Executive Summary

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

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

Explanation of Each Field

Theme 10	Development of Human Resources and Technology

Capacity Development

Contents of Executive Summary

1. Introduction
2. Summary of Each Theme

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

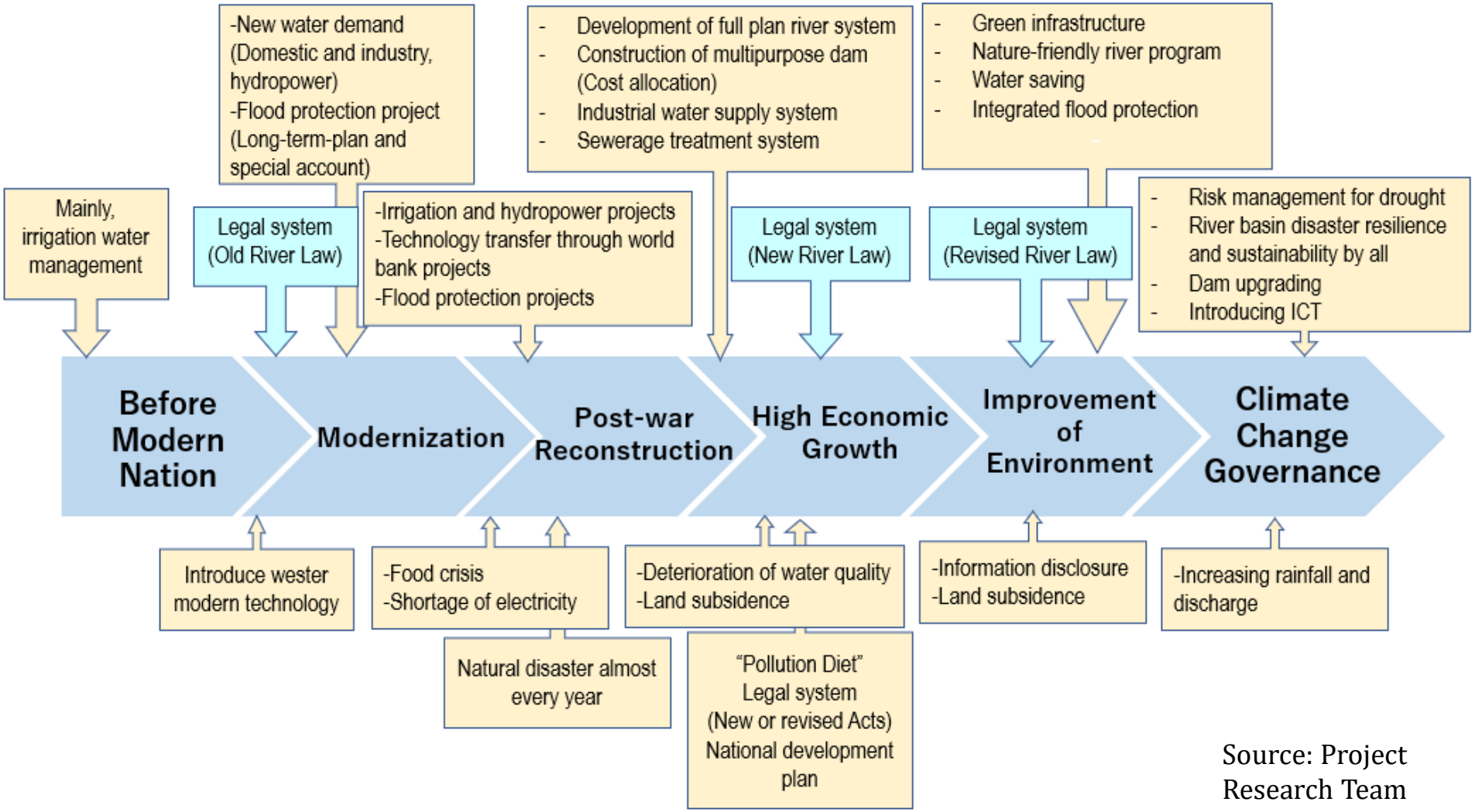
1. Introduction (3)

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)

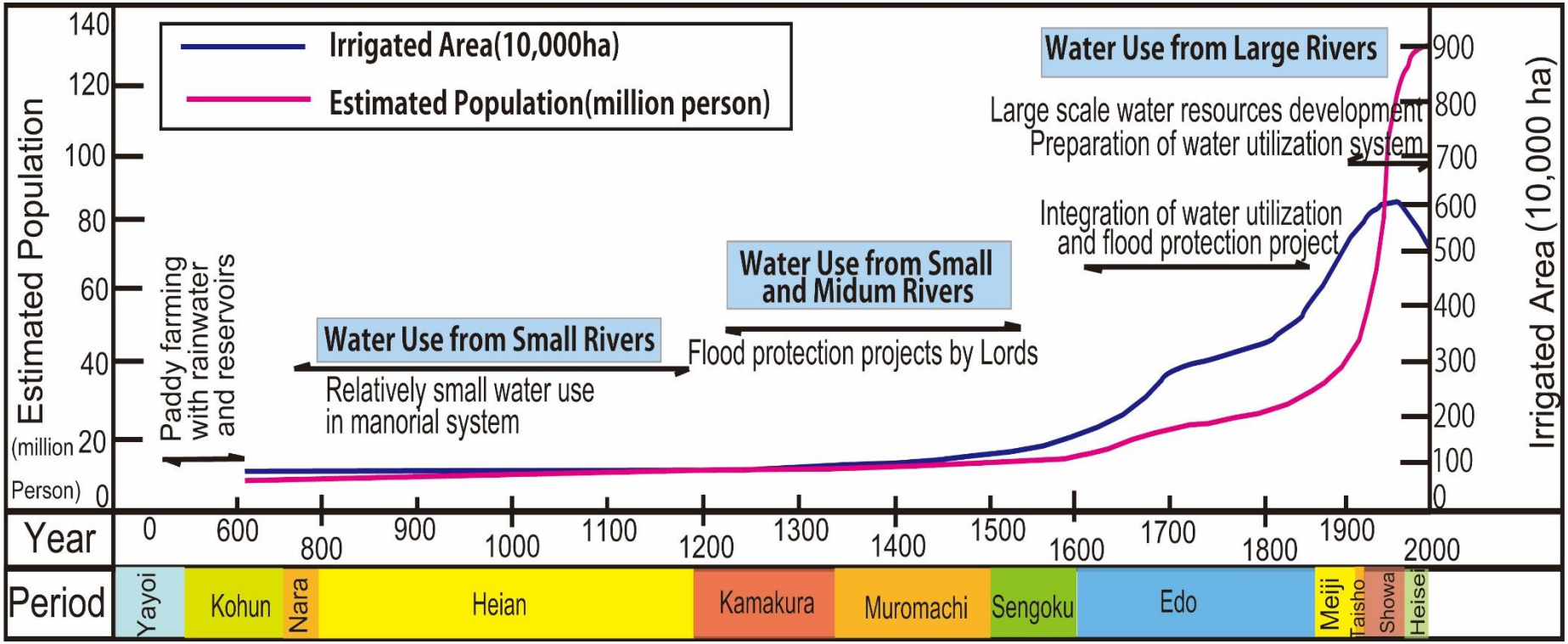


Source: Project Research Team

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

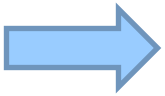
New River Law (1964)

- 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.

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)

1.1 Evolving Management of Water Resources (9)

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

Matsubara-Shimouke Dams
Affected People
Rebuilding Submerged Communities

- Act on Special Measures for Water Source Area

Nagaragawa River Mouth Barrage
Civil Society Organization
Environmental Problems

- Change in Water Governance
- Information Disclosure, Transparency, Accountability

Yanba Dam
Dam Policy and Science Debate

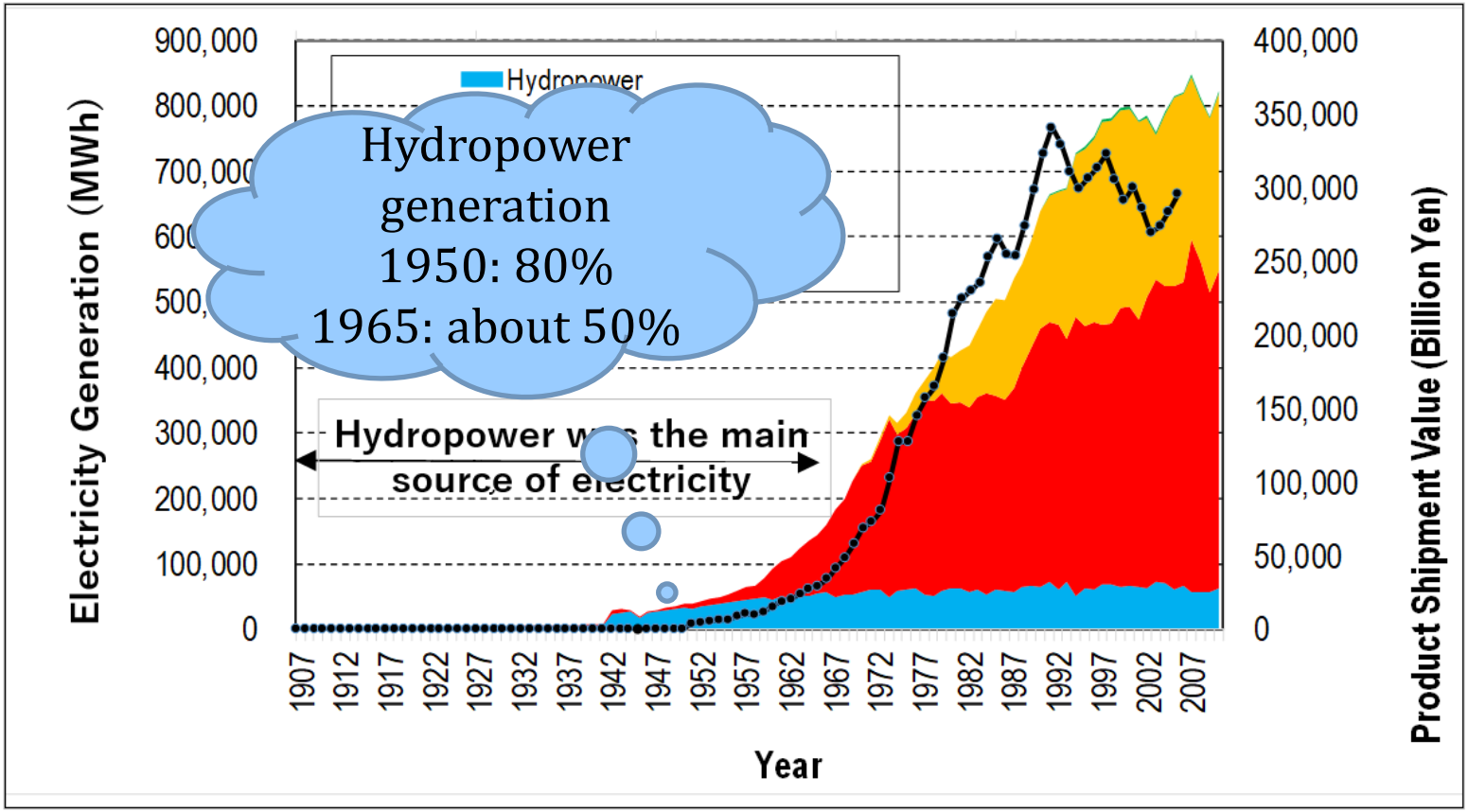
- Policy debate on Flood Protection and Environment
- Re-evaluation based on Scientific Data

Three Projects Affected on Consensus Building

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

Water resources management contributed to the quality improvement.

