

Theme 5

Urban Water Management

Integrated Response to Complex Problems



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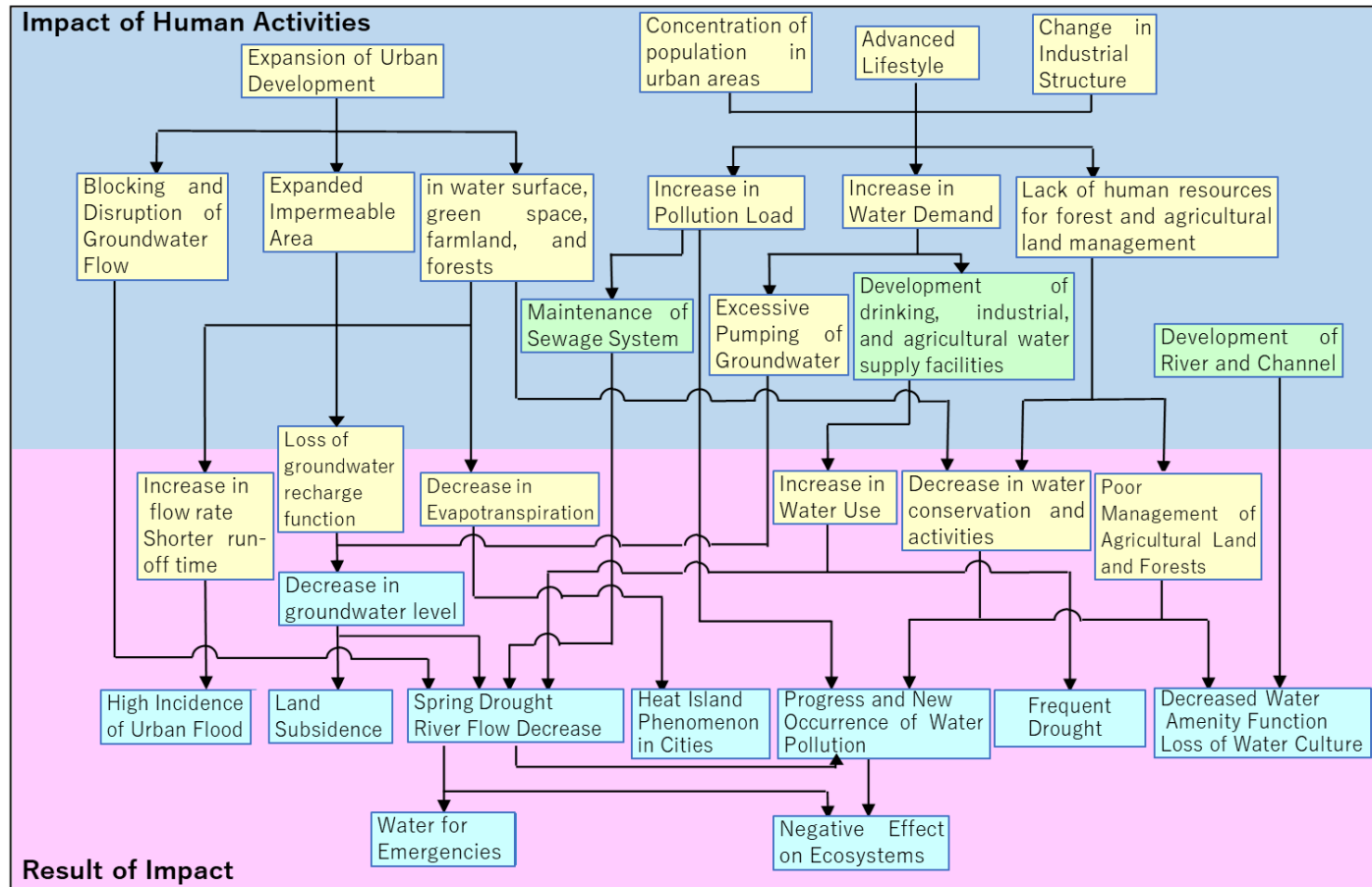
1. Introduction

