implementation of Comprehensive Flood Protection

"Promotion of Comprehensive Flood Protection Measure" in 17 rivers (1980)




Source: Toward the creation of a plan of a sound water cycle system, Liaison meeting of related ministries and agencies regarding development of a healthy water environment, October 2003

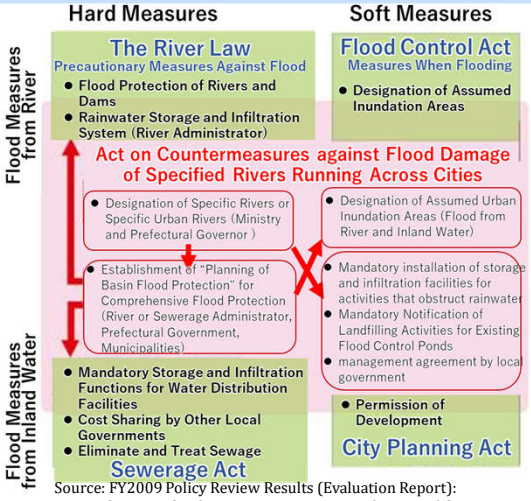






# 4. Flood Protection Efforts

## (1) Implementation of Comprehensive Flood Protection




Source: FY2009 Policy Review Results (Evaluation Report): Comprehensive Flood Countermeasures – Verification of the Implementation Status of the Act on Countermeasures against Flood Damage of Specified Rivers Running across Cities, MLIT (March 2010)

# 4. Flood Protection Efforts

## (1) Implementation of Comprehensive Flood Protection

Wastewater measures through Sewerage

**2007 Report**
- Construction of rainwater drainage pipes
- Pumping stations
- Rainwater storage pipes
- Development of inundation damage maps

**Law on the Promotion of Rain Water Usage (2014)**
Control concentrated outflow into sewer & rivers by temporarily storing rainwater

**"Flood Damage Control Area" system (2015)**
- PPP and private sector redevelopment
- Government provide financial support
- Local government manage facilities

2018: only 59% of Tokyo's sewerage system can handle 5-year rainfalls







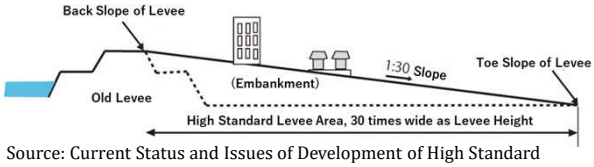
# 4. Flood Protection Efforts

## (2) River Improvement in Urban Areas

Source: MLIT Shinano River Downstream Office Website

Source: MLIT Website

**Hydrophilic Revetment**




Source: Current Status and Issues of Development of High Standard Levees, Nobuhiro Yamashita, Research and Legislative Reference Bureau, National Diet Library, Reference No.831 (April )

**High Standard Levee Concept Diagram**

Overtop

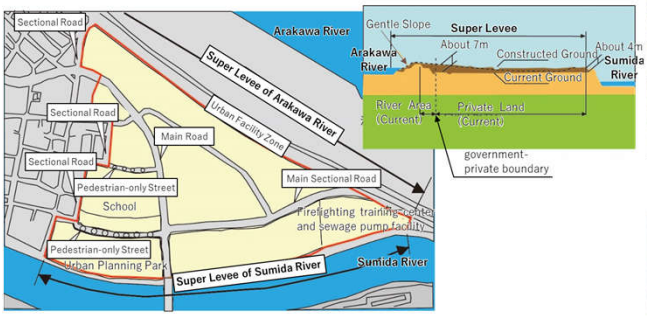
Infiltration

Earthquake

Source: MLIT Website

# 4. Flood Protection Efforts

## (2) River Improvement in Urban Areas




Source: UR x Green Infrastructure Case Studies with addition by the Project Research Team

**Heart Island SHINDEN**

Walkway along Arakawa River

Urban Planning Park







# 4. Flood Protection Efforts

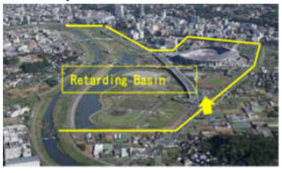
## (3) Retarding Basin, Regulation Ponds and Underground Diversion Tunnel

Effective for temporarily storing flood water

- Integrated joint project to utilize space & reduce costs
- 50% land ownership UR, 50% Shinjuku/Nakano wards
- Tokyo Gov. uses entire area as regulating pond, covers related implementation and O&M costs

Source: Myoshoji River No. 1 Regulating Pond pamphlet, Tokyo Metropolitan Government

**Myoshoji River No.1 Adjustment Pond**




Source: Tsurumi River Multipurpose Retarding Basin Pamphlet (edited)

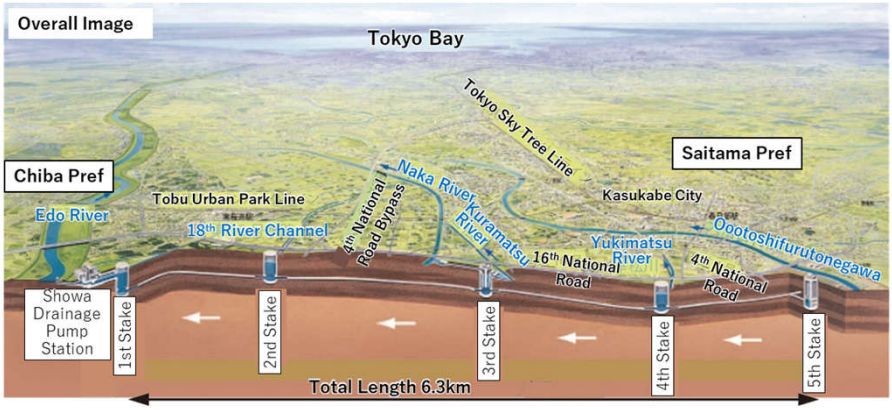
**Tsurumi River Multipurpose Retarding Basin**

Source: MLIT Keihin River Office Facebook

**During flood event**

# 4. Flood Protection Efforts

## (3) Retarding Basin, Regulation Ponds and Underground Diversion Tunnel




Source: MLIT Edogawa River Office Website

**Overall Image of the Metropolitan Ara Outer Discharge Tunnel**







# 5. Improving Water Environment

## (1) Sewerage Improvement & (2) Development of Green Infrastructure

Before construction: plank hurdle revetment

Renovation: Gabion revetment

13 years: Natural connection between slope & river

Source: Nature-oriented River Management Reference Book, Riverfront Research Center

Source: Yokohama City Website

**Umeda River**

# 5. Improving the Water Environment

## (1) Sewerage Improvement & (2) Development of Green Infrastructure

before



after

**Frequently used for environmental studies by children**

Source: River Law Amendment 20 Years Nature-friendly River Management Promotion Committee, 1st Pamphlet: Specific Examples of Nature-friendly River Management (No. 1), MLIT

**Kamisaigo River**

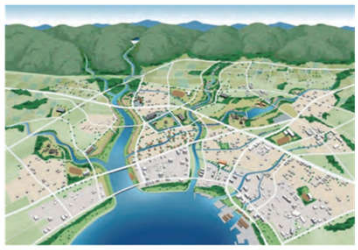






# 5. Improving Water Environment

## (3) Use of Waterfront for Tourism



Canoe, SUP

Cycling

Urban Area Development

Tourism & Transport Boat

Riverbed

Camp, BBQ

Open Cafe

Walking, Jogging

Event (Art, Screening)

Cherry Blossom Road

River Safety Lessons

Study and Experience of Natural Environment

Collaboration with Neighboring Facilities (Park, Roadside Station)

Customer Attracting Facility

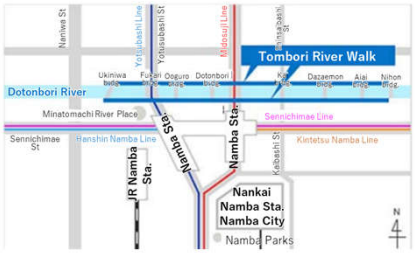
Marche, Morning and Night Market

Park Field

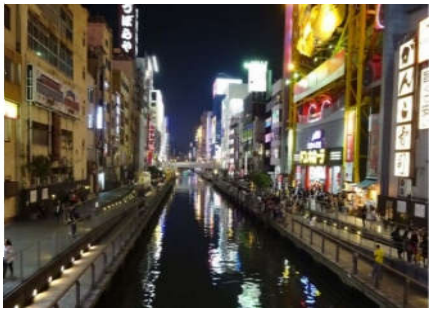
Source: Guide for Formulating a River-Town Development Plan, 1st Edition, MLIT, March 2020

# 5. Improving Water Environment

## (3) Use of Waterfront for Tourism




Source: MLIT Material



**Dotonbori River**

**River-Town Planning**
**"Kawamachi Zukuri"**
New values and characteristics unique to the region are created

- Help revitalize the community
- Improve local brand
- Opportunities for local interaction
- Tourism promotion







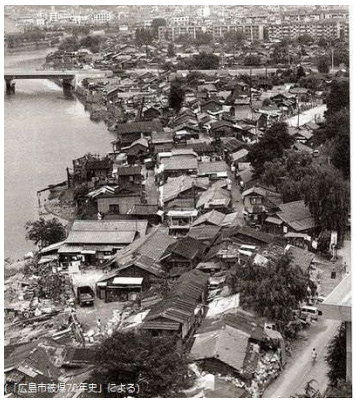
# 5. Improving Water Environment

## (4) Response to the Urban Poor in the River Area

**Post-World War II**
**"Atomic Bomb Slums"**
Many people (victims & repatriates) living in barracks build on riverside

**Coping with Housing Shortage**

- 4500 high-rise housing constructed
- Parks & riverside spaces secured



Source: 70th Anniversary of Hiroshima Atomic Bombing

**Atomic Bomb Slum in Hiroshima**

# 5. Improving Water Environment

## (4) Response to the Urban Poor in the River Area

**Current Residents Living in High Water Channel Area**

- Cases where the homeless have built temporary huts & settled down on flood water channel area of rivers
- In Arakawa, patrols are conducted to provide guidance to the people

before

after

Source: Efforts to respond to homelessness in the lower Arakawa River, Arakawa River Office, Onagi River Sub-branch, Ooyama Takeshi, MLIT Material

**Approach to the Homeless in the Arakawa River**







# 6. Lessons Learned (1)

(1) To ensure coexistence with the environment and resolve various urban related issues, the water cycle should be restored.

The concentration of urban population, expansion of urban areas, and increase in socioeconomic activities have caused deterioration of the water cycle in urban areas. These affect various areas in terms of the quality and quantity of water, the riparian environment, and groundwater. Organizations were concerned about the need to collaborate to restore the water cycle.

(2) To cope with water demand due to the influx of the population into urban areas, water demand management and water recycling should be promoted.

Water demand could be managed by tariff systems and other software measures. The reduction of water leakage and use of rainwater and recycled water should be promoted. A review of the production process and recycling water is also required for industrial water supply.

## 8. Lessons Learned (2)

(3) To mitigate the flood damage in urban areas, comprehensive measures should be taken.

Urbanization caused a decline in water retention capacity and an increase in peak flood discharge. Flood risk is increased by climate change. Thus, integrated approaches to improve river facilities, river basins, and flood damage mitigation should be undertaken. Cooperation among related organizations should also be consolidated.

(4) To conduct efficient development, the private sector's expertise should be utilized.

For example, parks and piloti-type housing complexes were developed above regulation ponds to store floodwaters in Tokyo. The government organizations provided incentives to the private sector. This has enabled the effective use of expensive land in urban areas.







## 8. Lessons Learned (3)

(5) To improve the water environment, multiple approaches should be taken in terms of water quality, discharge, ecosystems, and recreation.

A decline in water quality during high economic growth in Japan has resulted in ecosystem deterioration, and residents have avoided access to rivers. Various efforts to improve the water environment have been implemented to integrate "river space" and "town space," improve the waterfront environment, and conserve the ecosystem. Flood protection facilities have also contributed to urban development by providing recreational functions. Involving the local community and private organizations in implementing these initiatives was necessary. This collaboration led to the creation of a good space uniting the "river" and "town," which promoted tourism and rejuvenated the area.

# 8. Lessons Learned (4)

(6) Developing green infrastructure can achieve multiple benefits.