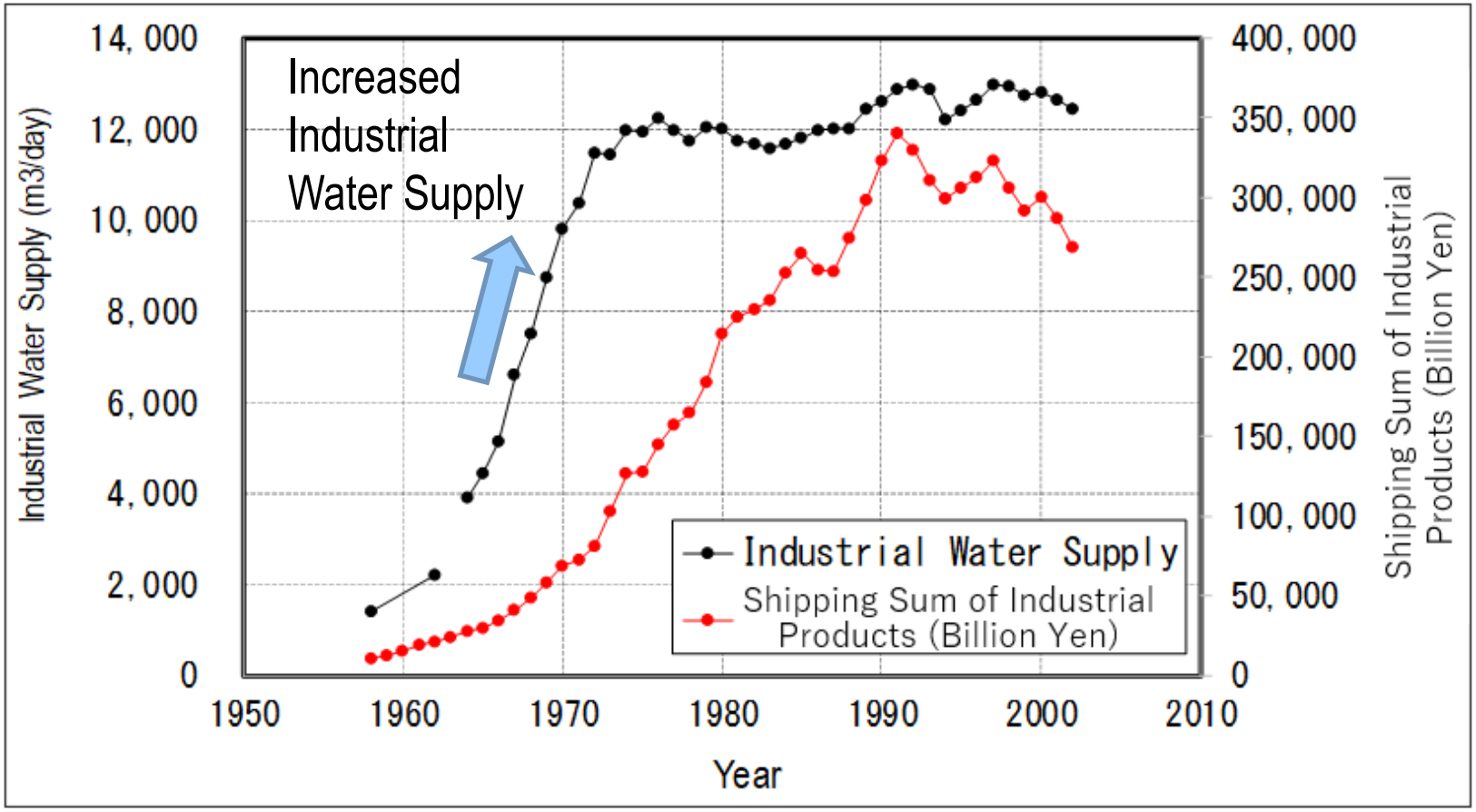
Energy Sector: Hydropower was the main source of electricity until 1965.



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)

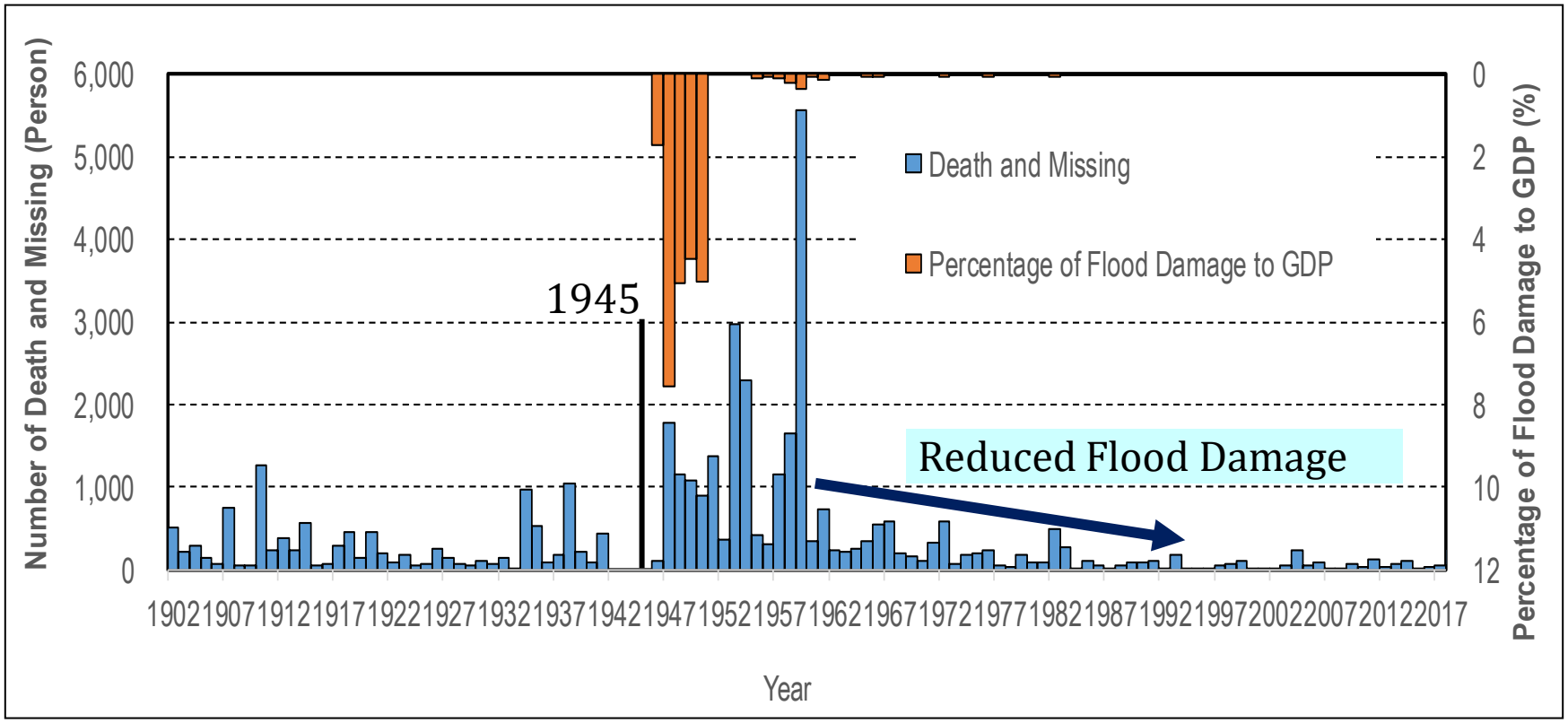


Trend of Industrial Water Supply and Shipping Sum of Industrial Products

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

(1) Social Resilience

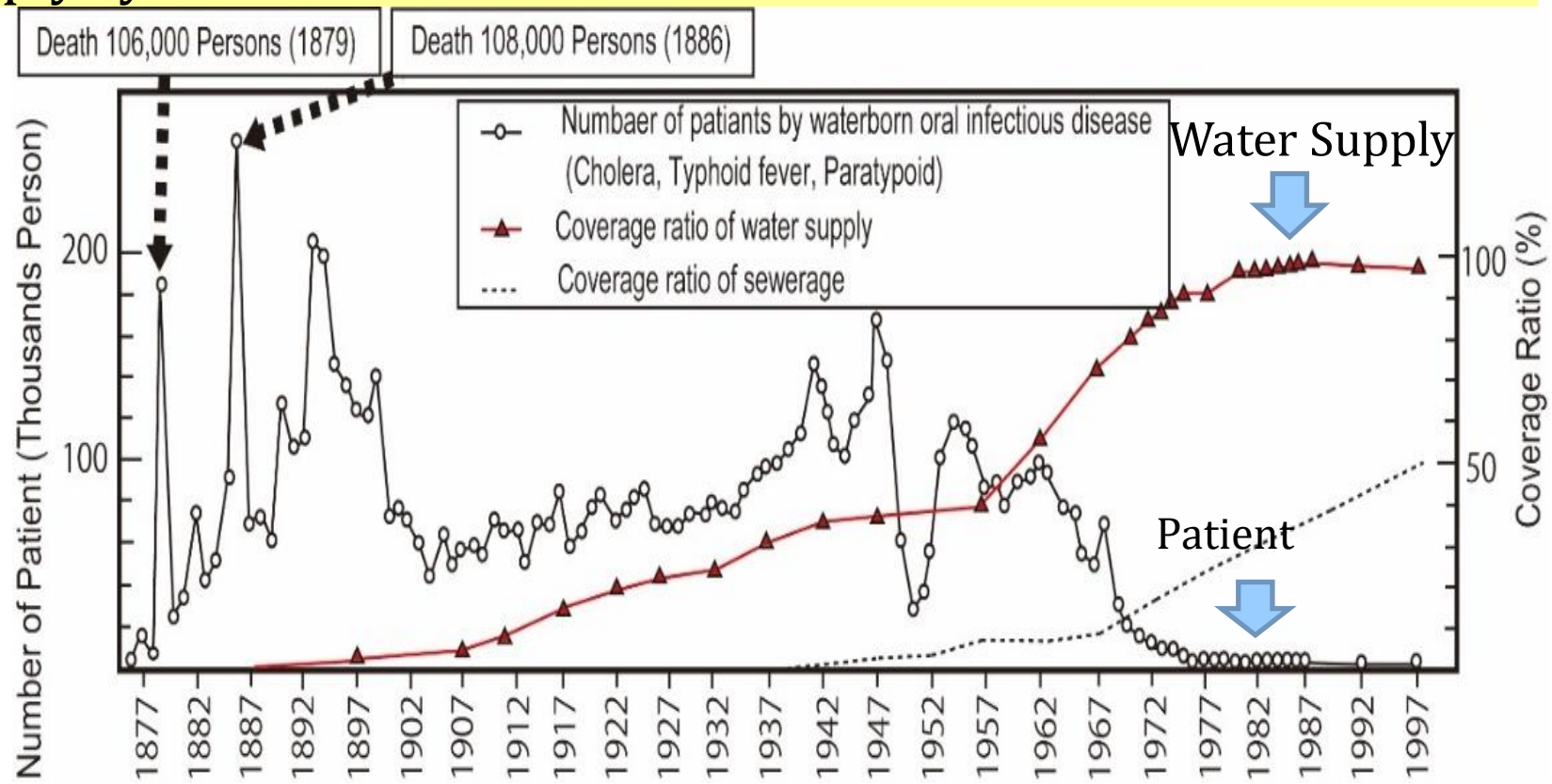
The investment in the flood protection reduced the flood damages.



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.