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

Water Use

Water supply fee system

Water saving faucet spindle

Reduce leakage ratio

Reuse grey water

Treated wastewater

Reuse industrial water

Rainwater storage

Desalination

Flood Protection

River improvement

Multi-purpose detention basin

Underground River

Underground Water Storage

Permeable pavement

Environment

Nature-oriented river

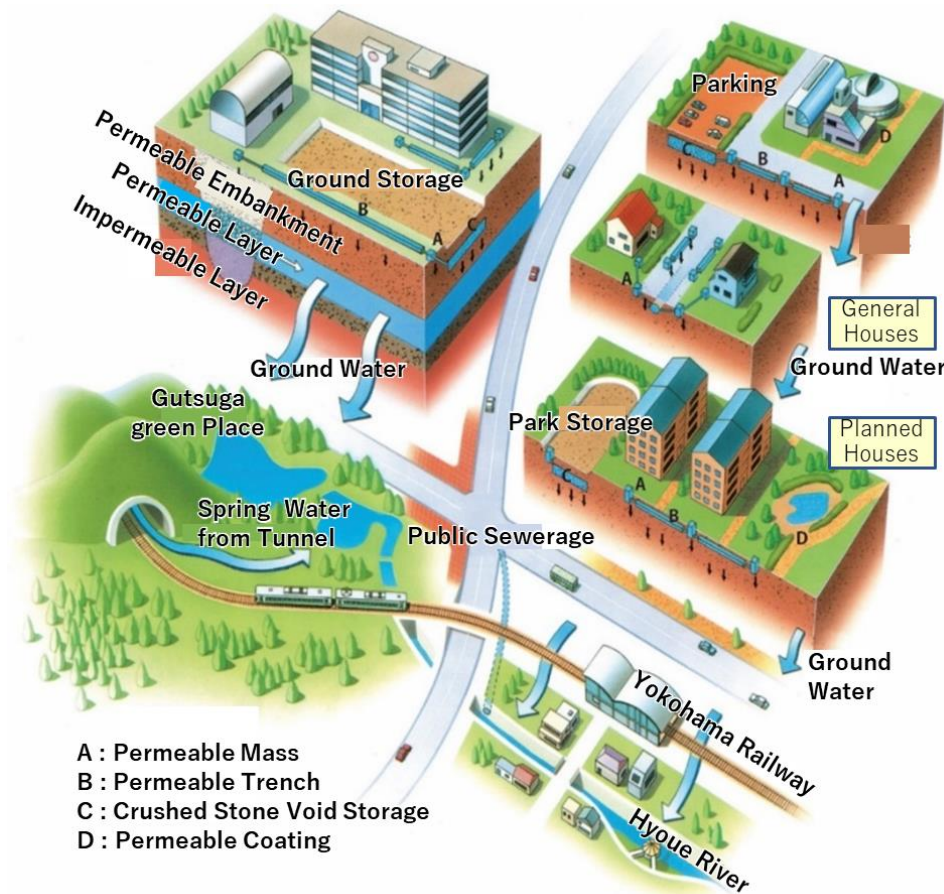
Sewerage Maintenance

Awareness raising activities

Nature-oriented River Works

2. Water Cycle in Urban Area

Development of Hachioji Minamino City



Flood peak discharge reduced by 20~40%

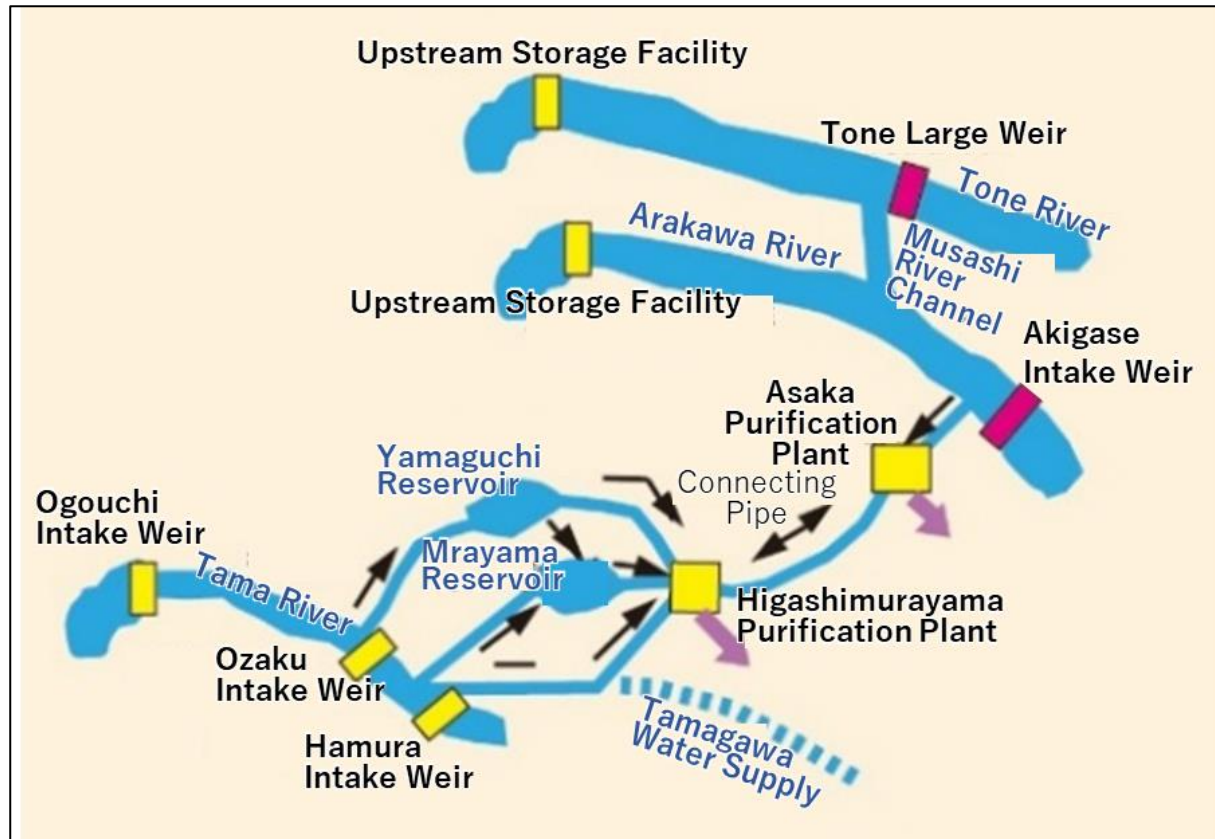
Drought discharge increased by 1.5 ~ 2 times