Flood protection works contribute to achieving various objectives using natural functions. These objectives include disaster management, improvement of the living environment and waterfront, conservation of ecosystems, promotion of regional development, and mitigation of climate change.

(7) To improve issues of the urban poor in rivers public housing should be provided with river improvement works.

There were many slum areas along rivers in urban areas in Japan during post-WWII periods. Japan resolved these problems by providing affordable public housing for the urban poor with implementing flood protection works.

# Theme 6
# River Management
## Managing Land and Water Sustainability




1



# Contents





2

# 1. Introduction

Source: Project Research Team

Houses built along river course. These have high risks of flood damage on one hand and hinder the river capacity to carry flood flows on the other hand.



3

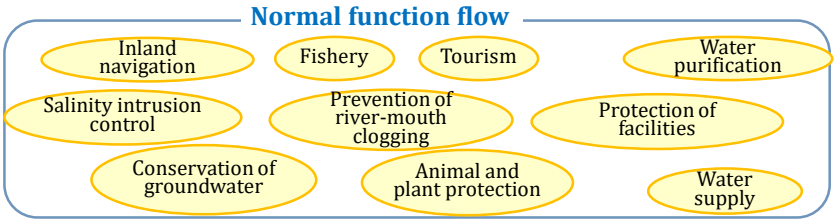


# 2. Purpose of River Management and Management Entity

## (1) Purpose and Administration

In Japan, the purpose of river management is to maintain and improve rivers in an appropriate condition from a wide range of perspectives.

- **Flood Protection**: Prevent disasters caused by floods, tsunamis, storm surges, etc.
- **Use of River**: Use rivers properly and maintain normal function of flowing water.



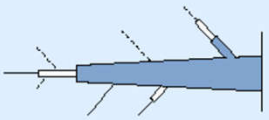
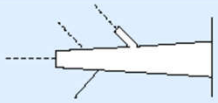
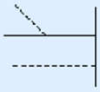

- **River Environment**: Conserve the river environment.



4

# 2. Purpose of River Management and Management Entity

## (1) Purpose and Administration

| River System | Schematic Diagram | River Classification | Administrator |
|---|---|---|---|
| Class A River System |  | Class A River System Section Directly Administered by MLIT | Minister of MLIT |
| | | Designated Sections | Prefectural Governor |
| | | Provisional Class River | Head of Municipality |
| | | Ordinary Rivers | Local Public Organizations |
| Class B River System |  | Class B River | Prefectural Governor |
| | | Provisional Class River | Head of Municipality |
| | | Ordinary Rivers | Local Public Organizations |
| Independent River System |  | Provisional Class River | Head of Municipality |
| | | Ordinary Rivers | Local Public Organizations |

Source: Website of Yamato River Office, Kinki Regional Development Bureau, MLIT

**River Management Classification**



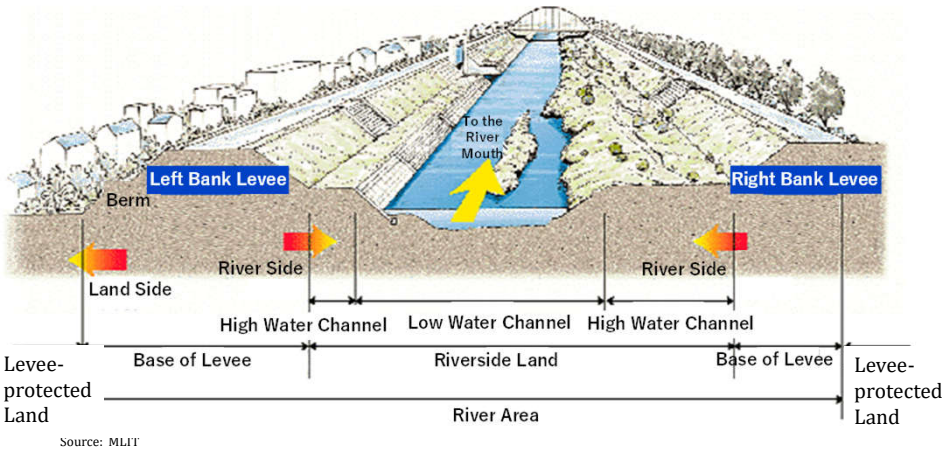
5



# 2. Purpose of River Management and Management Entity

## (2) Regulations on River Use

1) River Areas




Source: MLIT

**River Area**



6

## 2. Purpose of River Management and Management Entity

### (2) Regulations on River Use

1) River Areas

The River Area is defined as where:
1) river water flows continuously;
2) river management facilities are situated;
3) the land for managing integrally with these areas.

- Permission from the River Administrator is required for certain actions within the River Area.
- The River Administrator in Japan is Minister of MLIT for Class A rivers and Prefecture Governors for Class B rivers.
- The RMOs undertake the river management.







## 2. Purpose of River Management and Management Entity

### (2) Regulations on River Use

2) Actions Requiring Permission

a. New acquisition, change and renewal of water use (occupation of flowing water);
b. Exclusive and continuous use of the river area (occupation of land);
c. Collection of river products such as gravel and wood;
d. Construction and reconstruction of structures such as bridge and weir;
e. Excavation of land;
f. River flow transportation of timbers and passage through navigation lock.

## 2. Purpose of River Management and Management Entity

### (2) Regulations on River Use

3) Occupation of Land in the River Area

**Authorized Occupation Activities**

- Roads
- Railway
- Infrastructure such as water supply and sewerage pipes, power transmission lines, gas pipelines
- Welfare facilities such as parks and green spaces, golf courses
- Sites for flood protection facilities

Source: Landscape, General Incorporated Association

**River Space provided to the public (Kano River)**







## 2. Purpose of River Management and Management Entity

### (2) Regulations on River Use

4) Products in River

Source: ISHIGAMIJARI LLC.

**Gravel Mining**

## 2. Purpose of River Management and Management Entity

### (2) Regulations on River Use

5) Penalty and Enforcement

Source: Keihin River Office, Kanto Regional Development Bureau, MLIT

**Removal of Illegally Moored Vessels**







## 2. Purpose of River Management and Management Entity

### (3) Management of River Structure

1) River Management Facilities

Source: Fukushima Office of Rivers and National Highways, Tohoku Regional Development Bureau, MLIT

River Management Facilities:

- Dam
- Weir
- Sluice gate
- Levee
- Bank protection
- Groundsill
- Riverine buffer zone

**Example of Riverine Buffer Zone as Green Belt**

## 2. Purpose of River Management and Management Entity

### (3) Management of River Structure

2) Permitted Structure

- Organizations must obtain permission from the RMO for construction/reconstruction of structures such as bridges and weirs.
- The RMO examines the appropriateness of purpose, technical feasibility, effects/impacts on flood protection, water use and river environment.
- The structures should comply with technical criteria and standards.
- These structures can be used only when it passes the inspection by the RMO.
- The River Law includes "Special Provisions" for Dams to meet strict requirements (Theme 8 Dam Management).







## 2. Purpose of River Management and Management Entity

### (3) Management of River Structure

3) Maintenance

Stipulated in the River Law

River Administrator should maintain and repair the river management facilities to keep these in sound conditions.

Officials of the River Administrators (branch offices of national government and civil engineering offices of prefecture governments) should routinely monitor the River Areas for unusual situation and illegal river use.

## 2. Purpose of River Management and Management Entity

### (4) Disaster Management

**Flood Risk**

**When flood is expected to occur**, the **RMO** should:

- set up an alert team and conduct flood-fighting measures;
- announce flood forecast in cooperation with the Meteorological Agency;
- notify the relevant organizations , if the Danger Water Level is exceeded.

**Extraordinary Drought**

**In the event of extraordinary drought:**

- Information should be provided to water users to promote mutual coordination among all relevant users.
- If discussions are not converging, necessary mediation should be conducted.





## 2. Purpose of River Management and Management Entity

### (5) Collaboration with Private Sector

Collaboration with the local community is prerequisite for the river management.

**Activities of River Collaboration Organizations**

Source: MLIT

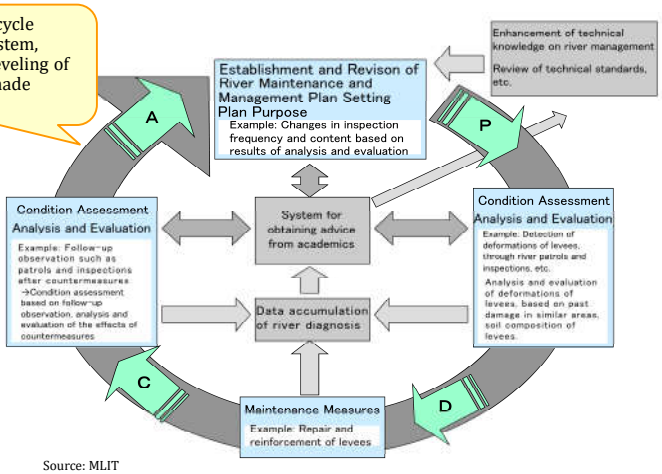
**Joint cleaning of channels**

**Fish investigation**

# 3. New Initiatives

## (1) Extending Lifetime of River Management Facilities

With the PDCA cycle maintenance system, reduction and leveling of total costs are made possible




Source: MLIT

**Cycle Maintenance and Management System**







# 3. New Initiatives

## (2) Collaboration with Relevant Offices

1) Comprehensive Sediment Management Plan


Source: Chubu Regional Development Bureau, MLIT

**Comprehensive Sediment Management Plan for Hino River Erosion Control and Afforestation**

# 8. Lessons Learned (1)

(1) The mechanisms of managing rivers need to be established.

In Japan, the RMO designates river areas that regulate various activities; organizations must obtain permission from the RMO to construct structures and conduct activities. As river water is a public good, water users require RMO permissions; the RMO formulated technical guidelines and standards detailing the permissions process. In Japan, when the prefectural government carried out river management, it was difficult to solve conflicts between upstream and downstream or left and right riverbanks. In response, the management responsibility was altered such that the national government manages major rivers, which is particularly useful for rivers flowing through multiple prefectures.







# 8. Lessons Learned (2)

(2) River management should adapt to changing social conditions.

As river management becomes more complex with societal development, management goals should be established flexibly. The unique natural conditions in Japan have meant flood protection has consistently been the main focus of river management. The country needs to adapt to effects caused by climate change. Also, sediment management, quality of structure, and leisure activities became more important issues. Restoration of nature requires a long time, and in the worst case, it may be irreversible.

(3) Systematic maintenance is required to ensure long-term quality of river structures.

Systematic maintenance is essentially required to ensure the quality of structures. Therefore, inspections, maintenance, and repairs must be continued at the operation and maintenance stages. These activities extend the longevity of river structures. The use of ICT may also prove to be effective for economic and efficient maintenance.

# 8. Lessons Learned (3)

(4) Climate change and environmental problems should be addressed through cooperation with communities and inter-governmental coordination.

The frequency and severity of large-scale floods and droughts are increasing worldwide due to climate change. These issues cannot be dealt with solely through using facilities, and river conservation cannot be conducted by the RMO alone. Cooperation with local communities and inter-governmental coordination are essential to cope with these issues; as such, a relevant mechanism should be established.