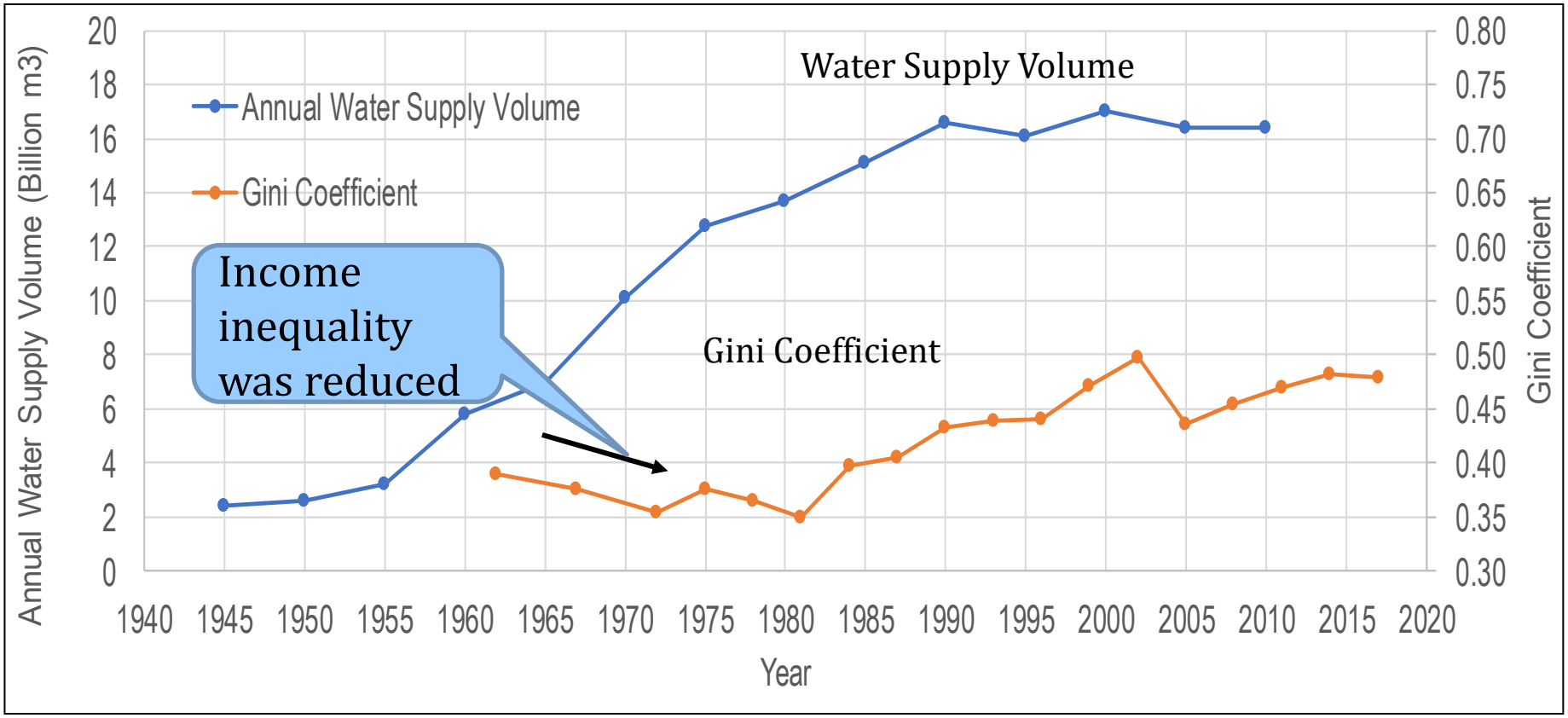
Source: Urban Development and Public Health, Nakatsuji Hideji, WHO in sight No.44(2010)

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

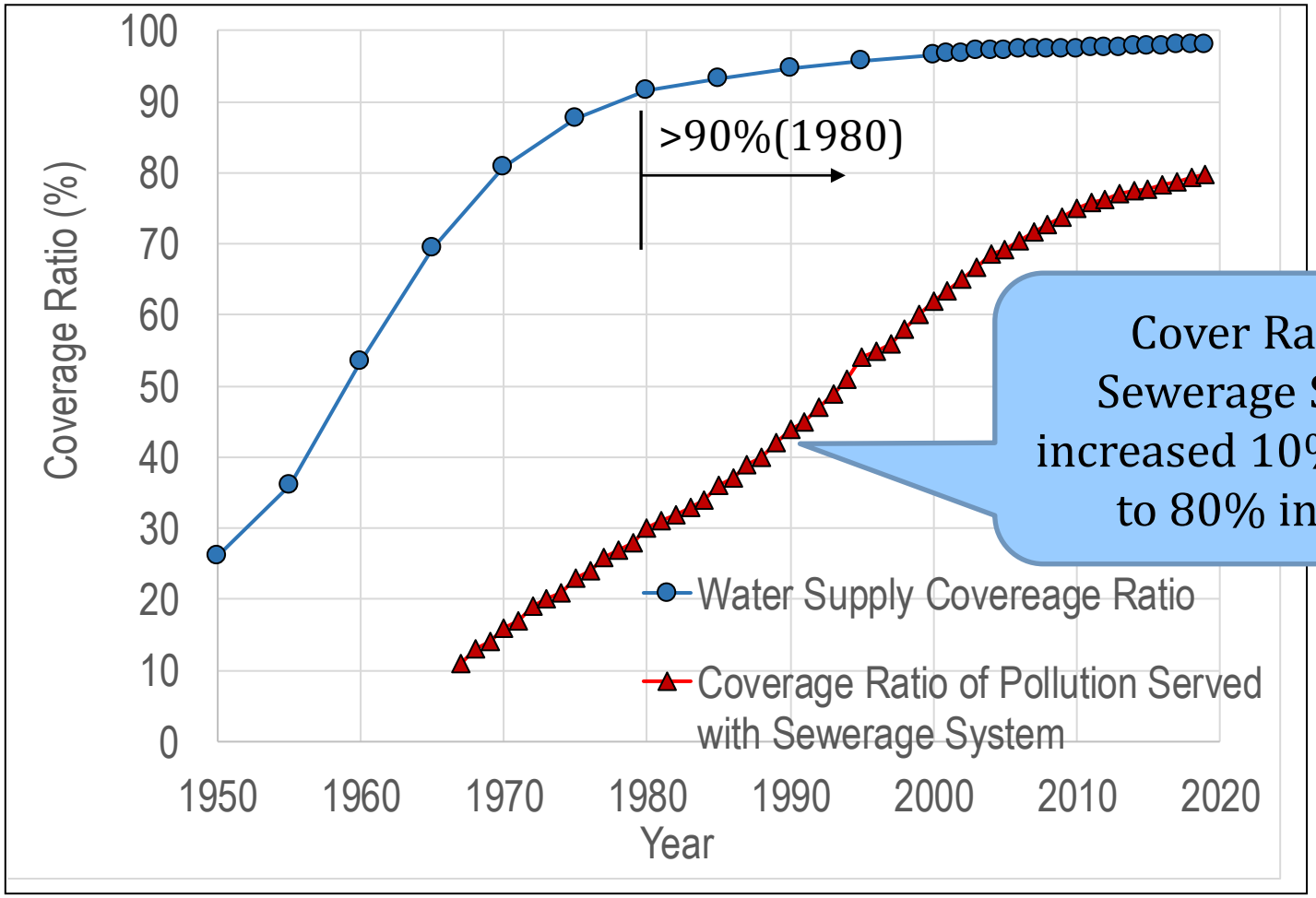
The improved water supply and flood protection supported urban development and mitigated regional disparities.



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.