Source: UR x Green Infrastructure Case Studies UR Agency

Hachioji Minamino City Water Cycle Regeneration System

3. Water Utilization Efforts

(1) Controlling Water Use

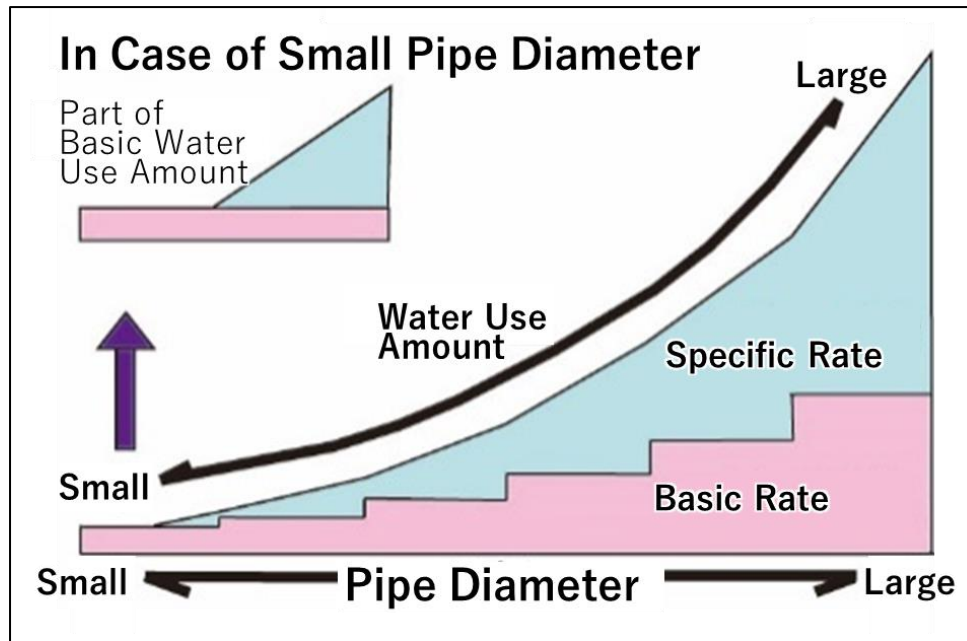


Source: Tokyo Metropolitan Government Bureau of Waterworks website

Wide-area Water Resources Utilization

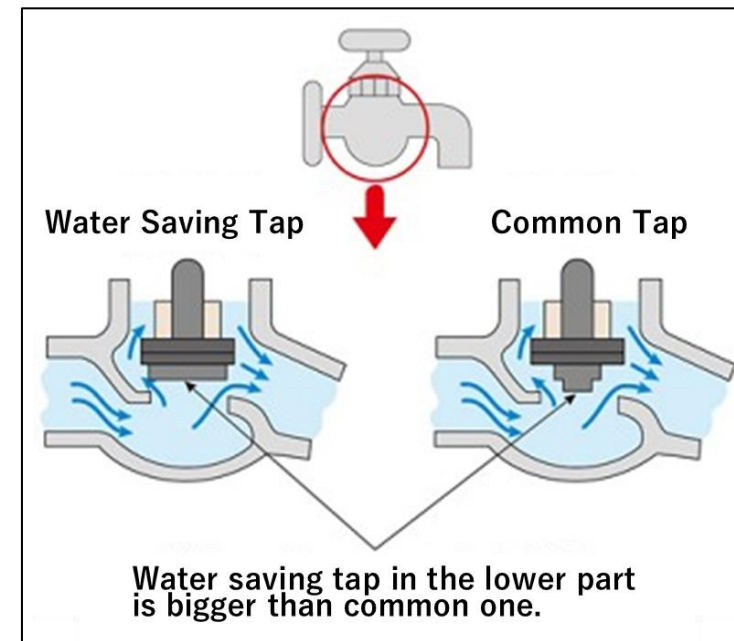
3. Water Utilization Efforts

(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

Awareness-raising activities



Mizu-iku

Mascot character

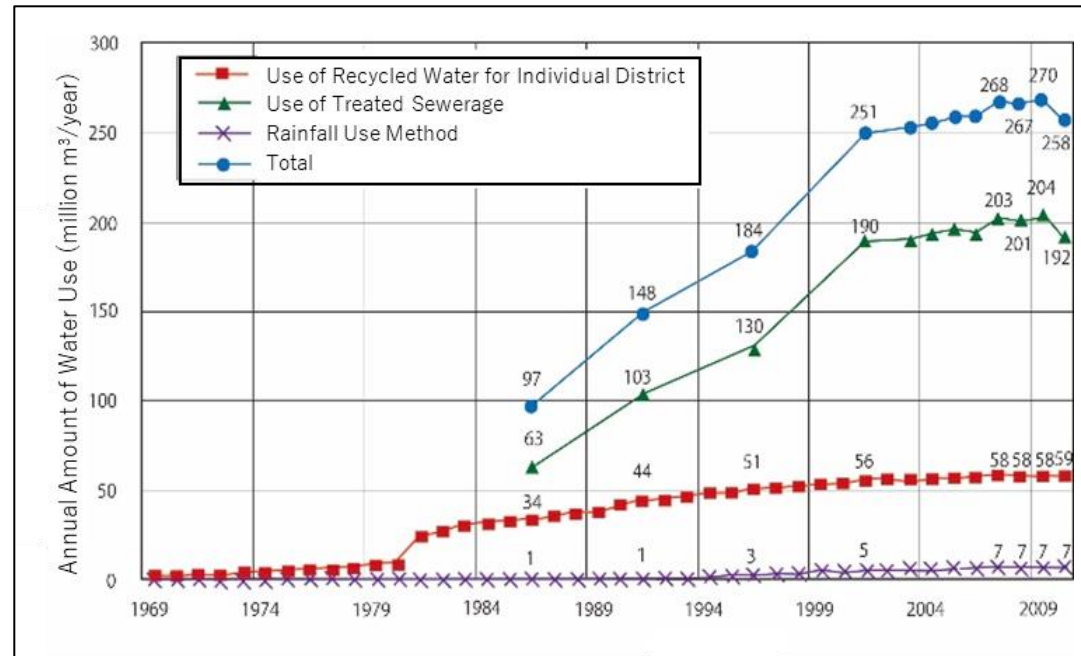
Public Relations Activities

Water Day

Eco-Mark System

Water Saving Campaigns

Source: Kumamoto City Website



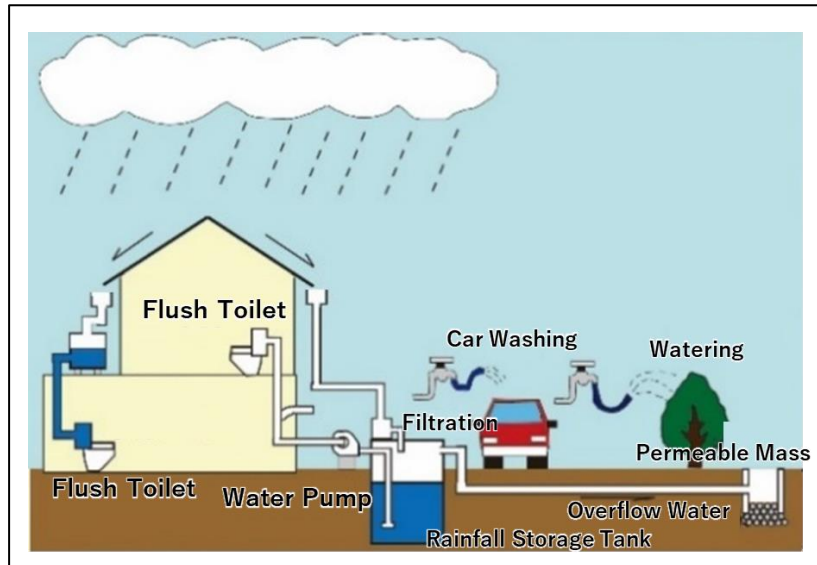
Source: Japan's Water Resources (2013), MLIT