# Theme 7
# Groundwater Management
## Secure Alternative Water Sources along with Regulations



1



# Contents





2

# 1. Introduction

Source: Tokyo Metropolitan Government, Bureau of Environmental Website

Zero Meter Area alongside Arakawa River

Source: JICA

Zero Meter Area in Jakarta, Indonesia

**Land Subsidence**



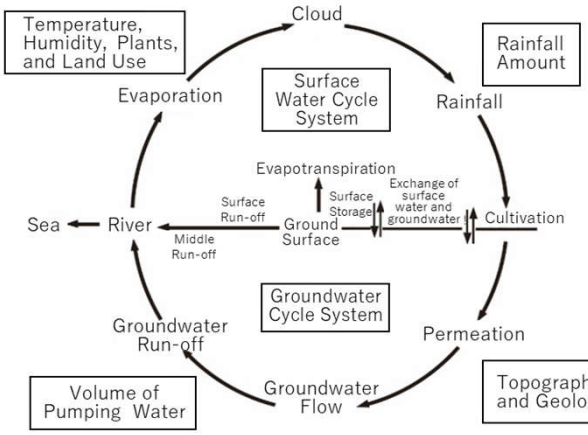




# 2. Groundwater Use

## (1) Current Status of Groundwater Use in Japan

1) Groundwater in the Water Cycle



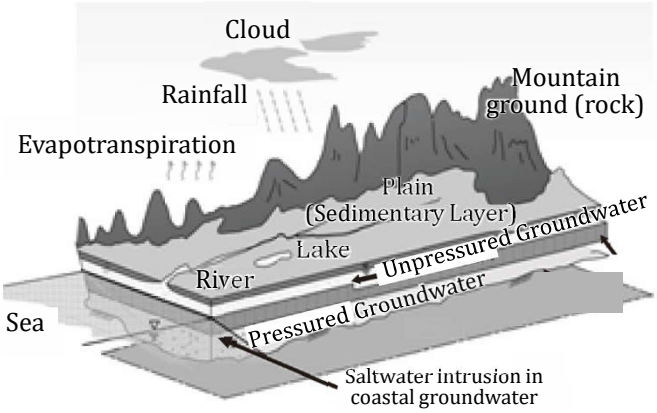

Source: Toward the Conservation and Sound Use of Groundwater, Advisory Group on Future Groundwater Use, March 2007, MLIT

**Conceptual Diagram of the Water Cycle**

# 2. Groundwater Use

## (1) Current Status of Groundwater Use in Japan

1) Groundwater in the Water Cycle




Source: Toward the Conservation and Sound Use of Groundwater, Advisory Group on Future Groundwater Use, March 2007, MLIT

**Conceptual Diagram of the Water Cycle**



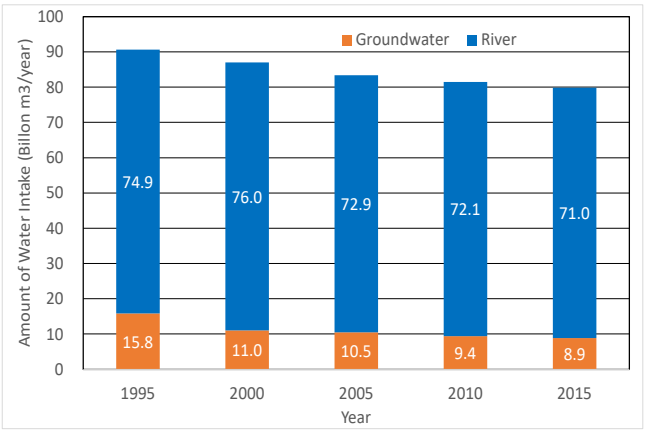
5



# 2. Groundwater Use

## (1) Current Status of Groundwater Use in Japan

2) Groundwater in Japan




Source: Japan's Water Resources, data from MLIT

**Annual Water Use by Source in Japan**



6

## 2. Groundwater Use

### (2) Regulation and Measures of Groundwater Use by Legislation

1) Land Subsidence Problem

**The Edo Period (1603-1868)**

- Groundwater was used as common property of communities.

**The Meiji Period (1968-1912)**

- Groundwater use for urban water supply increased.
- Groundwater use was accelerated since deeper and larger diameter wells became possible with mechanical drilling.
- No public regulation.







## 2. Groundwater Use

### (2) Regulation and Measures of Groundwater Use by Legislation

1) Land Subsidence Problem

**From around 1930**

- Land subsidence of locally 15 to 17 cm per year was observed.

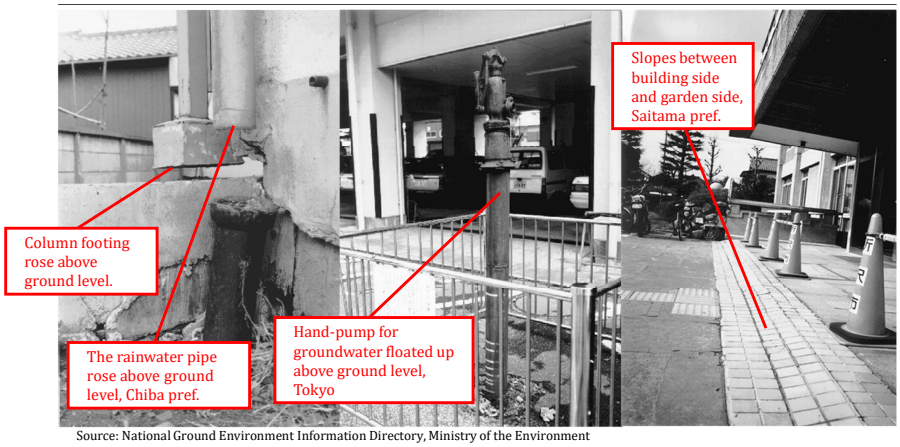
**From the post-WWII reconstruction period until the high economic growth (1955 -1973)**

- Groundwater use increased rapidly.
- Depletion of groundwater and damages of land subsidence and saltwater intrusion became serious especially in Tokyo and Osaka.

# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

### 1) Land Subsidence Problem




Source: National Ground Environment Information Directory, Ministry of the Environment

**Damage by Land Subsidence in Tokyo Urban Area**







# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

### 2) Salinization

- Salinization of groundwater is caused by seawater intrusion into an aquifer when the groundwater level is lowered below sea level owing to excessive water extraction.
- Since 1960, salinization issues occurred in many coastal areas.

- The groundwater level must be maintained above the sea level to prevent salinization through:
  1) restricting the amount of groundwater extraction,
  2) facilitating artificial recharge of groundwater,
  3) limiting the groundwater restriction zone to a coastal area and allowing saltwater intrusion in a limited zone, or
  4) building impermeable walls to prevent saltwater intrusion.

# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

### 3) Legal Regulations against Land Subsidence

- The ordinances of local governments were more effective in restricting groundwater extraction than national laws.
- In the 1970s, local governments established ordinances to regulate pollution as well as groundwater extraction in areas that National Acts could not cover.
- The ordinances covered groundwater extraction without limiting the purpose of water use.
- The ordinances also did not require the alternative development of water sources besides groundwater.







# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

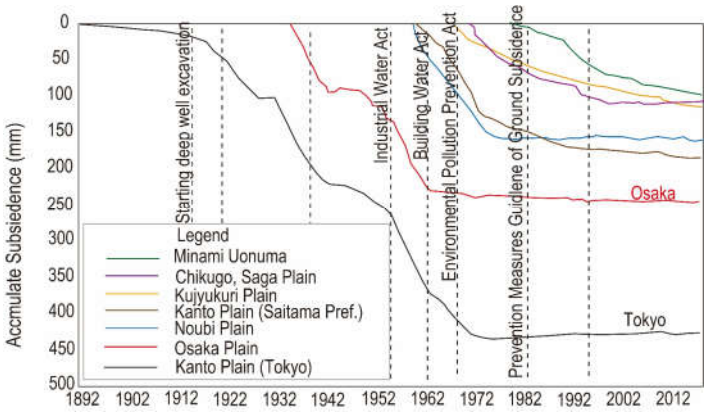
### 4) Changing Water Sources for Industrial Water

- The groundwater extraction for industrial water use was regulated by the Industrial Water Act by restricting the use of existing wells.
- This promoted converting water sources from groundwater to surface water.
- When local governments developed industrial water supply systems, industrial entities were instructed to abolish their own wells.
- The cost of groundwater extraction by industrial entities was JPY 1–3/$m^3$. The tariff of industrial water use provided by local governments was set at JPY 3.5/$m^3$. Subsidies were provided by the national government to avoid cost increases by changing water sources.
- In 2001, this tariff increased to 24.4 yen/$m^3$. However, it was still one-eighth of the unit cost of water supply by local governments. ➔ Environmental costs to the industry and local government.

# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

5) Land Subsidence




Groundwater extraction is restricted by Acts and Ordinances, followed by the recovery of groundwater level. The land subsidence substantially stopped.

Source: Overview of Land Subsidence in Japan in 2019, Ministry of the Environment, Water and Air Environment Bureau (2019 March)

**Land Subsidence experienced countrywide**







# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

6) Regulation by Tokyo Metropolitan Government

**Stage 1** (1900~1916)
Demand for daily water use depended on groundwater by more than 60%, but the land subsidence was not significant.

**Stage 2** (1916~1960)
The land subsidence became significant and finally serious. No effective measure was taken.

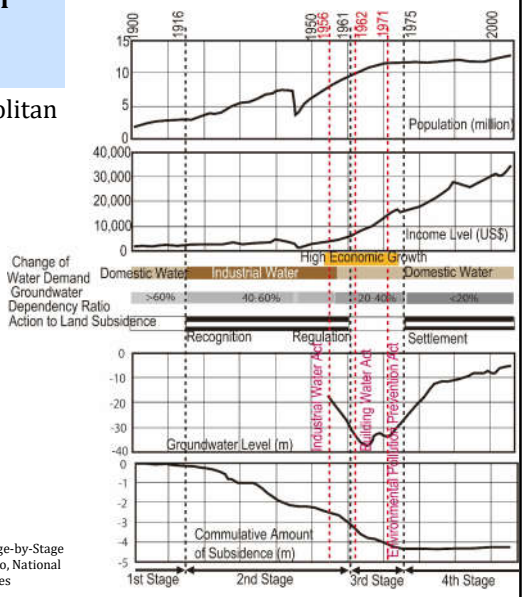
**Stage 3** (1961~1974)
Enacting the regulations of groundwater extraction based on the Industrial Water Act and the Building Water Act recovered the groundwater level gradually.

**Stage 4** (1975~)
The groundwater level continued recovering, and land subsidence ceased.

## (2) Regulation and Measures of Groundwater Use by Legislation

### 6) Regulation by Tokyo Metropolitan Government

- 1900-1916: Land subsidence was not significant.
- 1916-1960: Land subsidence became substantial and serious.
- 1961-1974: Enacted regulations on groundwater extraction. The groundwater level gradually recovered.
- 1975– : The land subsidence ceased.




Source: Urbanization and Land Subsidence in the Case of Tokyo: A Stage-by-Stage Approach Using Long-term Indicators, Tomoyo Toyoda & Shinji Kaneko, National Institutes for the Humanities, Institute for Global Environmental Studies

**History of Land Subsidence in Tokyo**



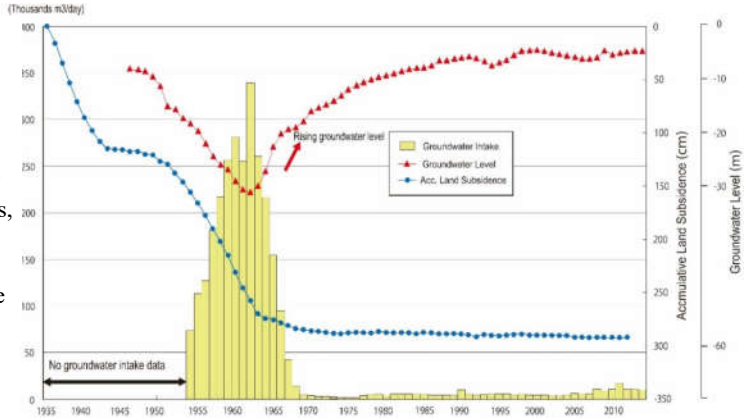


# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

### 7) Regulation in Osaka City

Osaka City regulated groundwater extraction rates. It allowed extractions only from deep layers, below -500 ~ -600 m. It made groundwater use difficult.




Source: "Report on the effective use of groundwater in consideration of the ground environment in the Osaka City area", Study Council on the Effective Use of Groundwater in Consideration of the Ground Environment in Osaka City Area (1991 February)

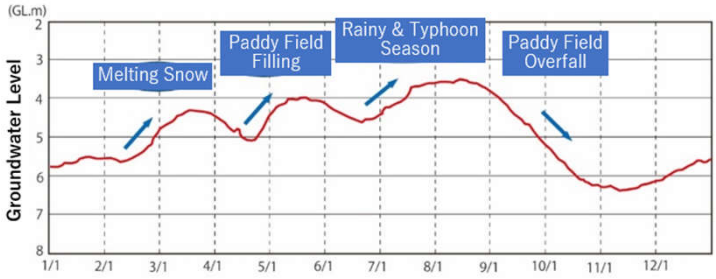
**Groundwater Use and Land Subsidence in Osaka City**

# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

8) Measures to counteract Drying of Wells in Snowfall Areas

**Drying of Wells in Snowfall Areas**
In snowfall areas, groundwater is used to melt & remove snow on roads during snow season, which may cause drying of wells.