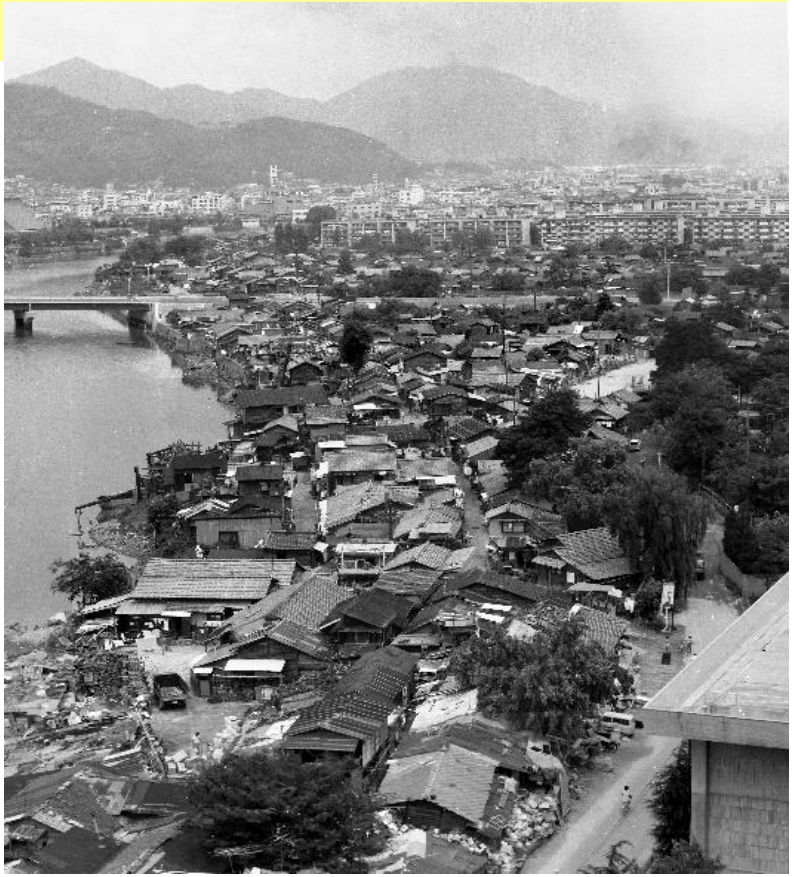


Water Supply and Sewerage Coverage Ratio

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

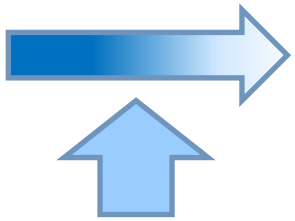
Atomic Bomb Slum in Hirosima

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

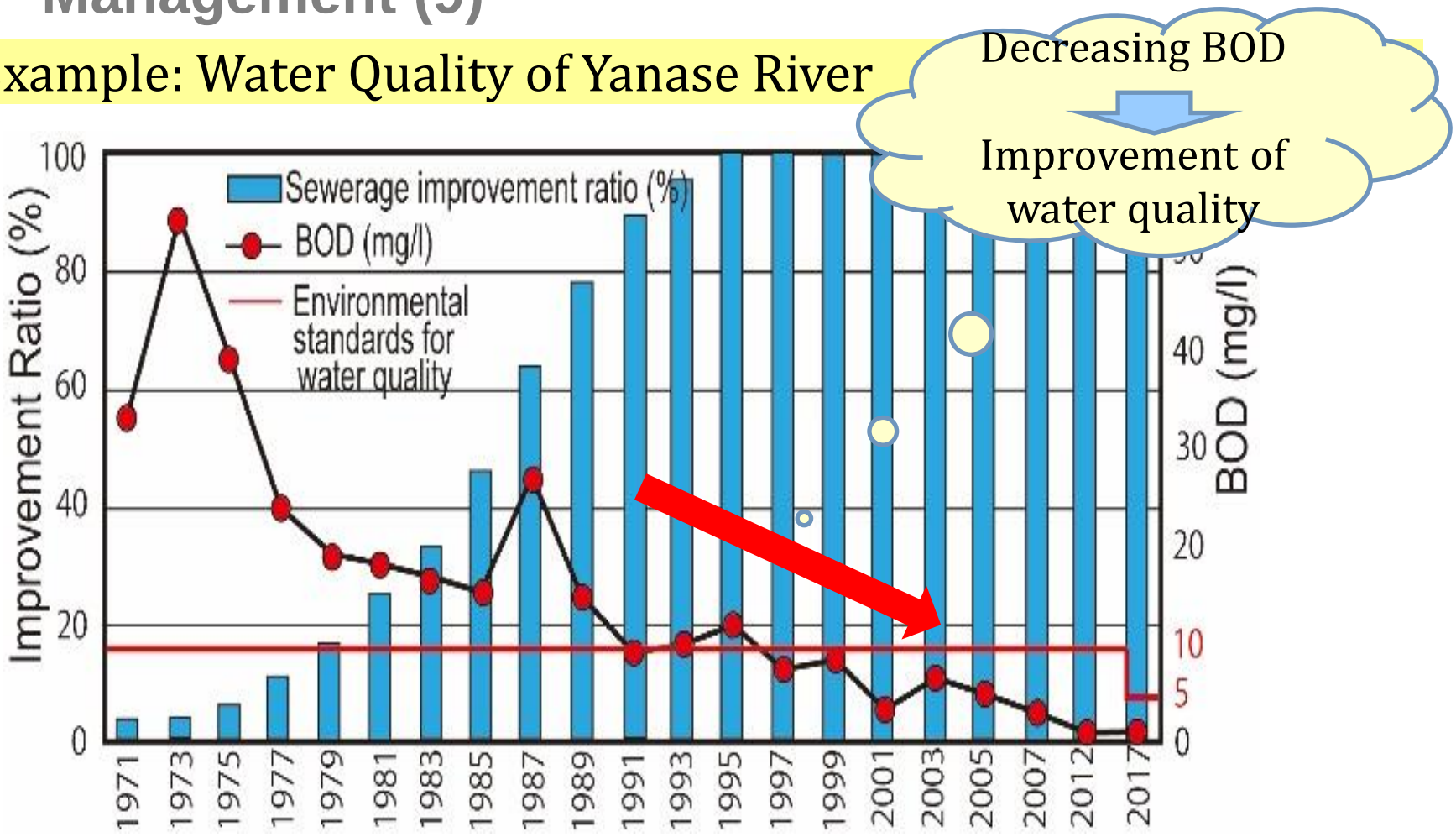


- Improvement of Water Quality

- Effluent control
- Promotion of sewerage system

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

Example: Water Quality of Yanase River

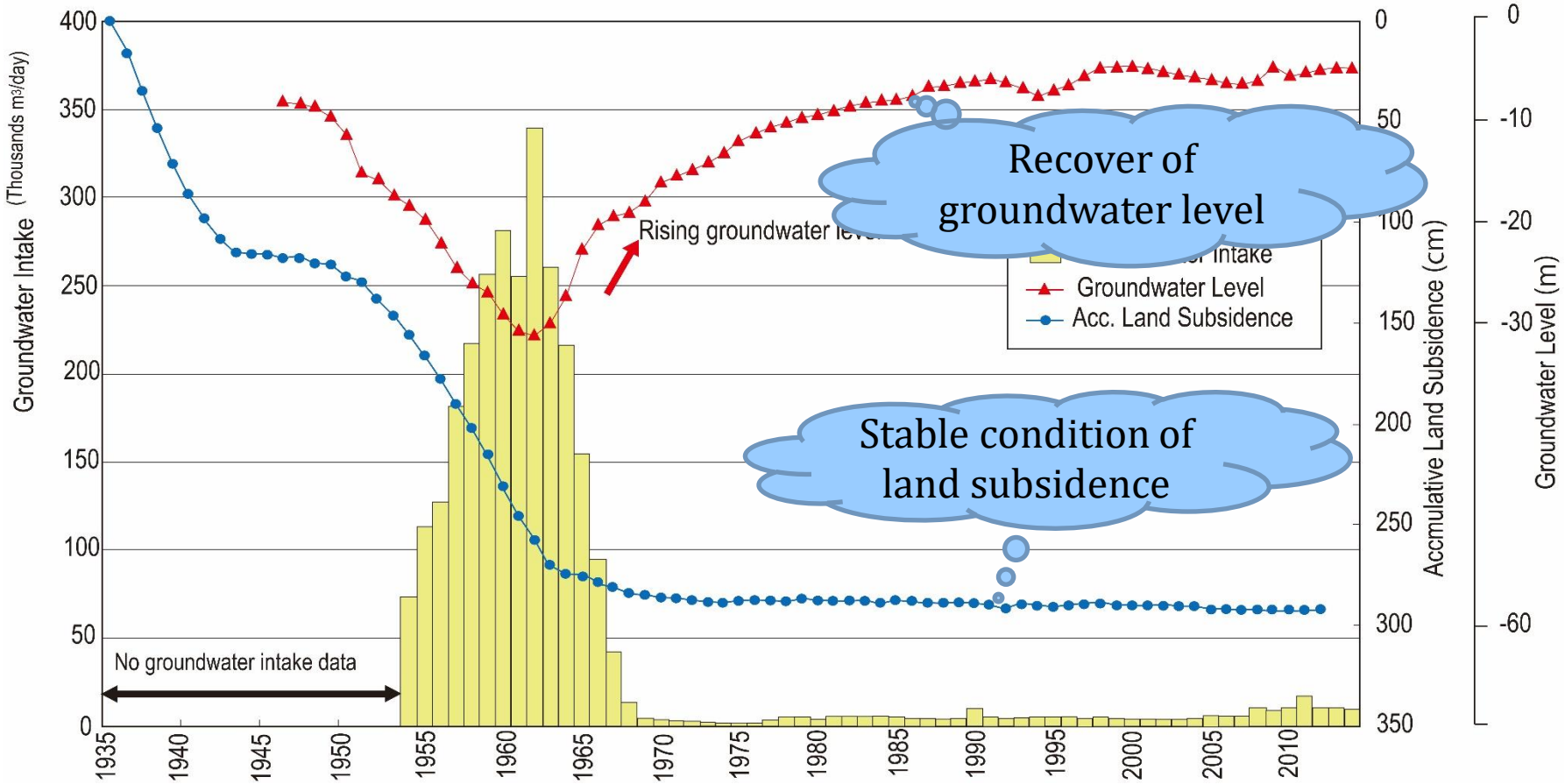


Water Quality of Yanase River and Sewerage Coverage Ratio

Source: Bureau of Sewerage, Tokyo Metropolitan Government

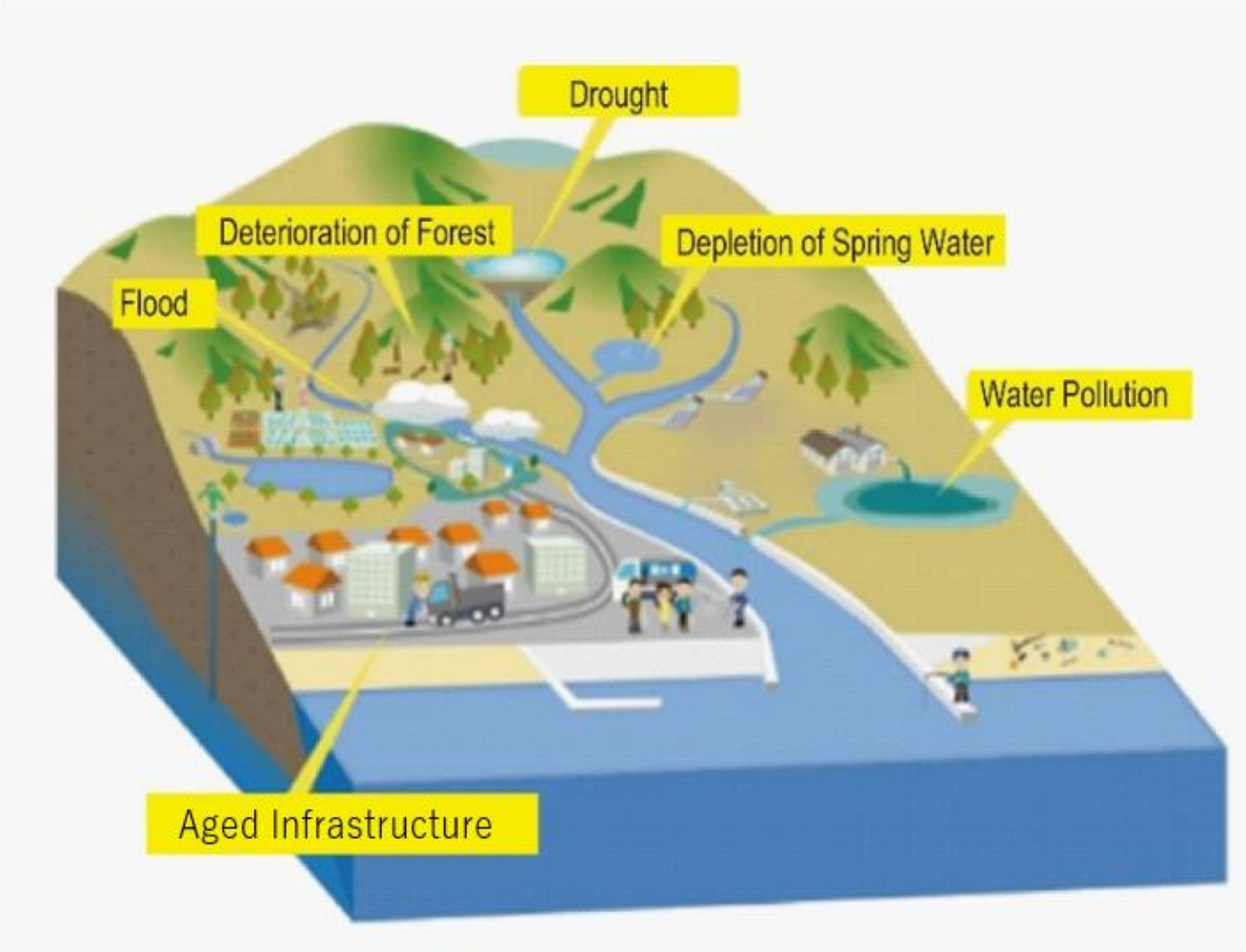
1.2 Japan's Accomplishment in Water Resources Management (10)