Trends in Rainwater and Recycled Water Use

3. Water Utilization Efforts

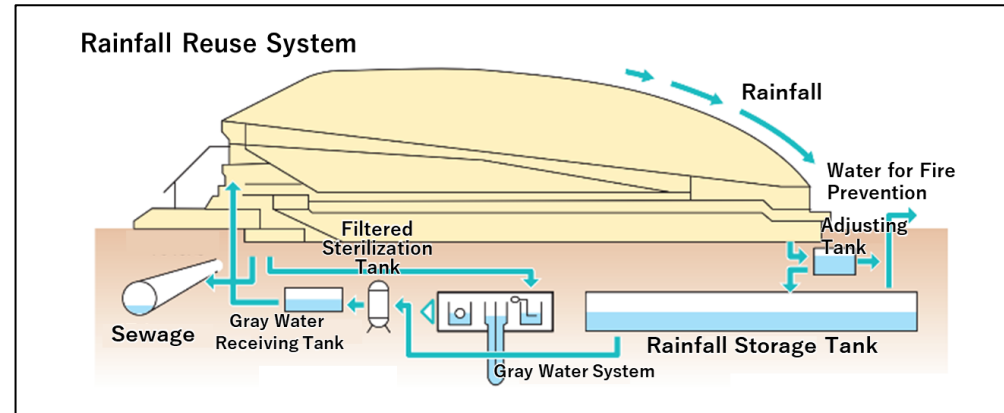
(1) Controlling Water Use

Using Miscellaneous Water



Source: Sumida Ward Website

Rainwater Reuse



Source: Rainwater Use Case Studies, MLIT

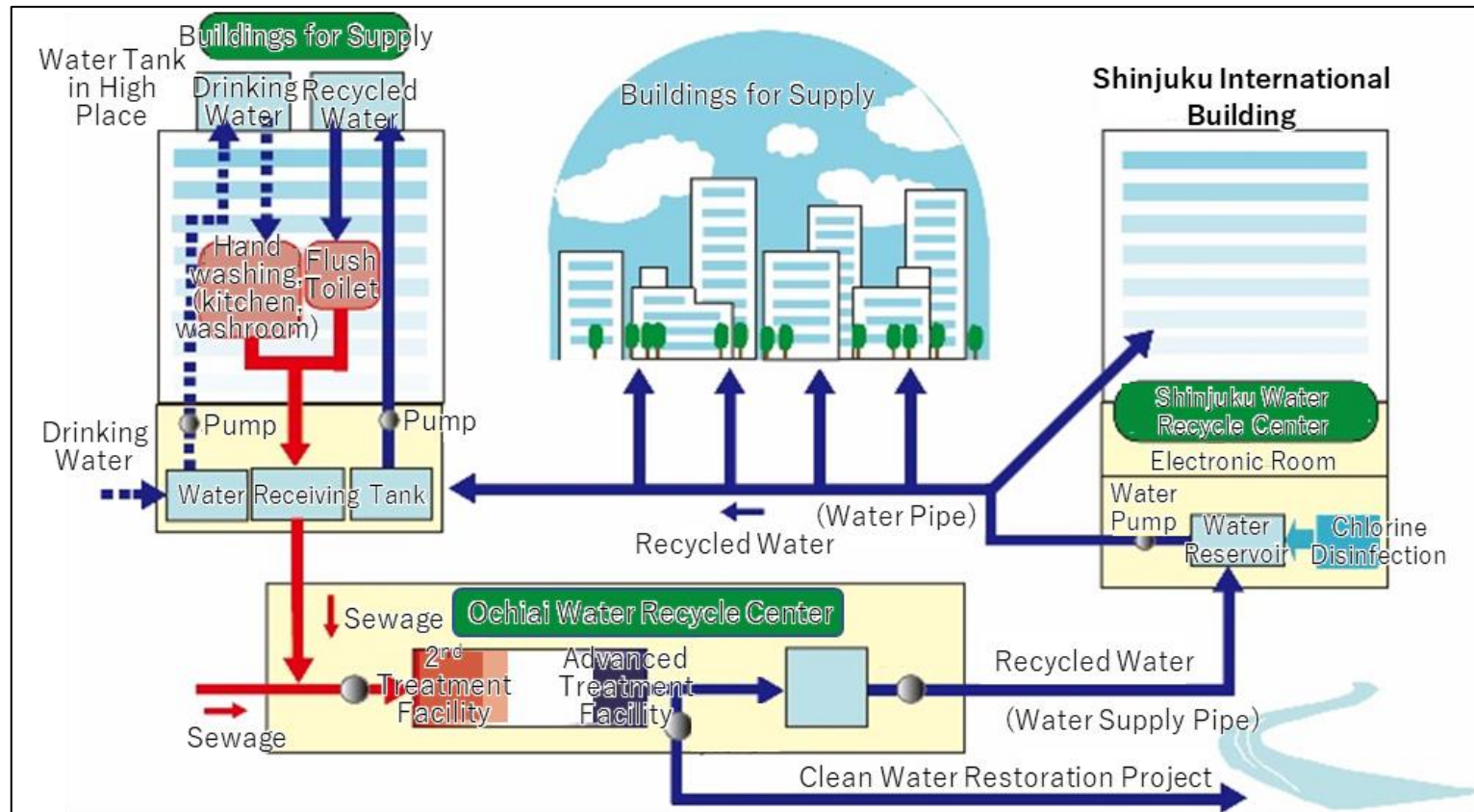
Rainwater Use at Tokyo Dome

- Underground storage tank (3,000 m³)
- Toilet flushing, firefighting
- 30% rainwater utilization rate