Source: Groundwater and Spring Water in "Echizen Ono, the Hometown of Yui" ~Revitalization of Spring Water Culture~ Ono City, Fukui Prefecture

**Seasonal Changes in Groundwater Level (Kasuga Park Observation Well)**







# 2. Groundwater Use

## (2) Regulation and Measures of Groundwater Use by Legislation

8) Measures to counteract Drying of Wells in Snowfall Areas

**Measures in Ono City (Kasuga Park) in Fukui Prefecture**
Groundwater is monitored. A warning is issued when a low groundwater level is observed.


Source: Ono City

**Kasuga Park Observation Well and Warning Board**

# 2. Groundwater Use

## (3) Groundwater Monitoring

1) Reporting Water Extraction

The ordinances by local governments require groundwater users to record their extraction volume and report it to the governors.

2) Monitoring Land Subsidence

Monitoring Items:
- Ground Level
- Groundwater Level
- Land Subsidence

Survey Items:
- Geology
- Amount of water extraction







# 2. Groundwater Use

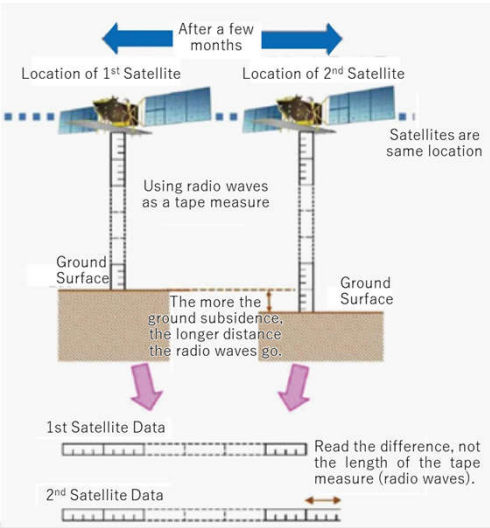
## (3) Groundwater Monitoring

3) Monitoring by Satellite Data

- MOE published "Manual for Utilization of Satellites in Land Subsidence Observation" (2017).
- It uses Advanced Land Observing Satellite-2 "Daichi-2" (ALOS-2).

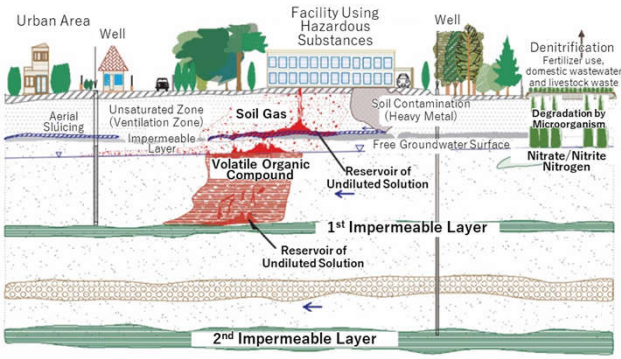
Source: Manual for the Use of Satellite Observation for Land Subsidence, Ministry of the Environment

**Land Subsidence Monitoring by SAR Satellite**



# 3. Water Quality Management

## (1) Groundwater Contamination Mechanism




Source: To clean up Groundwater, Ministry of the Environment (2004)

**Depiction of Groundwater Contamination**

**Main Substance of Contamination**

1. volatile organic compounds (VOCs)
2. Heavy metals
3. Nitrate-nitrogen and nitrite-nitrogen







# 3. Water Quality Management

## (2) Monitoring of Groundwater Quality

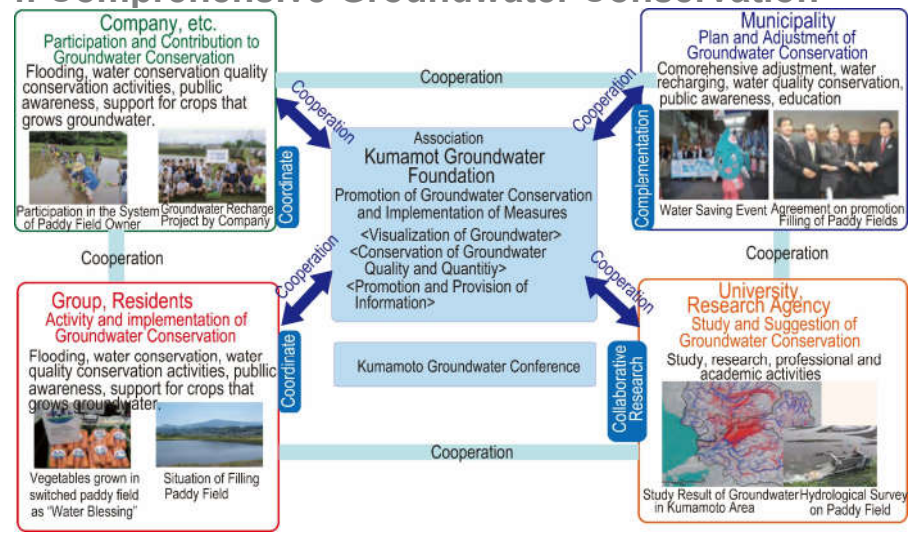
**Established Standards**

- 1. Groundwater Environmental Standards (Basic Environment Act)
- 2. Groundwater Purification Standard (Water Pollution Prevention Act)
- 3. Underground Infiltration Standard (Water Pollution Prevention Act)

**The Groundwater Quality Survey**

- 1. General survey
- 2. Survey of areas around contaminated wells
- 3. Continuous monitoring survey

## 4. Comprehensive Groundwater Conservation




Source: Case Studies of Watershed Management, Water Cycle Production Headquarters Cabinet Secretary

**Activities of the Kumamoto Groundwater Foundation**







## 8. Lessons Learned (1)

(1) Excessive extraction of groundwater lowers the groundwater level, which may induce land damage, structural damage, aggravated flood damage, and saltwater intrusion.

Groundwater is a key component of a healthy water cycle. Land subsidence is an irreversible phenomenon resulting from the consolidation of underground clay layers owing to the drainage of water contained in the clay layers.. Excessive extraction of groundwater has caused land subsidence in major cities, including Osaka and Tokyo, at rates of over 20 cm per year and a total subsidence of more than 5 m. Coastal areas have experienced salinization in groundwater, which has precluded its usage for drinking and industrial purposes, and has caused salt damage to crops.

## 8. Lessons Learned (2)

(2) Regulation of groundwater extraction and the development of alternative water sources are necessary for groundwater conservation.

In Japan, acts and ordinances have been established by the national and local governments to regulate groundwater use. Governments developed industrial water supply systems that use surface water as an alternative source. Their acts and ordinances stipulate the criteria for groundwater use permits. Groundwater users have been registered and are required to record and report the amount of groundwater extracted. Local governments continuously monitor the groundwater situation and land subsidence.







## 8. Lessons Learned (3)

(3) Proper groundwater quality management is required to prevent the infiltration of hazardous substances into groundwater.

Once groundwater is contaminated and the contamination spreads, restoration of groundwater quality is difficult. Therefore, early monitoring and measures are necessary. Management systems require environmental standards for groundwater quality, annual monitoring plans, and a system that enables prompt responses to emergency situations.

(4) To ensure sustainable conservation and usage of groundwater, a council of stakeholders should be established according to regional conditions.

Kumamoto City formulated mechanisms of groundwater management in collaboration with local governments, the private sector, residents, universities, and research institutions. Their management is supported by scientific evidence developed with universities and institutions in Kumamoto.

# Theme 8
# Dam Management
## Managing & Operating Dams Safely, and Enhancing their Functions



1



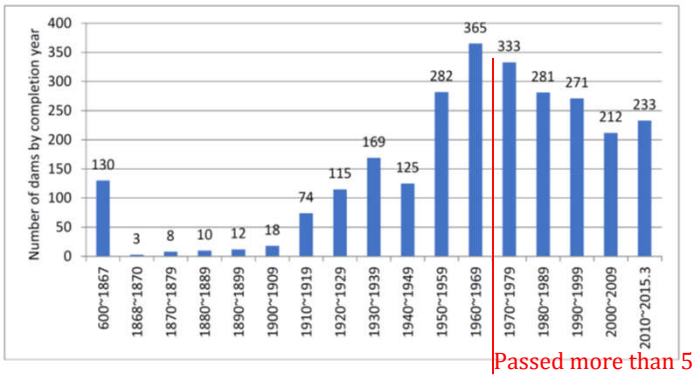
# Contents





2

# 1. Introduction




Source: Edited data from Year Book od Dams (Japan Dam Foundation)

**History of Dam Construction in Japan**

- Many dams were constructed in the 1960s to 1970s, and more than 50 years have already passed.
- It is necessary to manage aging dams efficiently and to maintain or improve their functions as necessary.



3



# 2. Dam Safety Management

## (1) Standards and Systems for Safety of Dams

| Name of Dam | Comple-tion | Acci dent | Type of Dam | Purpose | Damages |
|---|---|---|---|---|---|
| **Iruka-ike** | 1633 | 1868 | Earthfill dam | Irrigation | 941 dead |
| **No.1 Regulating Pond, Komoro Hydropower Station** | 1927 | 1928 | Buttress type concrete dam | Hydro-power | 5 dead |
| **Horonai Dam** | 1939 | 1941 | Gravity type concrete dam | Hydro-power | 60 dead |
| **Heiwa-ike** | 1949 | 1951 | Earthfill dam | Irrigation | 75 dead |
| **Yoake Dam** | 1952 | 1953 | Gravity type concrete dam | Hydro-power | - |
| **Taisyo-ike** | 1949 | 1953 | Earthfill dam | Irrigation | 105 dead |
| **Wachi Dam** | 1968 | 1967 | Gravity type concrete dam | Hydro-power | 1 dead |
| **Fujinuma Dam** | 1949 | 2011 | Earthfill dam | Irrigation | 8 dead/ missing |

Source: Edited data from the documents of No.21 Expert meeting on future policy and concept of flood management



4

# 2. Dam Safety Management

## (1) Standards and Systems for Safety of Dams

| | |
|---|---|
| Plan | River Administrator permit based on River Law.<br>(Occupation of Water, Land, Permission of New Construction) |
| Design | Review and Approved by Dam Basic Design Meeting<br>(Public Works Research Institute, NILIM, etc.) |
| Construction | Review and Approved by Experts of Public Works Research Institute, NILIM, etc. |
| Completion | Review and Approved of Initial Impounding Test by Dam Basic Design Meeting |
| | Final Inspection and Approval by River Administrator |
| | (Multipurpose Dam) MILT establishes the right to use Dam |

Source: Prepared based on "Construction of Multipurpose for Dams" published by Japan Dams



5



# 2. Dam Safety Management

## Review of Technical Standards Based on Experience of Great Disasters

**1. Great Hanshin-Awaji Earthquake (1995)**

Static Rigid Body Stability Analysis Method
Design seismic coefficient

→

Probable Maximum Earthquakes
Level 2 earthquakes

**2. Damages due to Excessive Flood**

**Review and Improvement of:**
- Information dissemination
- Public awareness
- Forecasting technology



6

# 2. Dam Safety Management

## Safety Management of Ponds & Small Reservoirs for Irrigation

Source: Brief session by Tohoku University one month after Earthquake dated on 13 April 2011

- 8 dead, 124 house damaged
- Dam was constructed with insufficient compaction & embankment with rich sand
- Magnitude of earthquake beyond past experiences