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

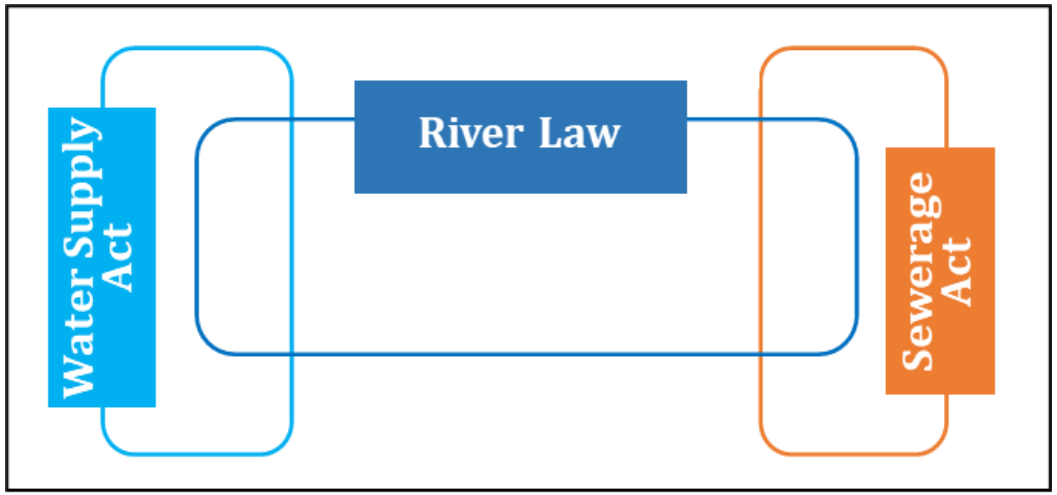
Legal and organization system

→ **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



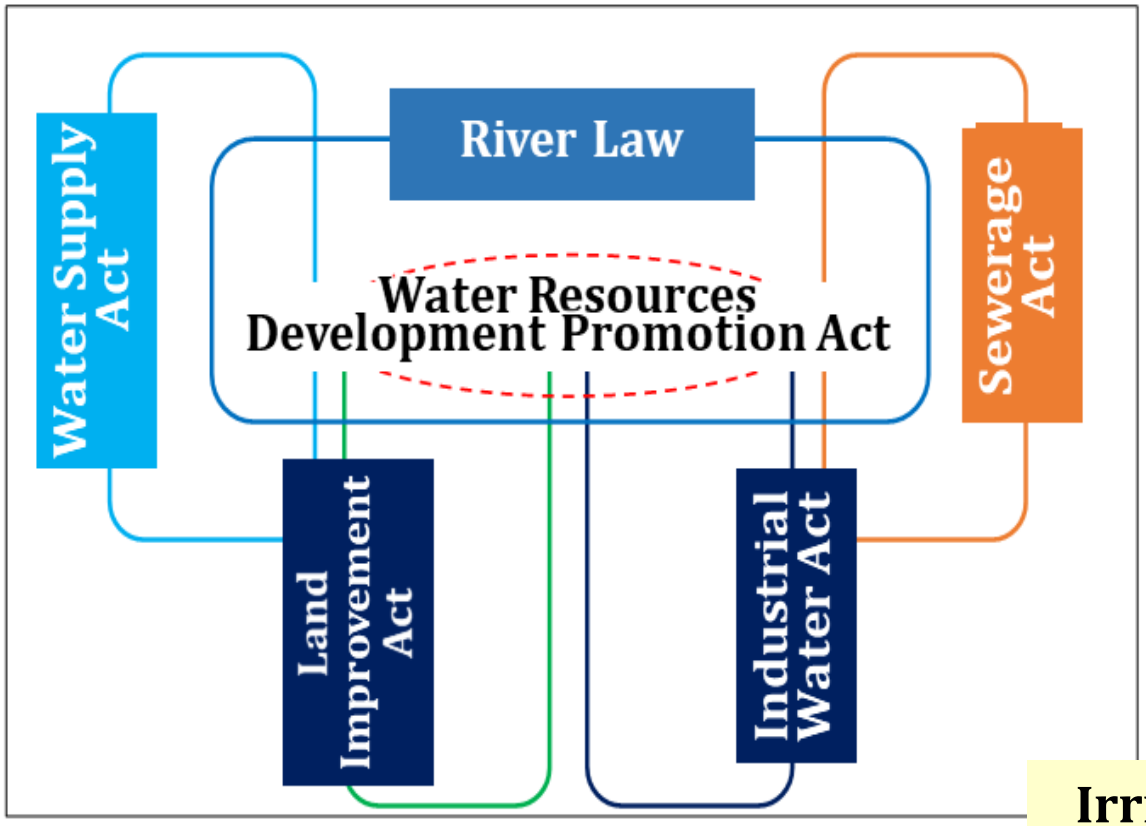
Flood Prevention and Public Health

Flood Protection
1896 Old River Law

For Public Health
1890 Water Supply Act
1900 Sewerage Act

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

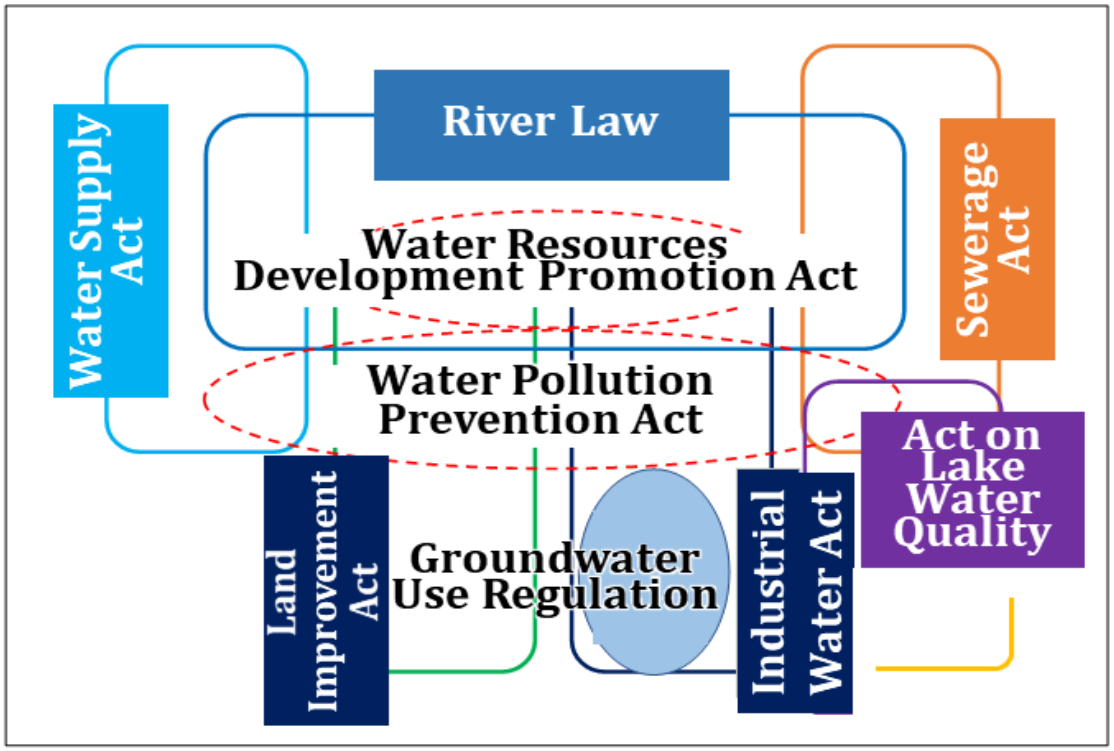
1964 New River Law

Irrigation and Water Supply

1949 Land Improvement Act
1956 Industrial Water Act

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

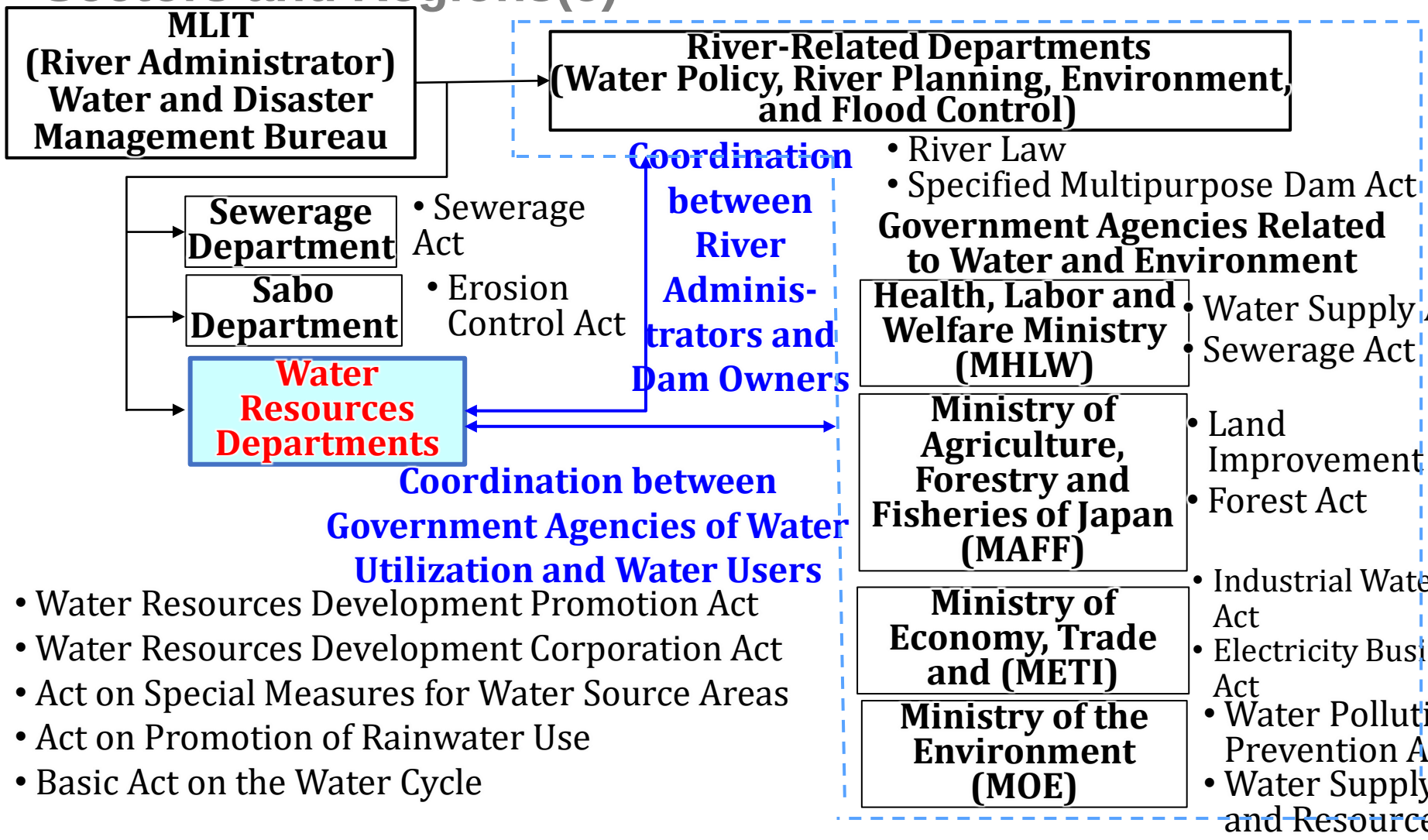
Sustainable Growth Period: 1970 - Present



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**

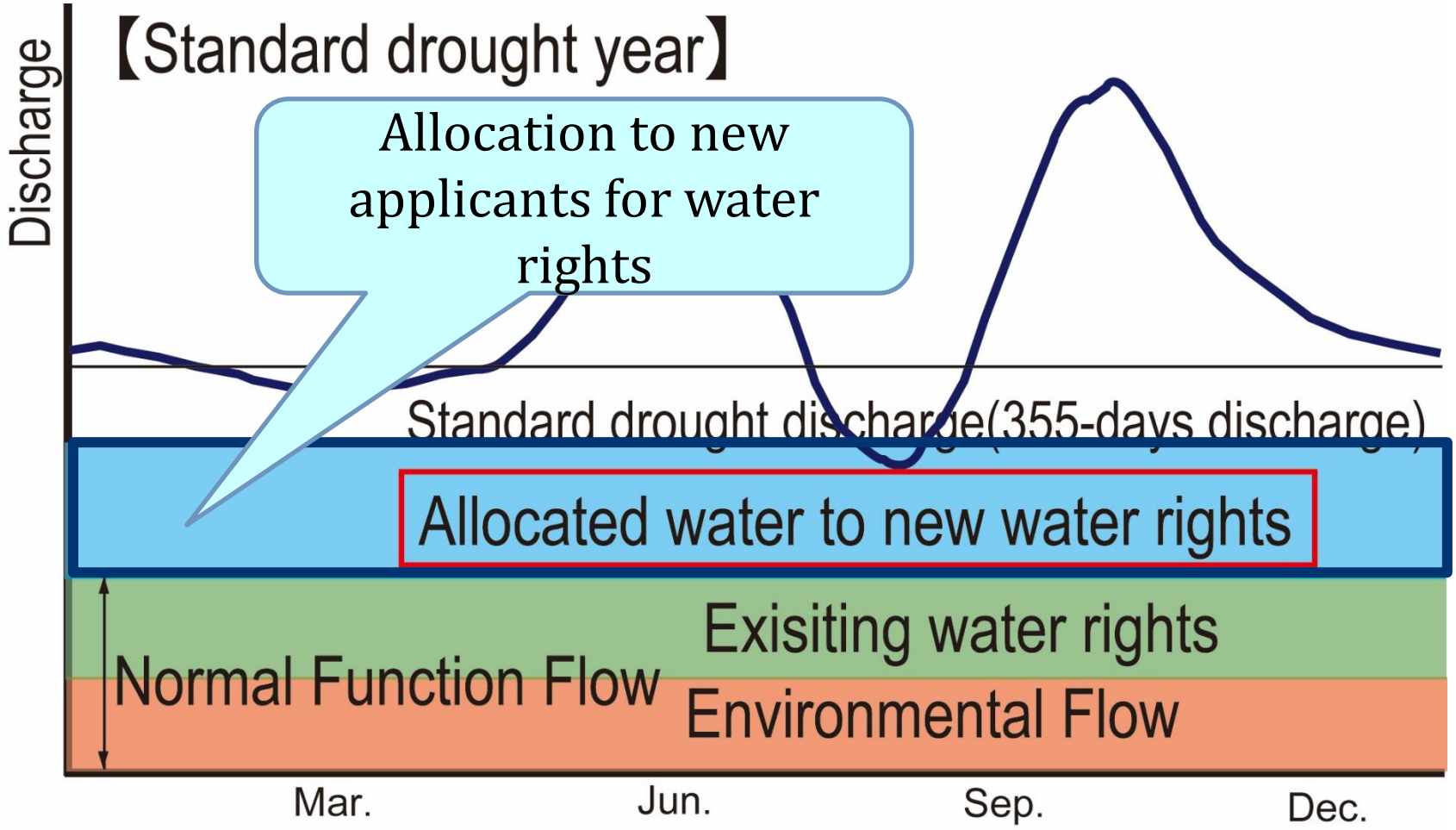
The River Management Offices (RMOs) manage the water rights and issue licenses.