3. Water Utilization Efforts

(1) Controlling Water Use

Using Miscellaneous Water

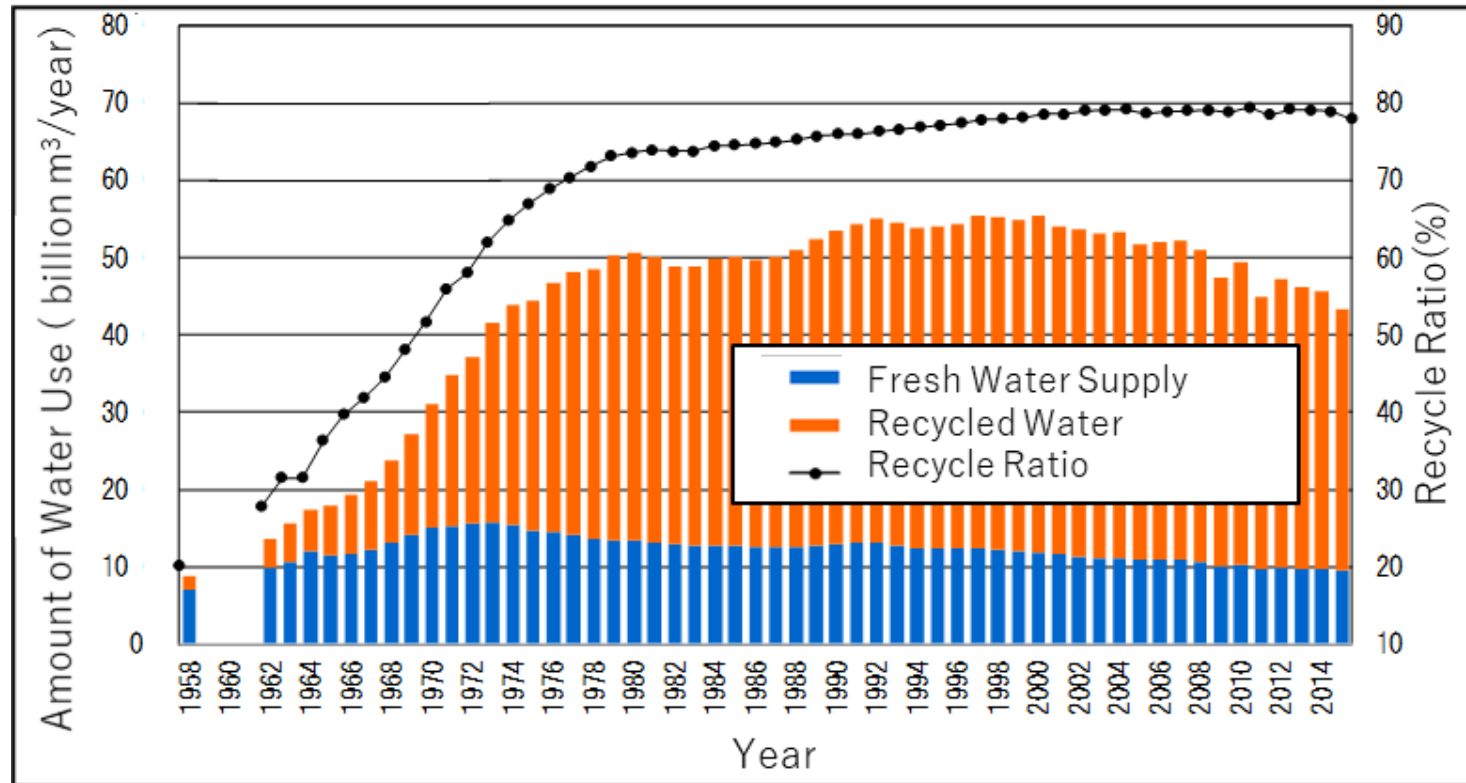


Source: Tokyo Metropolitan Government Bureau of Sewerage

Recycled Water Supply System (Nishi-Shinjuku and Nakano-Sakaue Area)

3. Water Utilization Efforts

(1) Controlling Water Use

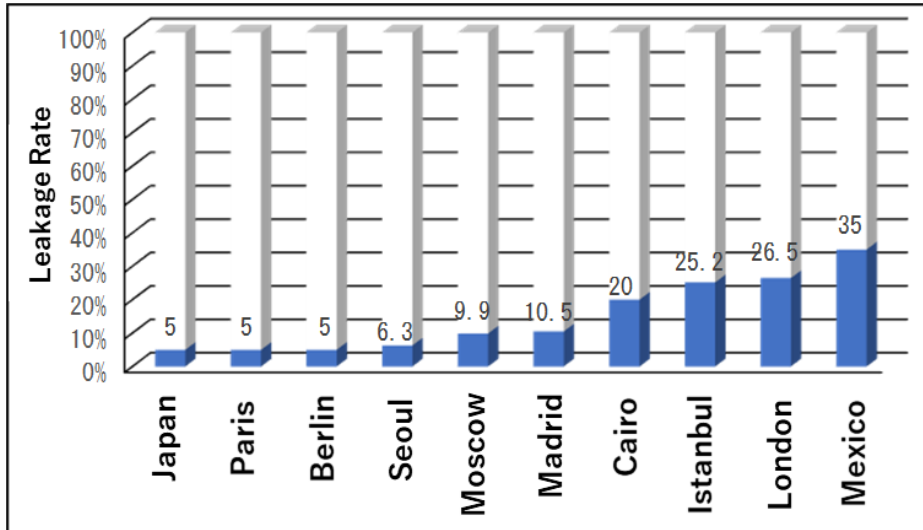


Source: Statistics from the Ministry of Economy, Trade and Industry

Changes in Industrial Water Usage

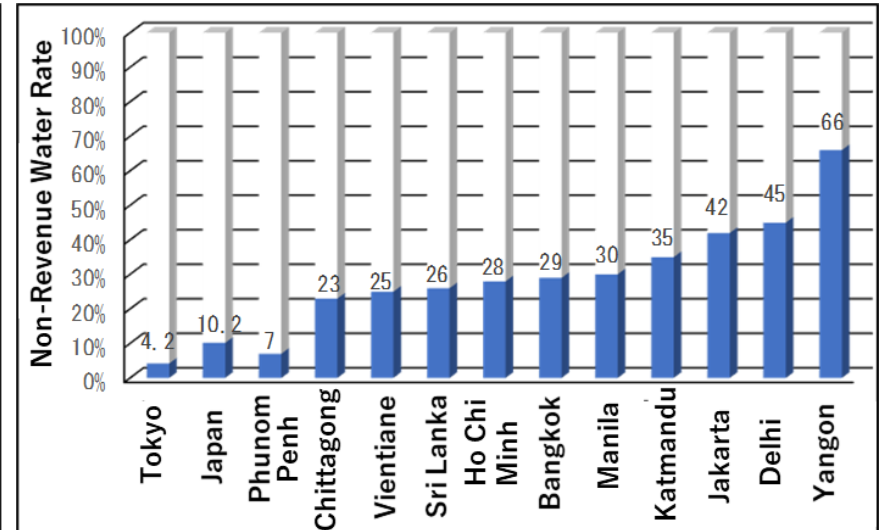
3. Water Utilization Efforts

(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 Countries

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 scarce water resources -> **desalination** is viable option

Cost

- For 10,000 m³/day capacity or more:
- Construction cost: 100-200 1000 yen per 1m³/day
- Production cost: 100~150 yen /m³

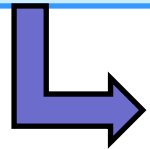
Japan:

- 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**



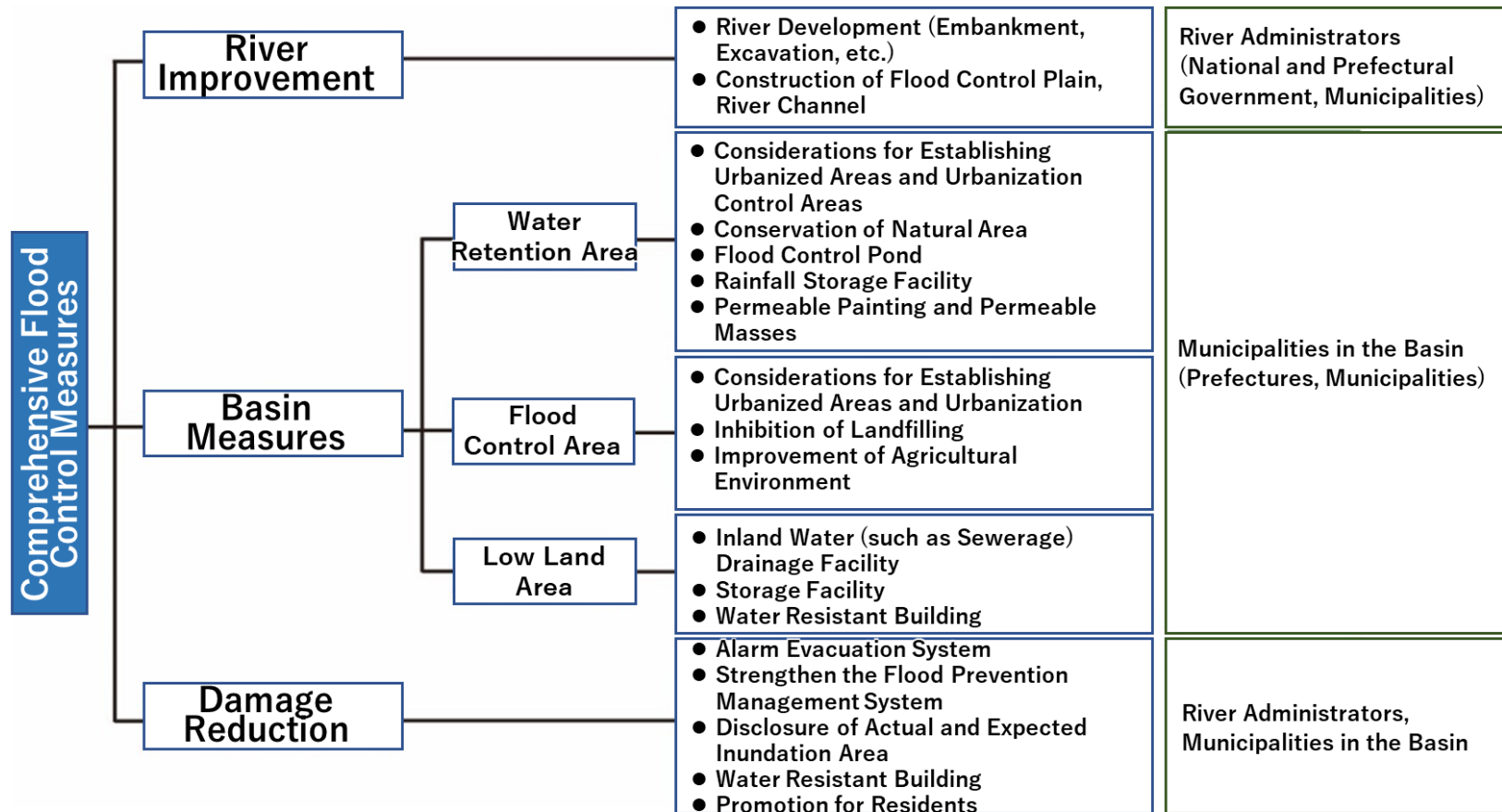
Comprehensive Flood Protection Measure

Act on Countermeasures against Flood Damage of Specified Rivers running across Cities

4. Flood Protection Efforts

(1) Implementation of Comprehensive Flood Protection

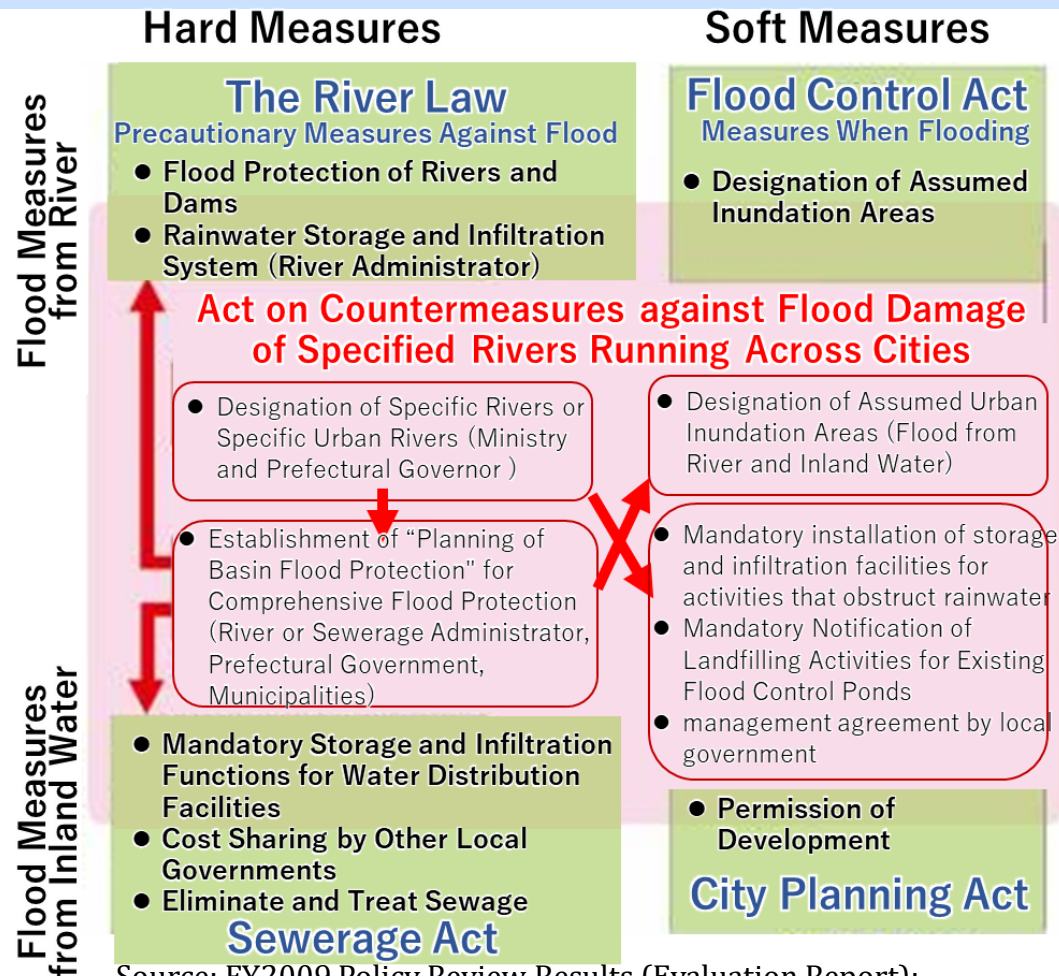
“Promotion of Comprehensive Flood Protection Measure” in 17 rivers (1980)



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

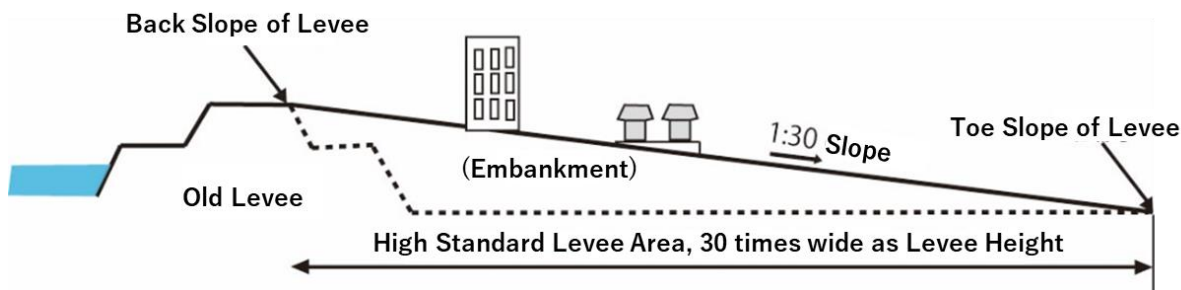


Source: MLIT Shinano River Downstream Office Website



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)