July 2018 collapse of 32 ponds

**Fujinuma Dam Failure (2011 Earthquake)**

**The Law of Management and Conservation of Ponds and Small Reservoirs for Irrigation (2019)**

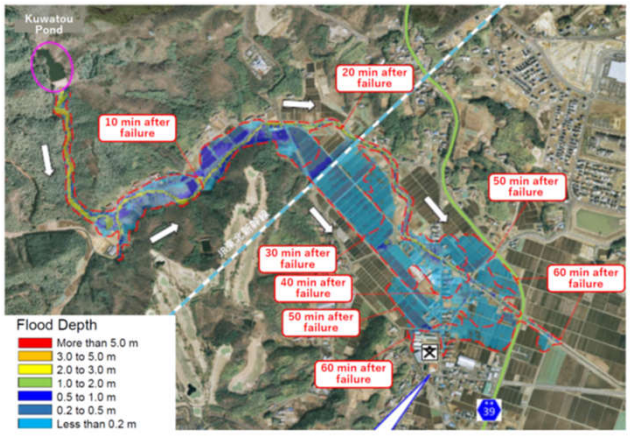


7



# 2. Dam Safety Management

## (1) Standards and Systems for Safety of Dams




Source: Data of Miyagi Prefecture

**Example of Information Disseminated for the Failure of Ponds and Small Reservoirs and Evacuation by Using Hazard Map**



8

# 2. Safety Management of Dams

## (1) Standards and Systems for Safety of Dams

- Examples of Maintenance and Management of Old Ponds and Small Reservoirs

Source: Agriculture and Rural Area Improvement Plan in Gunma Prefecture, 2020

**Sannako Dam Reinforcing against eqrthquake (Irrigation Water Supply Dam)**







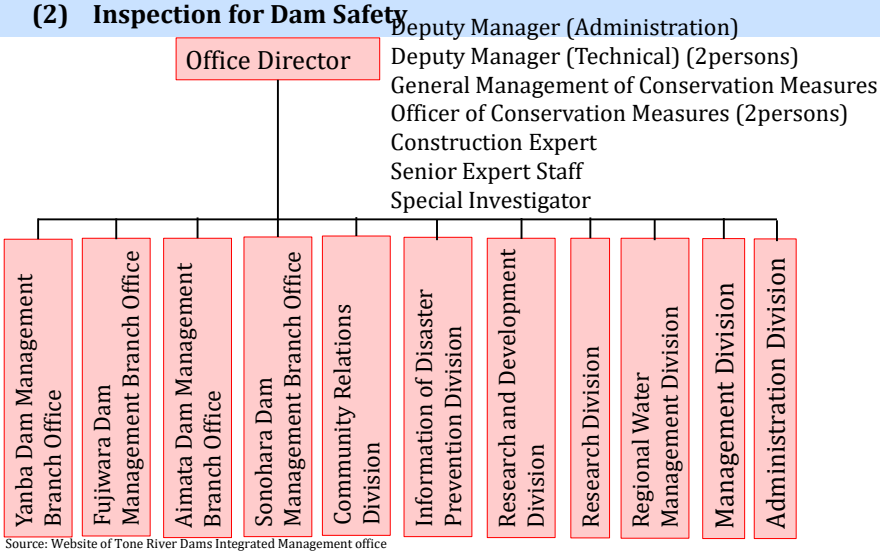
# 2. Safety Management of Dams

## (2) Inspection for Dam Safety

| | |
|---|---|
| **Patrol & daily inspection** | |
| **Occasional Inspection** | Earthquakes, floods |
| **Periodic Inspection** | • Once in 3 years<br>• Inspection of implementation status of maintenance<br>• Inspection of dam structure and its reservoir |
| **Comprehensive Dam Inspection** | • Once in 30 years<br>• Detect deteriorations & damages from long-term viewpoint |

# 2. Safety Management of Dams

## (2) Inspection for Dam Safety




Source: Website of Tone River Dams Integrated Management office







# 2. Safety Management of Dams

## (2) Inspection for Dam Safety

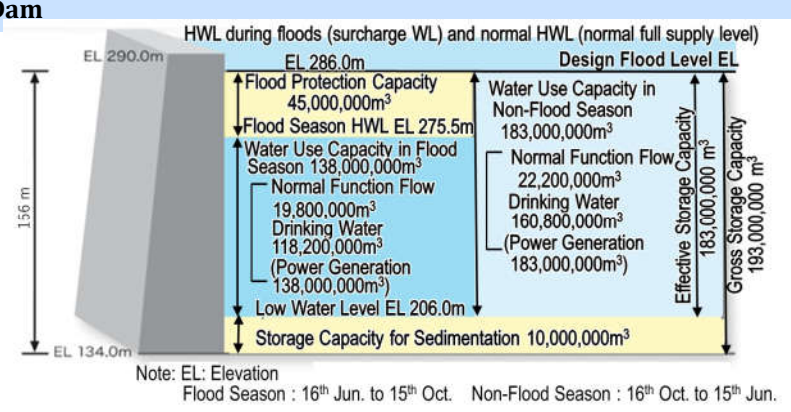
Source: Website of Tone River Dams Integrated Management Office

**Branch office of Fujiwara Dam**

- 3 Regular Staffs
- Part-time Staffs
- 3~4 Outsourced Staff

# 3. Dam Operation During Flood

## (1) Storage Capacity Allocation and Flood Protection of Multipurpose Dam




Source: Pamphlet of Miyagase Dam, Sagami River System Dam Management Office, Kanto Regional Development Bureau, MLIT

Non-flood season: 183 million m³ for water supply

Flood season: flood control space of 45 million m³ , rest for water supply

**Storage Capacity Allocation of Miyagase Dam**

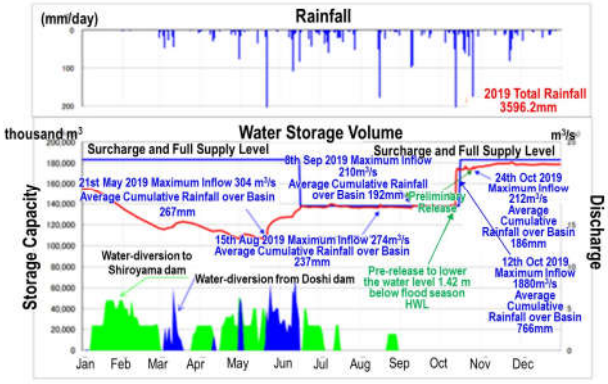






# 3. Dam Operation During Flood

## (1) Storage Capacity Allocation and Flood Protection of Multipurpose Dam



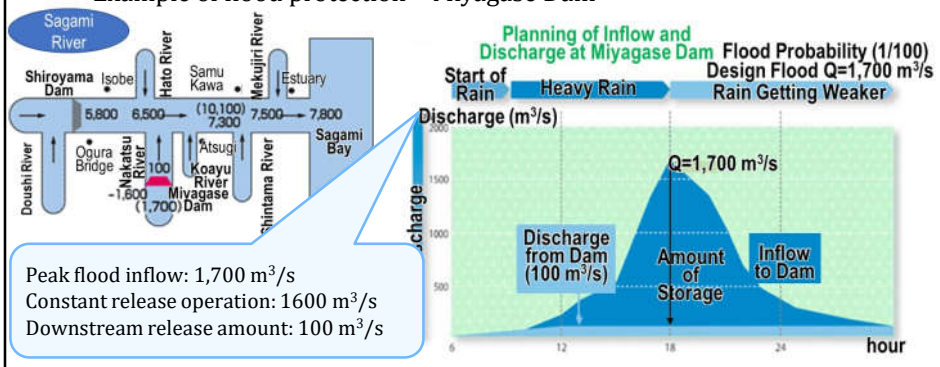

Note: Doshi dam will divert its water, when it is expected to start spilling therefrom, to Miayagase dam for storage therein while Miyagase dam will divert its water to Shiroyama dan which is in shortage of stored water to meet the water supply to Tokyo.
Source: Website of Sagami River System Dam Management Office

**Annual Reservoir Operation Record of Miyagase Dam**

# 3. Dam Operation During Flood

## (1) Storage Capacity Allocation and Flood Protection of Multipurpose Dam

- Example of flood protection – Miyagase Dam




Source: Website of Sagami River System Dam Management Office

**Flood Protection Plan of Sagami River and Flood Protection by the Miyagase Dam**



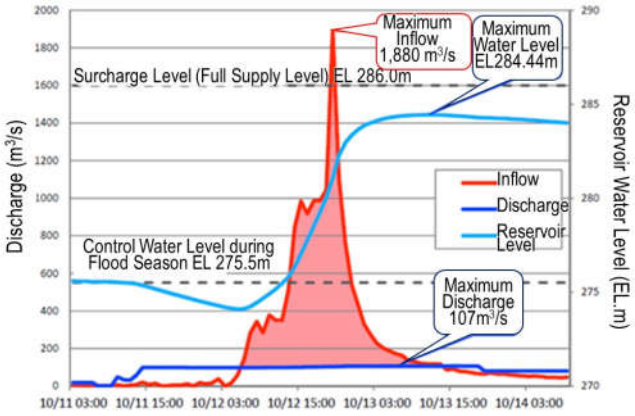




# 3. Dam Operation During Flood

## (1) Storage Capacity Allocation and Flood Protection of Multipurpose Dam

- Example of flood protection – Miyagase Dam

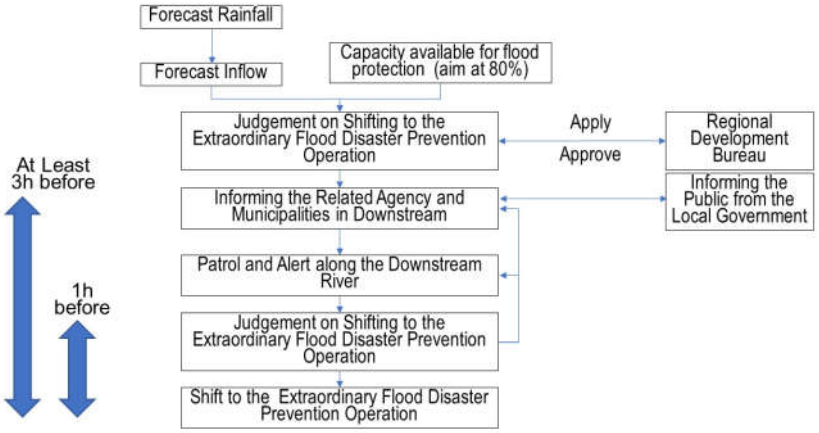



Source: States of Dams at Typhon No.19 in 2019, MLIT

**Flood Protection (Miyagase Dam for Typhoon No.19, 2019)**

# 3. Dam Operation During Flood

## (2) Dam Operation during Extraordinary Flood Exceeding the Design Discharge




Source: Hearing from Tone River Dams Integrated Management Office and Notes on Procedure for Operation of Nomura Dam







# 3. Dam Operation During Flood

## (2) Dam Operation during Extraordinary Flood Exceeding the Design Discharge

July 2018 major flood damage along Hijikawa River (100 year flood)

People in flooded area may not have received dissemination information from Nomura Dam & Kanogawa Dam

Proposed Measures to reduce flood damages caused by dam operation

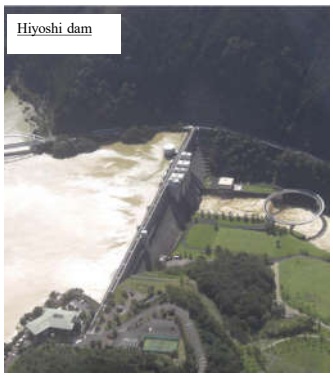
Source: MLIT

**Hijikawa River Inundation**

# 3. Dam Operation During Flood

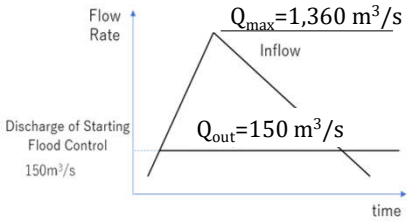
## (2) Dam Operation during Extraordinary Flood Exceeding the Design Discharge

Advanced Dam Operation during Heavy Flood (Typhoon No.18)




Source: Kinki Regional Development Bureau (MLIT)

**Hiyoshi Dam**




**Flood Protection Plan**

Typhoon No.18:
$Q_{max}$= 1,690 m³/s > $Q_{max}$ (Plan) =1,360 m³/s







# 3. Dam Operation During Flood

## (3) Operation and Role of Water Supply Dam during Flood

Classification of Water Supply Dam and Necessary Actions to Release Flood Water

**Type 1**

Flood discharge increase significantly
- Increase in flood flow velocity

↓

Reservoir needs to store part of flood inflow

**Type 2**

Rising water levels upstream
- Riverbed upstream has risen due to sedimentation, or
- Dam area not large enough

↓

Preliminary discharge

**Type 3**

Sudden rise in water level during flood
- Flood discharge > reservoir capacity, or
- Operation of flood discharge gates complicated