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.

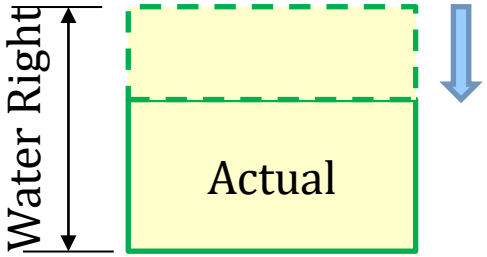
Farmers' Associations

- 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

Reduced Irrigation water

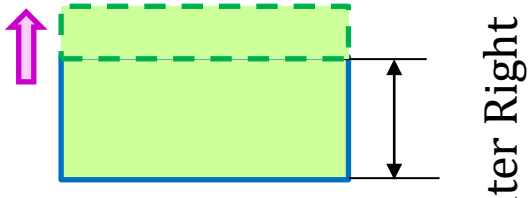


Irrigation Water

Urbanization

Decreased irrigation water may be allocated to domestic and industry water.

Transfer from Irrigation water



Domestic and Industrial Water

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

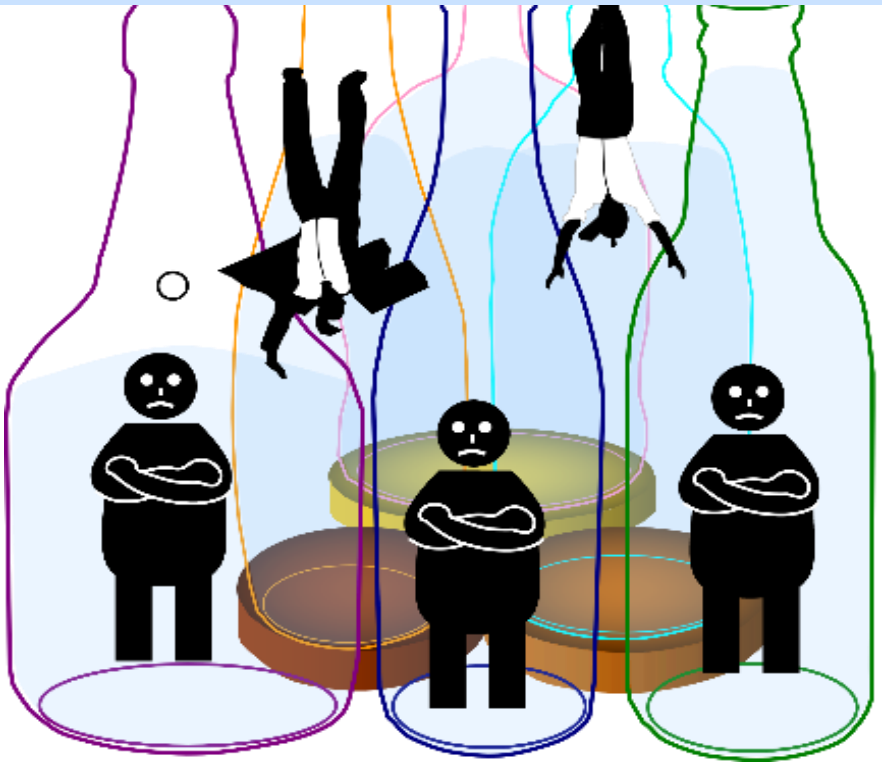
Disclosure of information

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.

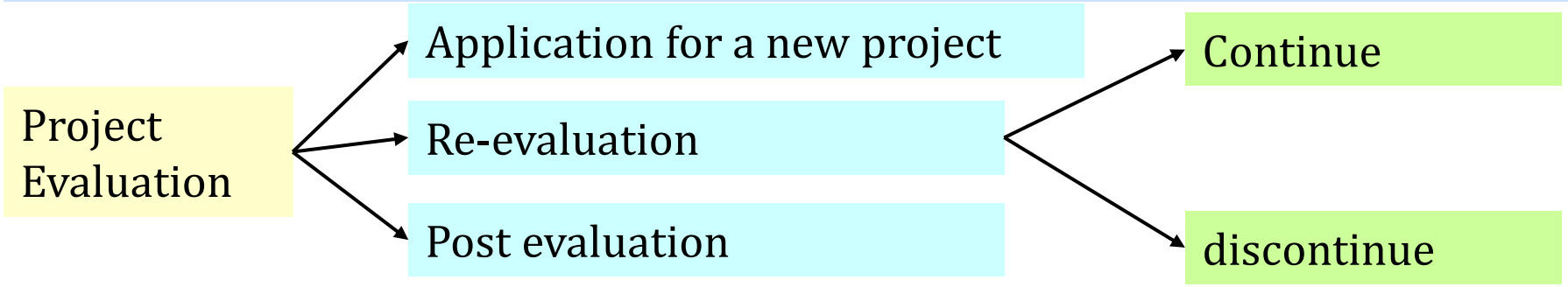
- 2001: Information Disclosure Act
- 2003: Guideline for procedure of resident participation (MLIT)

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)

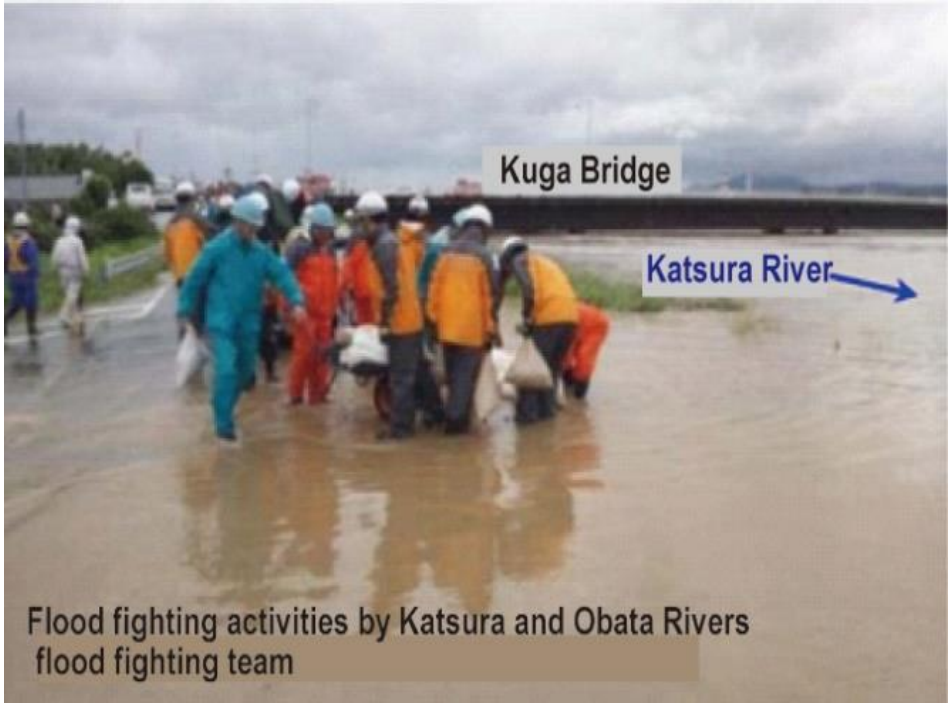
- Institutional support
- Financial supports

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

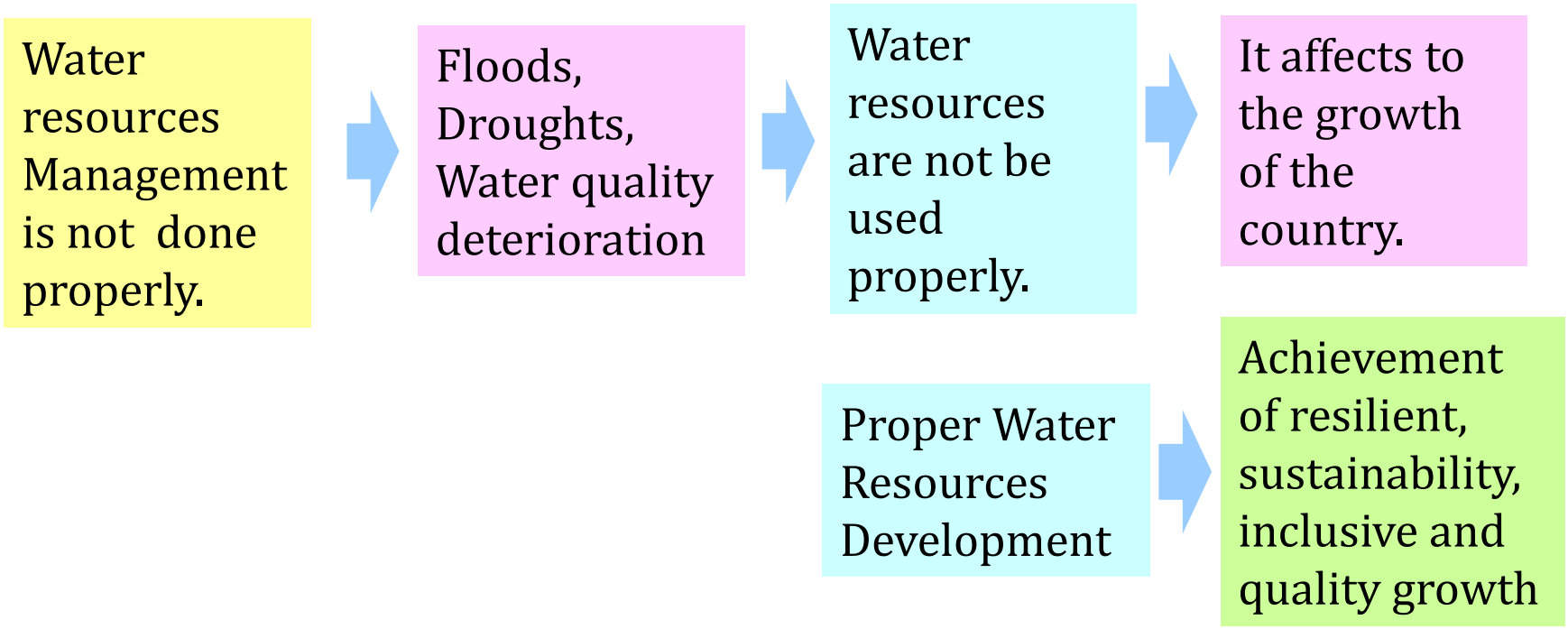
Environmental Conservation

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).



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

- Increased Food supply and Energy
- Increased Flood Damages

1960s

- Issues accompanied to the high economic growth

After 1962

- Formulation of NCDP
- 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.