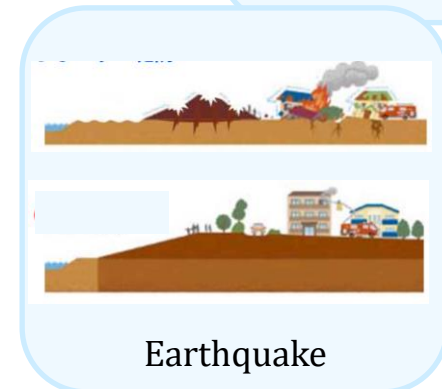
High Standard Levee Concept Diagram



Overtop



Infiltration

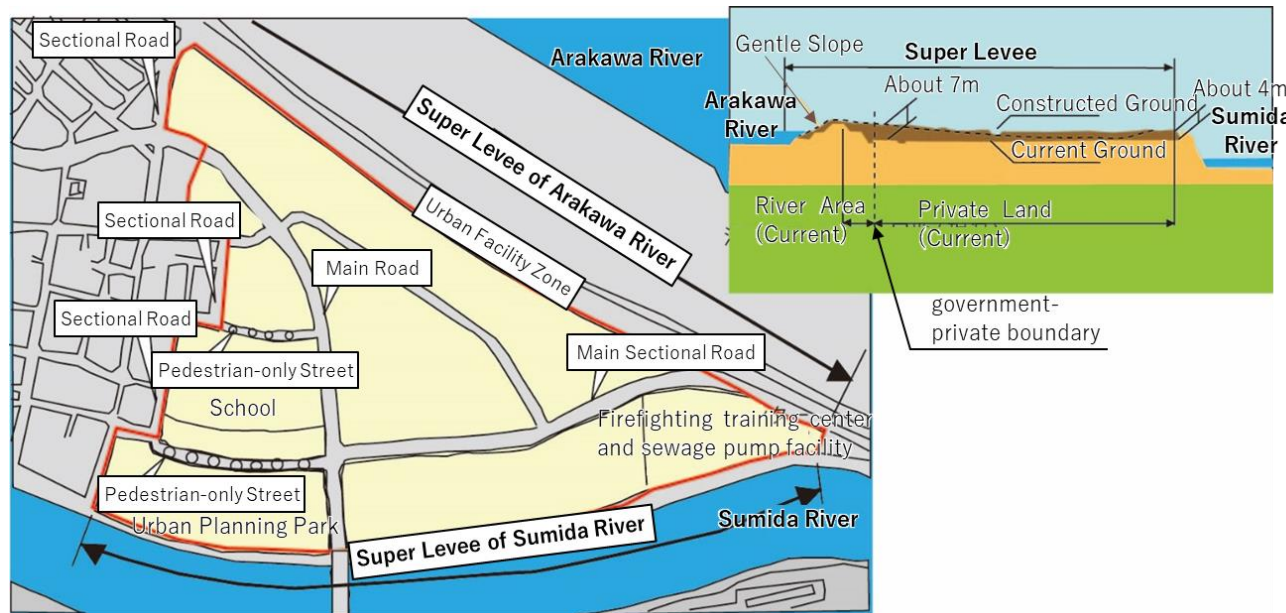


Earthquake

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

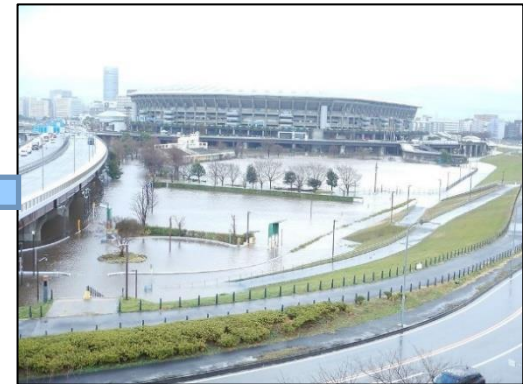
➤ Effective for temporarily storing flood water



- 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



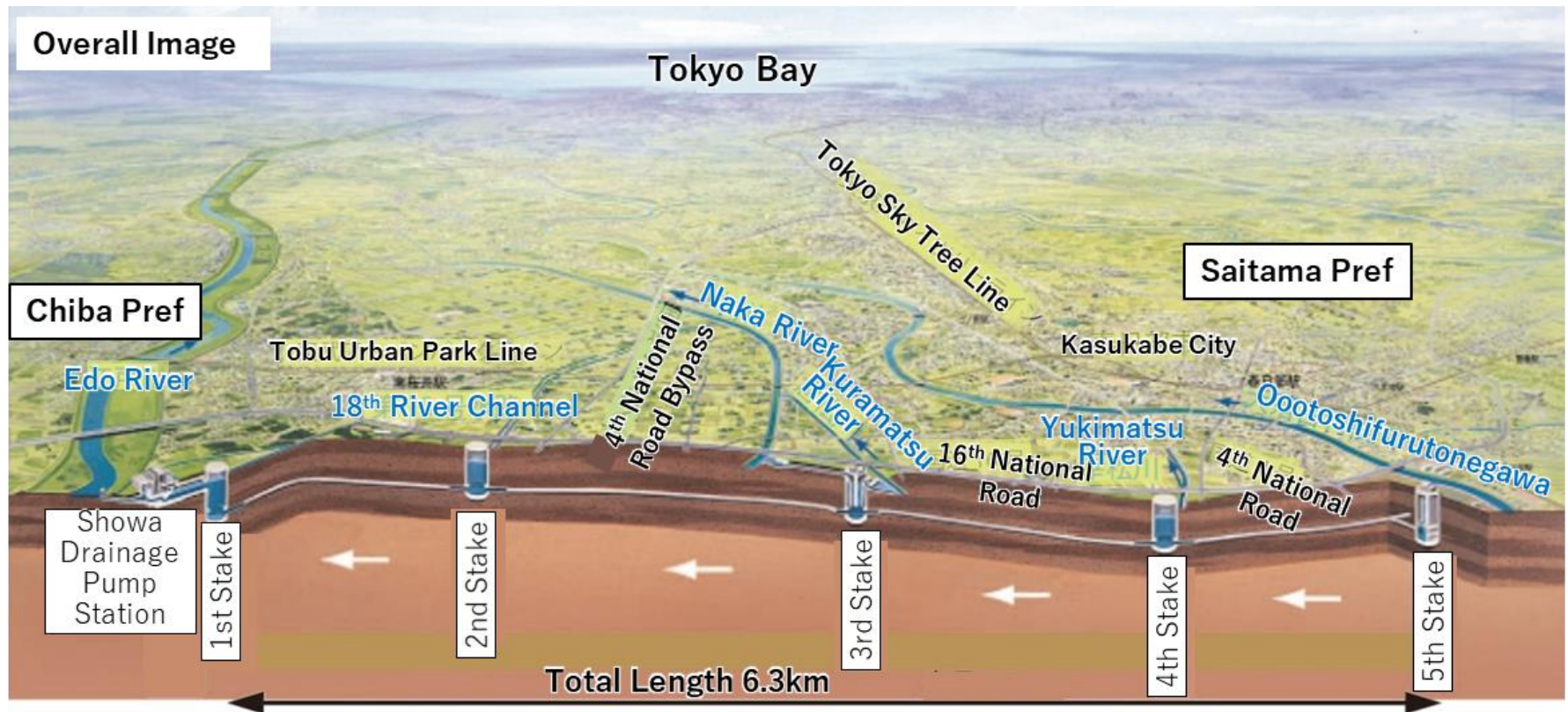
Source: Tsurumi River Multipurpose Retarding Basin Pamphlet (edited) Source: MLIT Keihin River Office Facebook