↓

Pre-releasing water to lower water level

**Type 4**

Flood water release cause no adverse effect on flood management downstream

↓

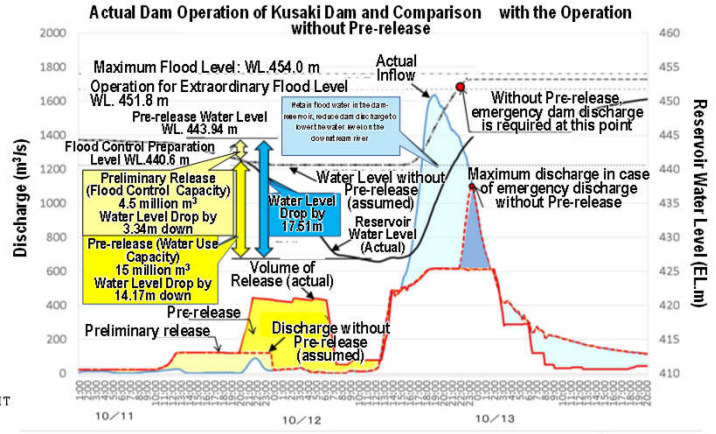
None

Article 52 of River Law: River administrator has authority to instruct temporary storage of flood water to the owner of the water supply dam

# 3. Dam Operation During Flood

## (3) Operation and Role of Water Supply Dam during Flood

Recent efforts to use reservoir water in water supply dams for flood protection




Source: MLIT

**Advance Release Operation of Kusaki Dam at Typhoon No. 18 in 2019 and its Effect**

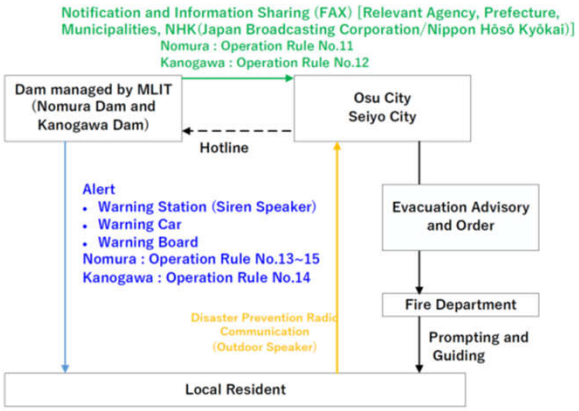






# 3. Dam Operation During Flood

## (4) Securing Safety for Residents and River Users in Downstream Area

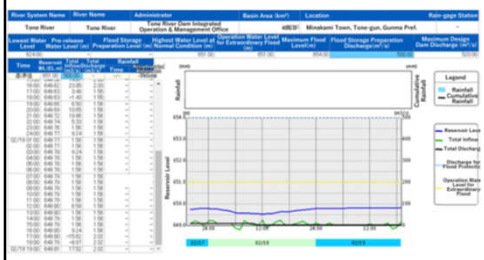



Source: Summary of Discussions for Verification of Information Sharing on the Operation of Nomura Dam and Kanogawa Dam, November 2018

**Example of Notification and Information Sharing (Nomura Dam and Kanogawa Dam)**

# 3. Dam Operation During Flood

## (4) Securing Safety for Residents and River Users in Downstream Area



Source: MLIT

Real-time dam data of MLIT


Source: Fujiwara Dam

Warning of discharge release (Twitter)

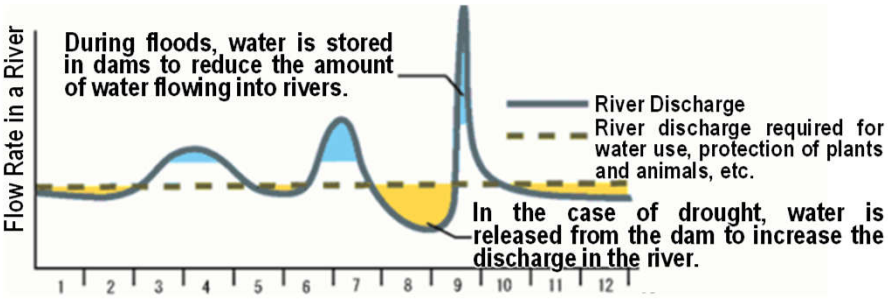






# 4. Dam Operation For Water Supply

## (1) Water Supply by Dam




Source: MLIT

Illustration of Water Supply Enhanced by Dam

# 4. Dam Operation For Water Supply

## (2) Integrated Operation of Dams


Source: Tone River Dams Integrated Management Office

**Integrated Operation of Multiple Dam**

- Integrated operation by considering the dam's location, reservoir volumes, and characteristics of the river basin
- Example: nine dams managed by national government & Japan Water Agency Tone River basin

**Dams Operated by the Tone River Dams Integrated Management Office**

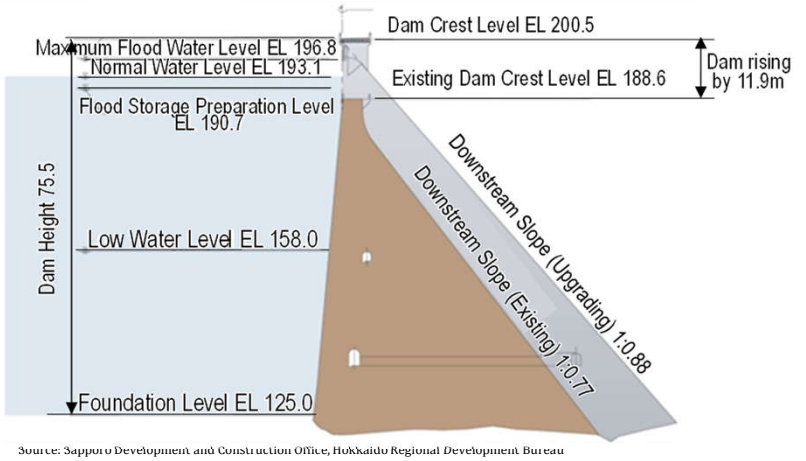






# 5. Measures for Rehabilitation and Improvement of Dam Function

## (2) Dam Rehabilitation Technologies in Japan



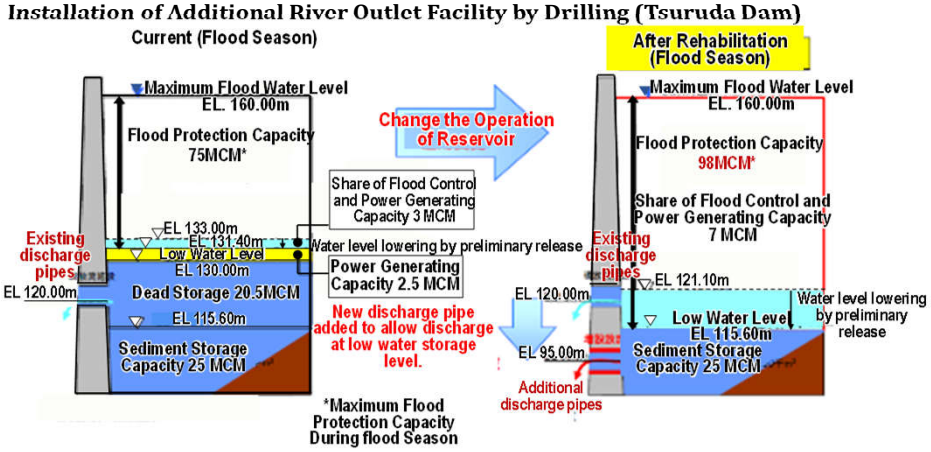

Source: Sapporo Development and Construction Office, Hokkaido Regional Development Bureau

**Cross Section of Dam Body**

## 5. Measures for Rehabilitation and Improvement of Dam Function

### (2) Dam Rehabilitation Technologies in Japan

**Installation of Additional River Outlet Facility by Drilling (Tsuruda Dam)**




Source: Sendai-gawa River Office, MLIT

**Reformulation of Reservoir Operation for Tsuruda Dam**







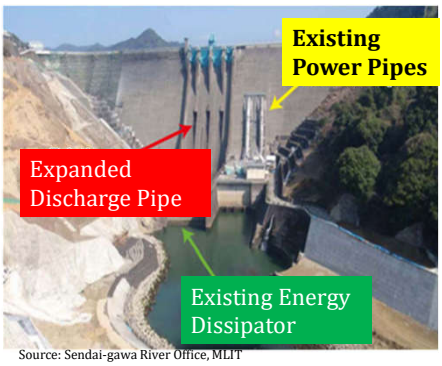
## 5. Measures for Rehabilitation and Improvement of Dam Function

### (2) Dam Rehabilitation Technologies in Japan

**Installation of Additional River Outlet Facility by Drilling (Tsuruda Dam)**

Source: Sendai-gawa River Office, MLIT

**Drilling of Dam Body**




Source: Sendai-gawa River Office, MLIT

**Rehabilitation Works**

## 5. Measures for Rehabilitation and Improvement of Dam Function

### (2) Dam Rehabilitation Technologies in Japan

**Installation of Additional River Outlet Facility by Drilling (Tsuruda Dam)**


Source: Sendai-gawa River Office, MLIT

**Restoration Works**







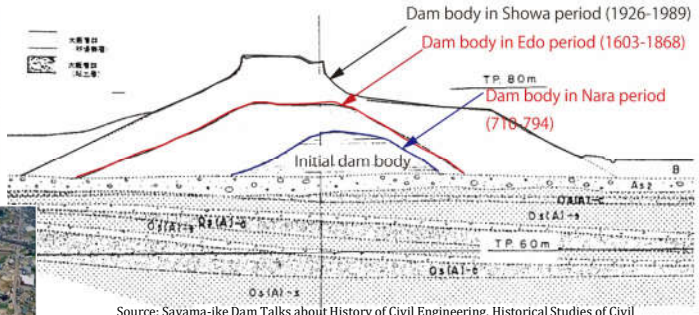
## 5. Measures for Rehabilitation of Dam & Improvement of its Function

### (2) Dam Rehabilitation Technologies in Japan

**Restoration of Japan's Oldest Dam (Improvement of Sayama-ike)**

Source: Website of Osaka Prefecture

**Before and after Restoration**



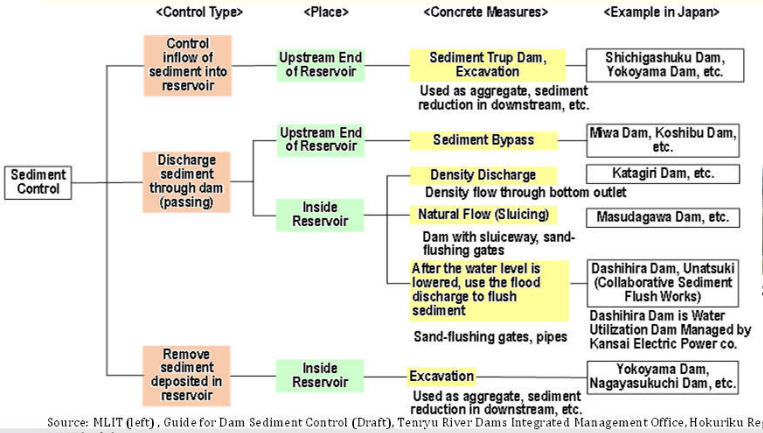

Source: Sayama-ike Dam Talks about History of Civil Engineering, Historical Studies of Civil Engineering No.15

**History of Restoration Works**

# 5. Measures for Rehabilitation and Improvement of Dam Function

## (3) Technologies for Dam Sediment Control

In Japan, the sediment capacity of reservoirs is determined by estimating the sedimentation volume that will be deposited over 100 years.




**Sediment Gates**

**Sediment discharge bypass facility**

Source: MLIT (left), Guide for Dam Sediment Control (Draft), Tenryu River Dams Integrated Management Office, Hokuriku Regional Development Bureau, MLIT(right)







# 5. Measures for Rehabilitation and Improvement of Dam Function

## (3) Technologies for Dam Sediment Control


Source: Nakagawa River Office

**"To Restoring Sediment Downstream" (Nagayasuguchi Dam)**

## 6. Lessons Learned (1)

(1) To secure dam safety, legislation, technical guidelines, and examination system should be established.

The mechanisms of dam safety should involve thorough examination at each stage, i.e., planning, design, construction, and maintenance. It is important to conduct daily inspections and patrols, as well as periodic inspections, and not to overlook any small changes or signs of risk. The periodic and comprehensive inspections and establishment of extension plans for the service life can improve the management and reduce the lifecycle costs. Because many ponds built in the old days have structural problems, accidents should be prevented through legislation and financial support for the inspection and reinforcement of dam structures.