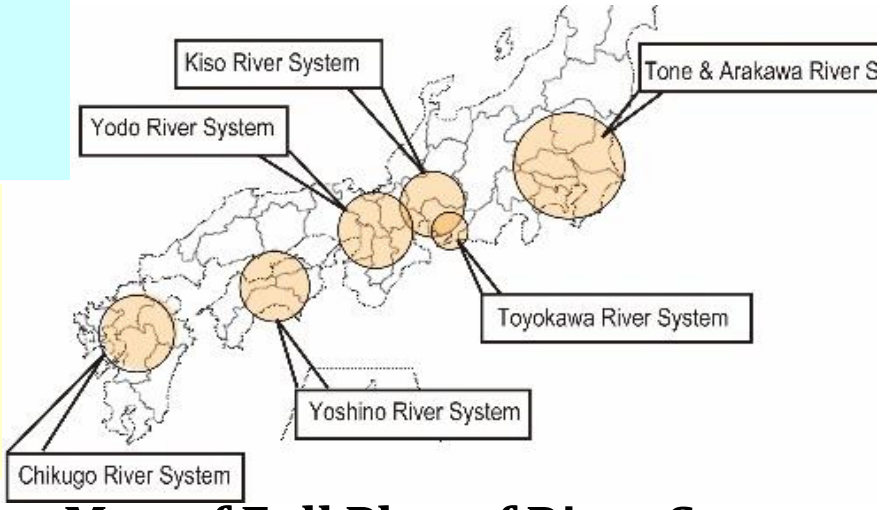
- Increase of Water Demand
- Difficult Coordination among Sectors and Stakeholders

→ 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

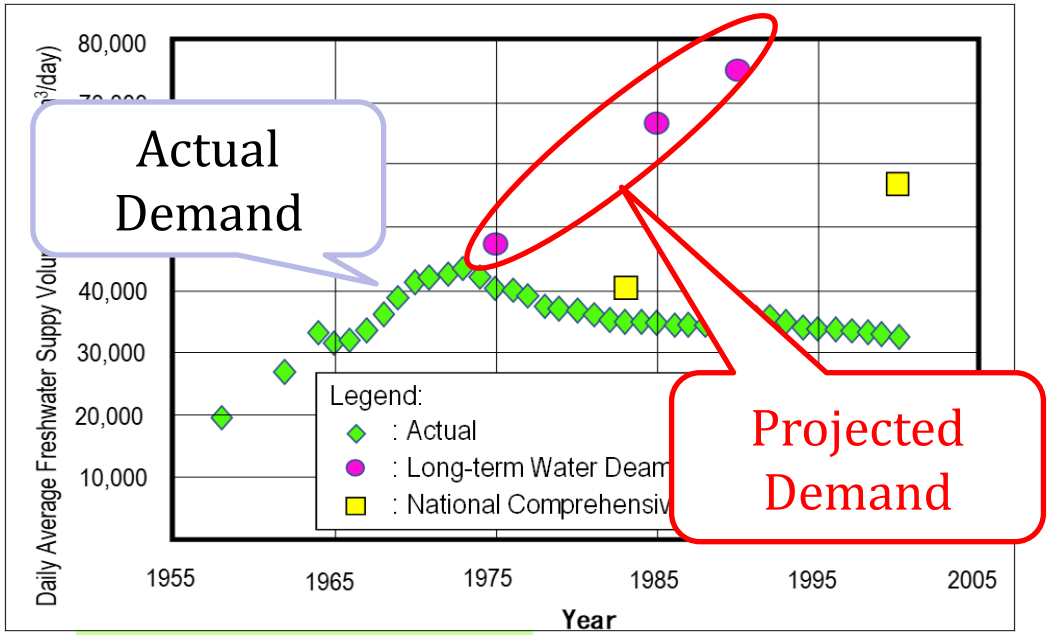
Source: PRT based on MLIT data

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)

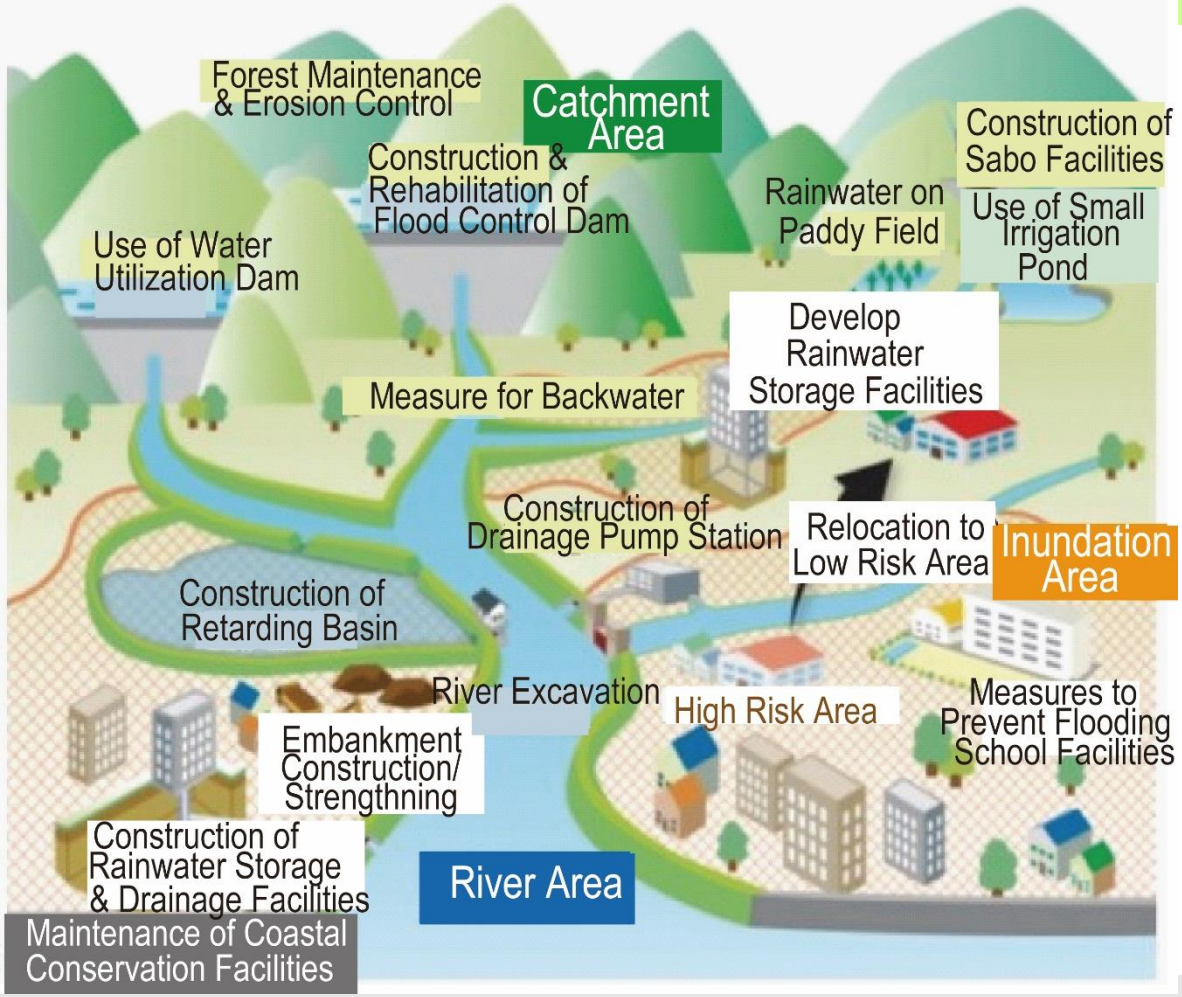
Under climate change, the flood management with a comprehensive and multi-layered approach by various stakeholders throughout the river basin, and the "risk management" for droughts are required.

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.

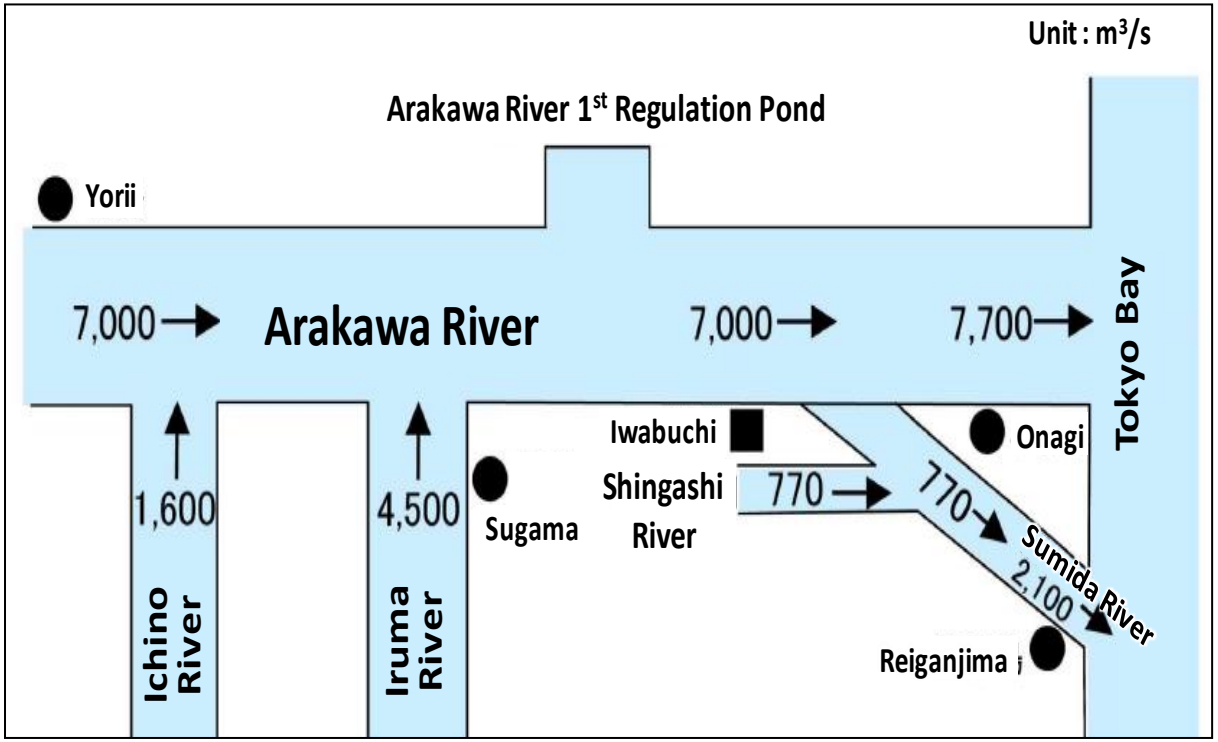
- Coordination of related sectors
- Setting flood protection level
- Optimization of improvement of facilities and water management