Tsurumi River Multipurpose Retarding Basin

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

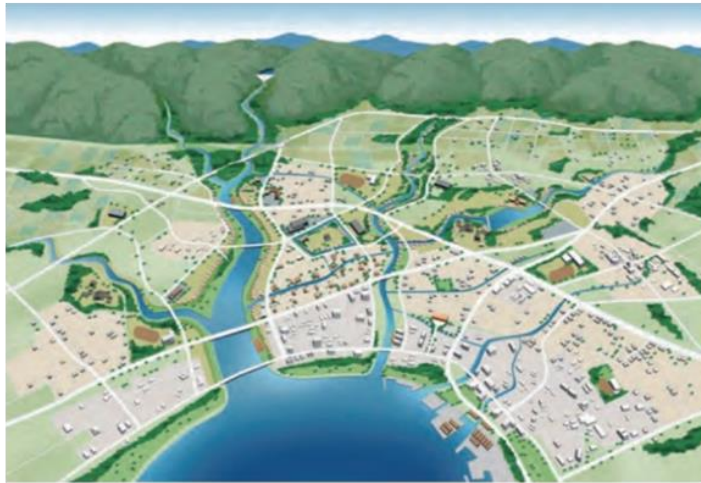


Frequently used for environmental studies by children

Source: River Law Amendment 20 Years Nature-friendly River Management Promotion Committee, 1st Pamphlet: Specific Examples of Nature-friendly River Management (No. 1), MLIT

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



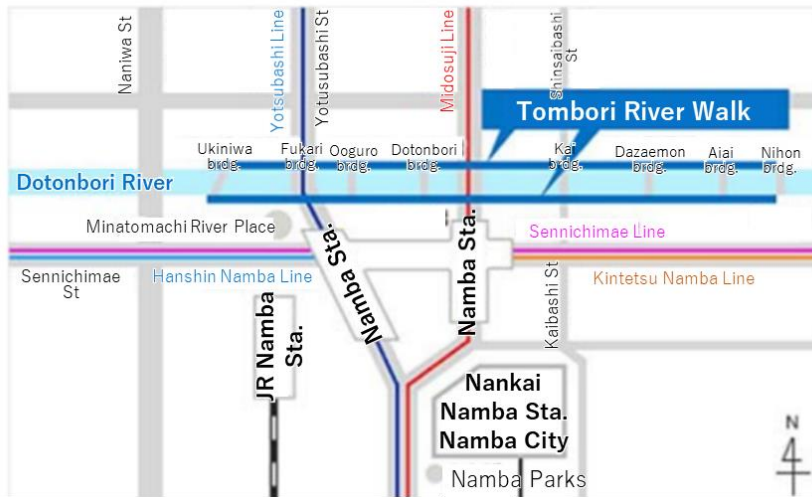
Marche, Morning and Night
Market



Park Field

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

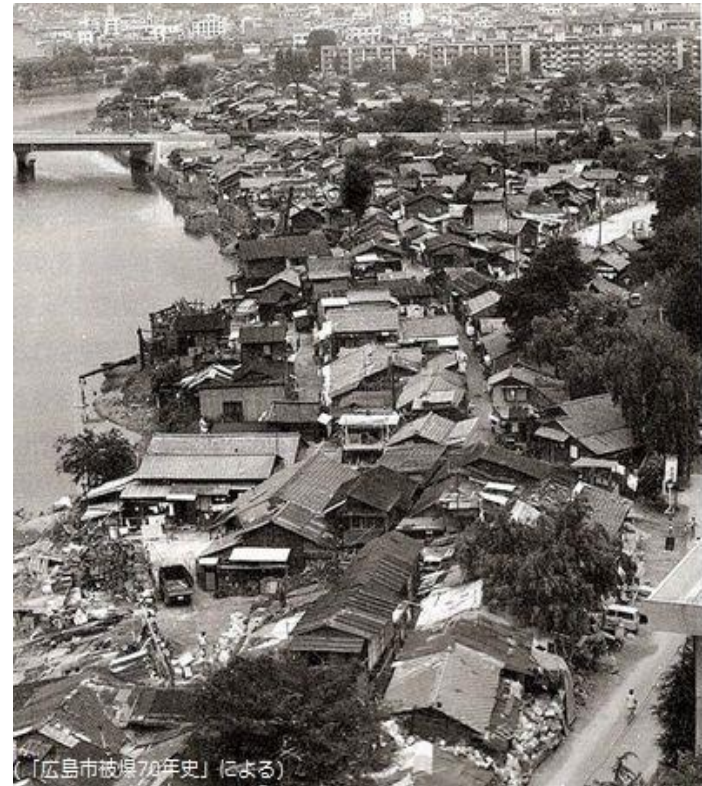
“Atomic Bomb Slums”

Many people (victims & repatriates) living in barracks build on riverside



Coping with Housing Shortage

- 4500 high-rise housing constructed
- Parks & riverside spaces secured



(「広島市被爆70年史」による)

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



Source: Efforts to respond to homelessness in the lower Arakawa River, Arakawa River Office, Onagi River Sub-branch, Ooyama Takeshi, MLIT Material

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.