## 6. Lessons Learned (2)

(2) To secure a dam and its downstream areas during flooding, operation rules should be followed.

The operation rules prescribe gate operations and procedures for the patrol and warning methods for downstream areas. They also cover the gate operations for extraordinary floods that exceed the design flood. This is intended to prevent artificial flooding in downstream areas, even under extraordinary floods. The flood inflow should be discharged in the same amount as entering the reservoir. The inflow volume can be obtained from the flood-inflow forecast based on rain radar data. Flood forecasting is effective for introducing and deciding whether to pre-release reservoir water for increasing the flood-protection capacity before floods.

(3) Integrated operation of multiple dams can ensure an adequate water supply.

The integrated operation of multiple reservoirs in the basin and reallocation of the reservoir capacity may enhance the reliability of the water supply and improve the river environment.

# 6. Lessons Learned (3)

(4) Rehabilitation works can extend lifetime and functions of dams.

Existing dams can be rehabilitated at a relatively low cost, in a short time, and with minimal burdens on nature and society. Additionally, it is possible to improve the dam functions by using the latest software and hardware technologies, e.g., flood forecasting and countermeasures for reservoir sedimentation, dam raising, and the construction of dam-discharging facilities. Some rehabilitation works can be implemented without interfering with the dam operation.

# Theme9
# Environmental and Social Consideration in Large-scale Projects

## Supporting the Reconstruction of Submerged Communities




1



# Contents





2

# 1. Introduction

**Why is environmental consideration required?**

- Large-scale structures may change a way-of-life of residents and communities.
- Construction projects often alternate the natural topography and lose beautiful landscape.
- Such physical changes may threaten the habitat and behavioral range of plants and animals in the project area

**Theme 9 describes,**

- Supporting the people in reconstructing their lives
- The various environmental measures and environmental protection in water resources
- Environmental Impact Assessment



3

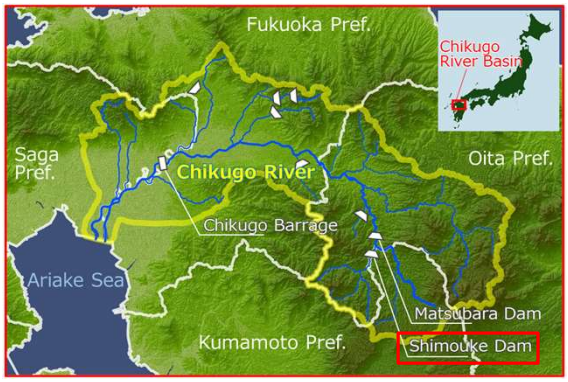


# 2. Promotion and Support for Reservoir Areas

**(1) Measures for Local Communities and Residents to be Submerged due to Dam Construction**

1) Opposition Movement against Shimouke Dams (13 years)

- Consider consistency between public works projects and basic human rights
- Protect the property rights of residents in submerged area




Source: Created based on the Japan Water Agency's website

**The Chikugo River Basin and Shimouke Dam**



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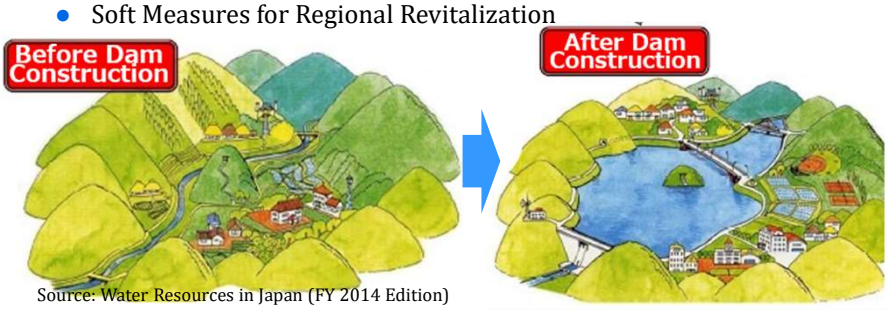
## 2. Promotion and Support for Reservoir Areas

### (1) Measures for Local Communities and Residents to be Submerged due to Dam Construction

2) Support System for Residents of Submerged Areas

- Compensation by Dam Developer
- Act on Special Measures for Water Resources Areas
- Water Source Area Development Fund
- Soft Measures for Regional Revitalization




Source: Water Resources in Japan (FY 2014 Edition)

**Overall Picture of Measures for Water Source Areas in Dam Construction**



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## 2. Promotion and Support for Water Source Areas

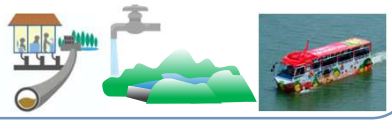
### (2) Establishing Legal System and Securing Financial Resources

**General Compensation**

- ✓ Relocation site
- ✓ Relocation of public facilities

**Act on Special Measures for Water Sources Areas**

- ✓ Land improvement, roads, simple water supply, sewerage, public facilities
- ✓ Tourism and recreation facilities



**Reservoir Area Development Fund**

- ✓ Counseling
- ✓ Forest maintenance

**Reginal Revitalization**

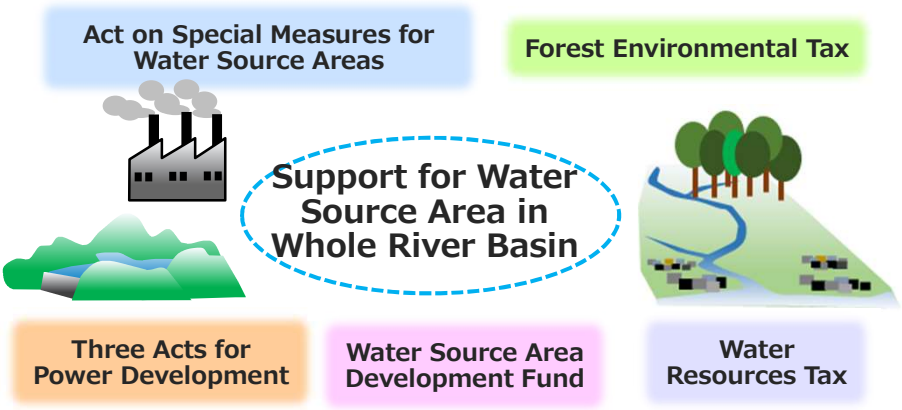
- ✓ Special product
- ✓ Support network



6

## 2. Promotion and Support for Water Source Areas

### (2) Establishing Legal System and Securing Financial Resources




Source: Project Research Team (PRT)

**Support for Water Source Areas in Whole River Basin**



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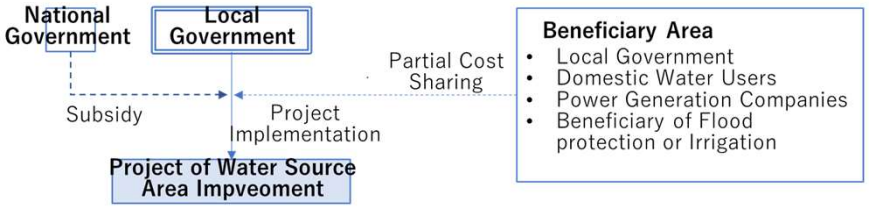
## 2. Promotion and Support for Water Source Areas

### (3) Fair and Satisfactory Compensation Process

1) Act on Special Measures for Water Resource Areas

- National government, local municipalities, and beneficiary area share the cost.




Source: PRT

**Cost Burden for Projects Related to the Water Source Area Improvement Plan**



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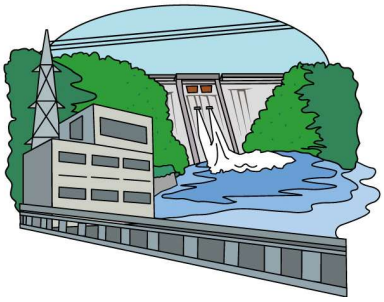
## 2. Promotion and Support for Water Source Areas

### (3) Fair and Satisfactory Compensation Process

2) Three Acts for Power-Resources

These laws aim to **promote power supply** development and facilitate operations by helping **subsidize** areas where power supply development is to take place.





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## 2. Promotion and Support for Water Source Areas

### (3) Fair and Satisfactory Compensation Process

3) Reservoir Area Development Fund

The Fund is used for meticulous projects for reconstruction of residents' livelihood and community development

It is collected from beneficiaries located downstream area.

In the Tone River system, the community is revitalized through mutual exchange between people in upstream and downstream area.

Source: Tokyo and Gunma Prefecture Website

**Upstream and Downstream Exchange Project in Tone River**



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## 2. Promotion and Support for Water Source Areas

### (3) Fair and Satisfactory Compensation Process

4) Financial Resources for Water Source Area Conservation

- Act on Forest Environment Tax and Forest Environment Transfer
- Tax for Reservoir Area


Source: Kanagawa Prefecture website

**Forest in Water Source Area**



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## 2. Promotion and Support for Water Source Areas

### (4) Relocation Site Development

By preparing relocation sites, the local community and industry can reconstruct the livelihood for relocated residents.

In Miyagase Dam, total number of 281 persons relocated. 68% of persons were relocated to the alternative site.

Source: Dam Handbook

**Miyagase Dam**



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## 2. Promotion and Support for Water Source Areas

### (5) Involvement of People outside the Water Source

1) Support for Livelihood

The MLIT is implementing the "headwater villages support project" to revitalize the region


Source: Headwater Villages Support Project, MLIT

**Contest for the Design of a Trip to Headwater Villages**

Source: Road Station of Yanba Dam Website

**Specialty Products**



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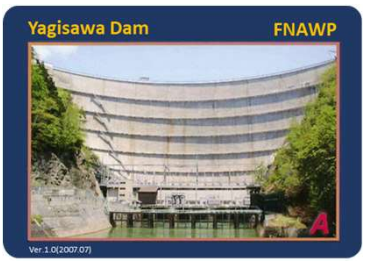
## 2. Promotion and Support for Water Source Areas

### (5) Involvement of People outside the Water Source

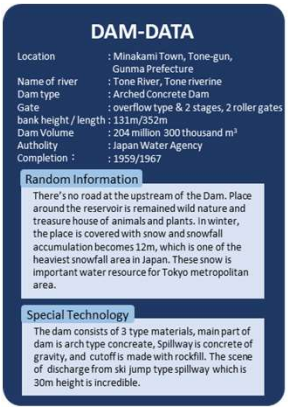
1) Act on Special Measures for Water Resource Areas

**Dam Card Distribution**

- "Dam card" is distributed to people who visited the dam.




Source: MLIT website




**Example of Dam Card**



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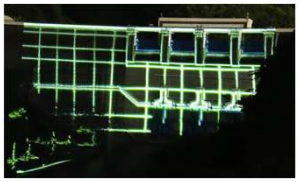
## 2. Promotion and Support for Water Source Areas

### (5) Involvement of People outside the Water Source

### Economic Revitalization Using Reservoirs

- Projection Mapping
- Triathlon tournament utilizing the dam environment
- Backstage tour by private entities

Source: Izumo River Office website



Source: Yodo River Dams Integrated Management Office website

Source: Nikkou City Website

**Regional Revitalization Using Reservoirs**



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## 3. Environmental and Ecosystem

### (1) Environmental Impact Assessment and Countermeasures

1) Environmental Impact Assessment (EIA)

1. Primary Environmental Impact Consideration
2. Scoping Document
3. Draft Environmental Impact Statement (EIS)
4. Environmental Impact Statement (EIS)
5. Impact Mitigation Report



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# 3. Environmental and Ecosystem

## (1) Environmental Impact Assessment and Countermeasures

2) JICA's System on Environmental and Social Considerations

1. Categorization (4 categories)

2.Documents on environmental and social considerations

3. Environmental review results

4. Monitoring results



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# 3. Environmental and Ecosystem

## (1) Environmental Impact Assessment and Countermeasures

3) JICA'S Environmental and Social Consideration

- Advisory Committee for Environmental and Social Considerations
- Residents Relocation Plan

Source: JICA

**Advice of Advisory Committee for Environmental and Social Considerations**



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# 3. Environmental and Ecosystem

## (2) Environmental Conservation Measures

1) Conservation of Ecosystems by Biotopes and Fishwavs


Source: Website of the Sagami River Wide Area Dam Management Office, Kanto Regional Development Bureau, MLIT

**Higashizawa Biotope Created in Miyagase Dam Area**



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# 3. Environmental and Ecosystem

## (2) Environmental Conservation Measures

1) Conservation of Ecosystems by Biotopes and Fishways


**Pirika Dam Fishway**

**Lower channel in low flow channel**

**Refuge Pool**

**Fish Ladder**

**Nature-oriented Fishway**

Source: Website of Hakodate Development and Construction Department, Hokkaido Regional Development Bureau, MLIT



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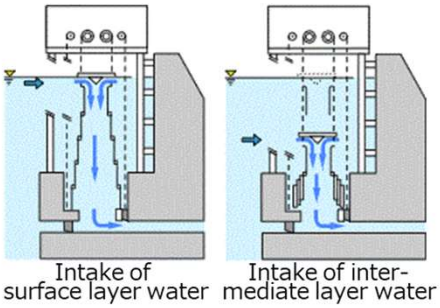
# 3. Environmental and Ecosystem

## (2) Environmental Conservation Measures

2) Measures for Water Quality Deterioration Caused by Dam Discharge

**Exterior view of facility**




**Mechanism of selective intake**

Source: Website of the Sagami River Wide Area Dam Management Office, Kanto Regional Development Bureau, MLIT

**Selective Intake Facility of the Miyagase Dam**



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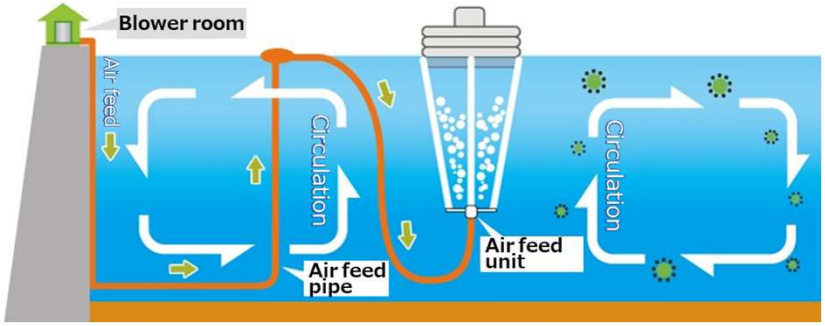
# 3. Environmental and Ecosystem

## (2) Environmental Conservation Measures

2) Measures for Water Quality Deterioration Caused by Dam Discharge




Source: Website of the Hijikawa River Dam Integrated Management Office, Shikoku Regional Development Bureau, MLIT

**Mechanism of the Aeration System**



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## 4. Lessons Learned (1)

(1) Large-scale projects should be planned for the benefits of affected local communities also.

Large-scale projects, such as dam construction, could adversely impact local communities and ecosystems if appropriate measures are not taken. The entire community could be submerged and collapsed. Projects should support local communities and industries in rehabilitating their lives and activities. The project should include relocation site development as a part of the project. Support for livelihood reconstruction is required for the affected residents. Affected people must be involved in the process of consensus building and planning for reconstruction and resettlement programs.





## 4. Lessons Learned (2)

(2) Measures for water source areas, including financial resources, need to be institutionalized.

It is necessary to implement various effective measures for water source areas. Legal systems should be provided to implement measures and secure the financial resources necessary for implementation, such as river basin funds.

(3) Partnerships with various stakeholders should be established to support the water source areas.

Cooperative relationships with downstream areas, private companies, and civil society organizations are crucial for mobilizing resources and developing activities. People outside the water source areas, such as those from downstream or urban areas, should be involved in efforts to revitalize the water source area. Interactions between people and those in the water source area deepen their understanding about each other and develop cooperative activities.

# 4. Lessons Learned (3)

(4) Assessing the environmental impact and considering conservation are prerequisites for large-scale projects.

Large-scale water management projects may affect the natural environment. To improve the project plan, there is a need to properly assess the environmental impacts, and carefully consider environmental conservation measures. It is also necessary to establish a procedure for environmental impact assessments, prepare the necessary documents at each stage, and incorporate residents' opinions into the assessment. Various environmental conservation measures should be implemented when constructing and managing facilities to avoid or reduce the adverse impacts.

# Theme10
# Development of Human Resources and Technology
## Establishing Systems to Meet Changing Needs



1



# Contents





2

# 1. Introduction

It is necessary to secure and develop diverse human resources in water resources management and develop necessary technologies to respond to changing social conditions and needs.

**Why is Human Resources Development required?**

- The works of water resources management cover wide-range of fields.
- Involvement of people with different specialties is required.
- A certain number of human resources should be secured and trained to enhance individual expertise.



3



# 2. Securing and Developing Human Resources

## (1) Securing Human Resources

**<1870~> The government invited foreign engineers to modernize engineering and promote technology learning**

**<1880~> Engineers who studied abroad at national expense led public works, taking over the position of foreign engineers. They taught science and engineering and trained their successors.**

**<20th Century~> Japan continued developing human resources by acquiring, inheriting and developing advanced technologies transferred from the Western countries.**



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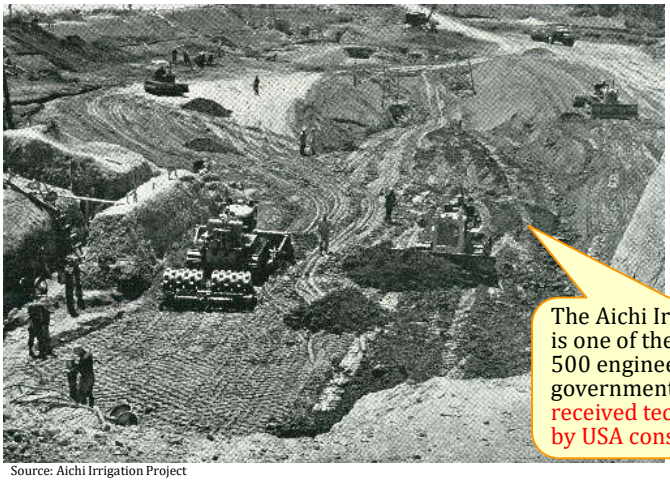
# 2. Securing and Developing Human Resources

## (1) Securing Human Resources



The Aichi Irrigation Project is one of the projects that 500 engineers and local government officials received technical guidance by USA consultants.

Source: Aichi Irrigation Project

**Construction using Large Machinery**



5



# 2. Securing and Developing Human Resources

## (2) Developing Human Resources

1) Training

- In Japan, the capacity development is practically conducted by self-development through **OJT as the core**.
- **Off-JT** was conducted to promote ability development.

2) Lectures and Seminars

- National Institute for Land and Infrastructure Management (NILIM), MLIT
- Public Works Research Institute (PWRI) , MLIT

3) Acquisition of Technical Qualifications, Japan

- professional engineers (PEs)
- first-class construction management engineers
- first-class architects



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# 2. Securing and Developing Human Resources

## (3) Japan's Support in Developing Human Resources

JICA is working to support in developing the human resources for the sustainable development, by dispatching experts and providing study programs.

- Dispatching JICA Experts
- Technical Cooperation Projects
- Task-specific Training
- Japanese Yen Loan (supporting the development of human resources in the developing countries)







# 2. Securing and Developing Human Resources

## (3) Japan's Support in Developing Human Resources

2) Other Activities

- Scholarship Program for Human Resources Development
- Science and Technology Research Partnership for Sustainable Development (SATREPS)

Source: JICA

**Higher Education Support Program for Engineering in Mongolia**

# 3. Technology Development

## (1) Roles of Government Agency

To disseminate the technology to local governments and companies through horizontal deployment of research results;

To lead the technology development on themes that meet the social needs.

Example: The Roller Compacted-Dam Concrete (RCD) method, a dam construction method developed in Japan is a typical example.

This method enabled the effective use of large machinery in concrete dams, and reduction of construction costs.

Source: Japan Dam Engineering Center

**RCD Method (Yunishigawa Dam)**







# 3. Technology Development

## (2) Utilization of Technologies of Companies

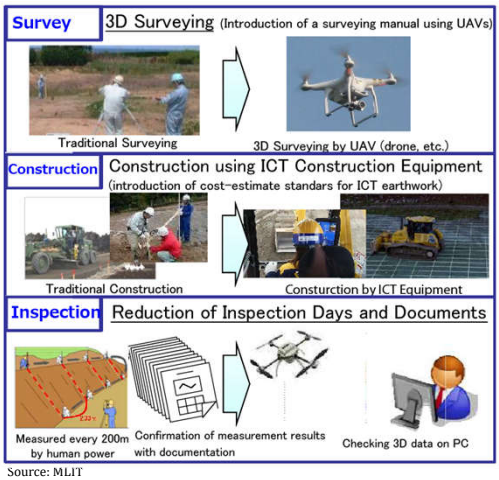
1) i-Construction

Problem: shortage of workers

i-Construction

1) Fully utilizing ICT
2) Standardizing Specifications
3) Distributing the timing and load

Abb.: ICT: information and communications technology. UAV: unmanned aerial vehicle




Source: MLIT

**Improvement of Productivity by i-Construction**

# 3. Technology Development

## (2) Utilization of Private Sector Technologies

### 2) Public Invitation for Research and Development in River Works Technology

- This system was established to research and develop river works technology;
- Themes of technology are selected by inviting proposals from universities, public corporations, and companies.
- An evaluation committee examines and suggests entrusting R&D to certain organizations.
- Public invitation theme of FY2021 is "Development of evaluation technologies that contribute to the study of strengthening structures of river levees against overflow."







# 3. Technology Development

## (2) Utilization of Private Sector Technologies

### 3) Innovative River Management Project

**Innovative River Management Projects under the MLIT**

- Risk management type water level gauge
- Simple river monitoring camera
- All-weather drones
- Land and underwater laser drones
- Unmanned and labor-saving flow-observing equipment

Source: Foundation of River and Basin Integrated Communications

**Risk Management Type Water Level Gauge**

# 3. Technology Development

## (2) Utilization of Private Sector Technologies

4) Issuing verification certificates for new construction technology

- Public service corporations issue verification certificates for new construction technologies developed in the private sector.
- The public-service corporations also support the dissemination of such new technologies.
- A web system is operated to provide reference information for new technologies.

5) Bidding system

- The comprehensive bid evaluation method requires bidders to submit technical proposals. It has become the standard for the government to procure construction works and services.
- Each company conducts its own research and development.





# 4. Lessons Learned (1)

(1) To continuously secure human resources to manage water resources, the education system should be expanded in line with the development of society.

Various human resources with different specialties are required to manage water resources. The number of personnel need to increase with progress in infrastructure development. To meet these requirements, it is necessary to develop and successfully implement technologies transferred from developed countries and steadily expand the skills of human resources. It is also necessary to establish an education system to support technology and human networks.

(2) To develop skills by broadening the knowledge of human resources, off-JT and OJT should be positioned as the core for capacity development in water resource management.

It is effective in providing various opportunities and encouraging off-JT. The utilization of training programs would also be helpful.

## 8. Lessons Learned (2)

(3) To transfer technology to domestic administrators and engineers, financing from development agencies may provide good opportunities.

After World War II, Japan utilized loans from the World Bank for large-scale development projects. Western consultants were engaged as per the loan conditions of the World Bank. Japan utilized the opportunity to acquire knowledge and the latest technology to organize and manage large-scale projects.

(4) To meet social needs, the national government should lead technology development on the themes needed.

The national government takes the initiative to promote large-scale technology development that meets social needs and requires cooperation among the government, industry, and academia.







## 8. Lessons Learned (3)

(5) The national government should strive for the dissemination of research results.

It is important to establish unified technical standards that meet national requirements and share these standards among the parties concerned to ensure the quality of water resource management.

(6) The government can encourage the private sector to invest in research and development.

The Japanese government uses advanced technologies, including those from different fields, to rationalize water resource management through inviting research programs and technical proposal for bidding.

Back Covers Photos

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| 1. | | 2. |
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1. : Matsubara Dam, MLIT
2. : Ookozu Diversion Channel, MLIT
3. : Nagaragawa River Mouth Barrage, Japan Water Agency
4. : Yamada Weir (Traditional Construction Method of Intake Weir), Asakura City
5. : River-Town Planning (Kamisaigo River), Fukutsu City
6. : Clean Aid in Arakawa River, MLIT
7. : Tame River Basin Advisory Council, MLIT