- 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



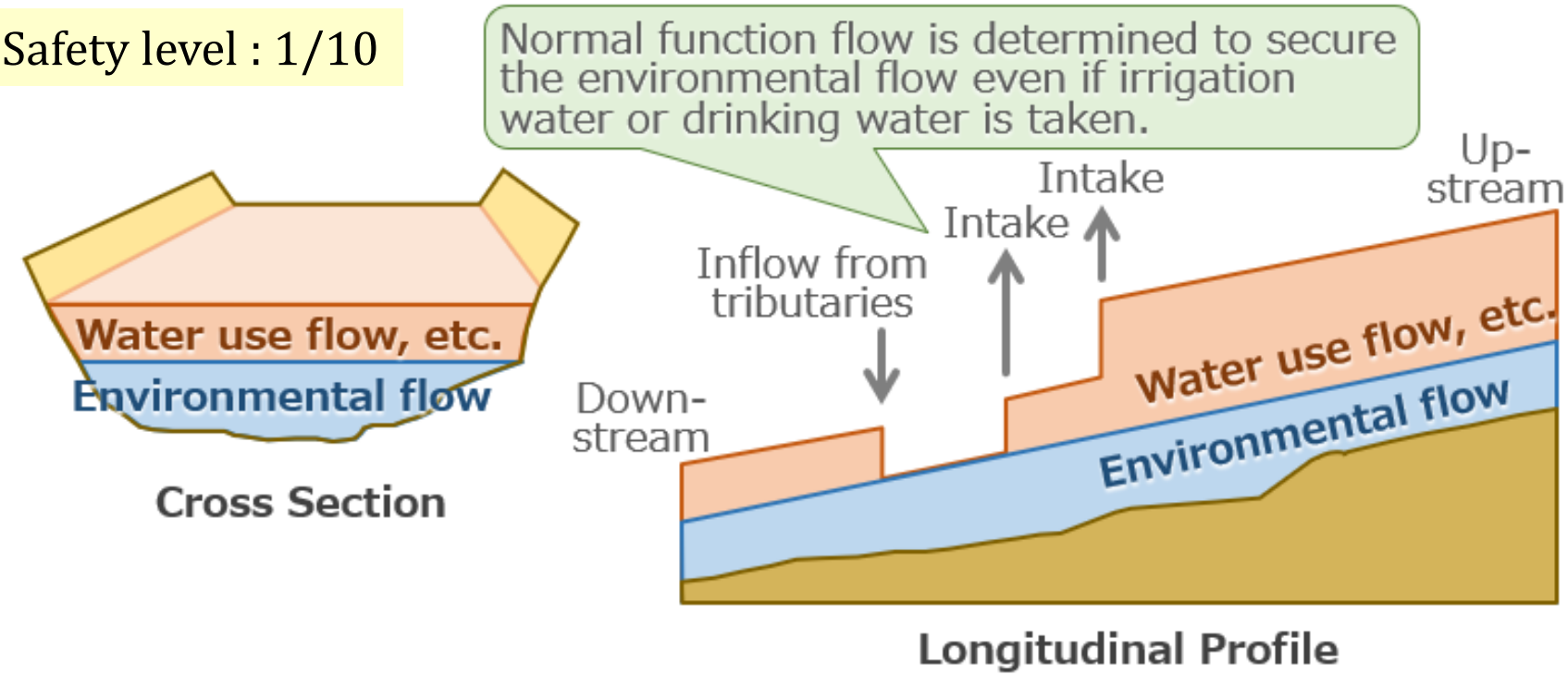
Planned Flood Discharge of the Arakawa River

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.

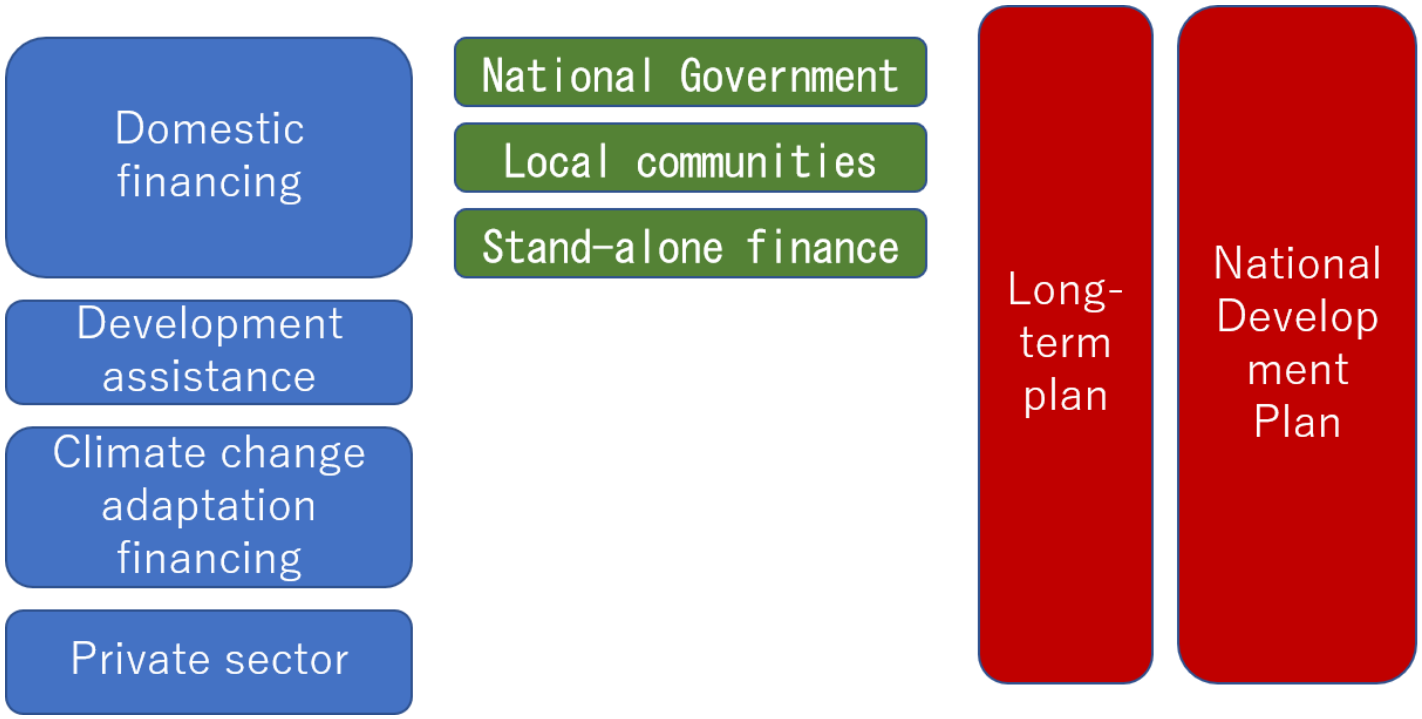
- The RMOs are responsible for Water Resources Management.
- The MLIT has a RMO for each river.

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)

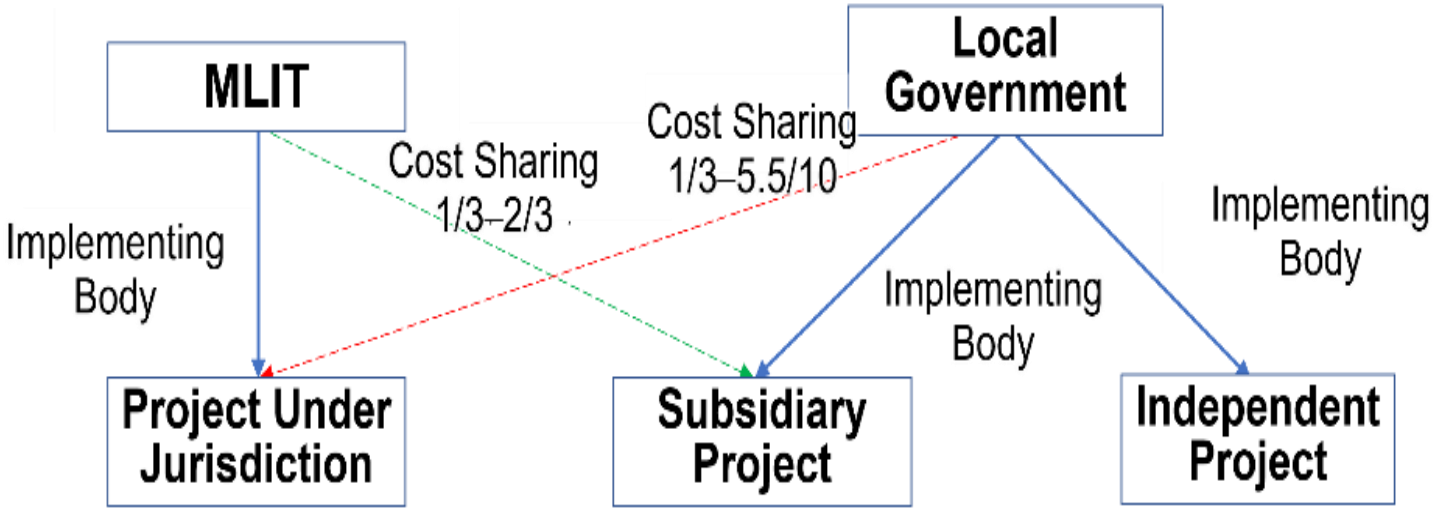
Governments should provide financing investments and involve the private sector in water resources management.



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)

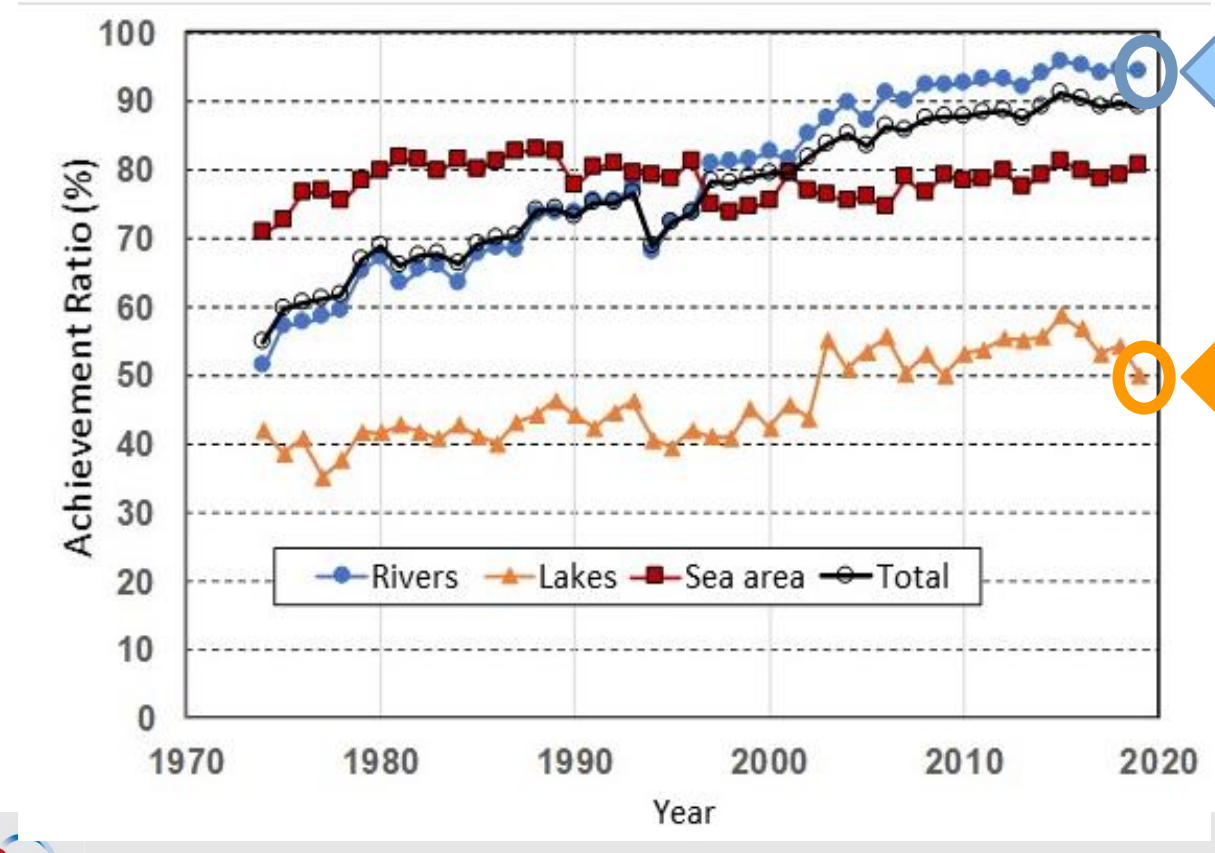
Local Governments
Enacted stricter Standards by **Ordinances**

→

- 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)

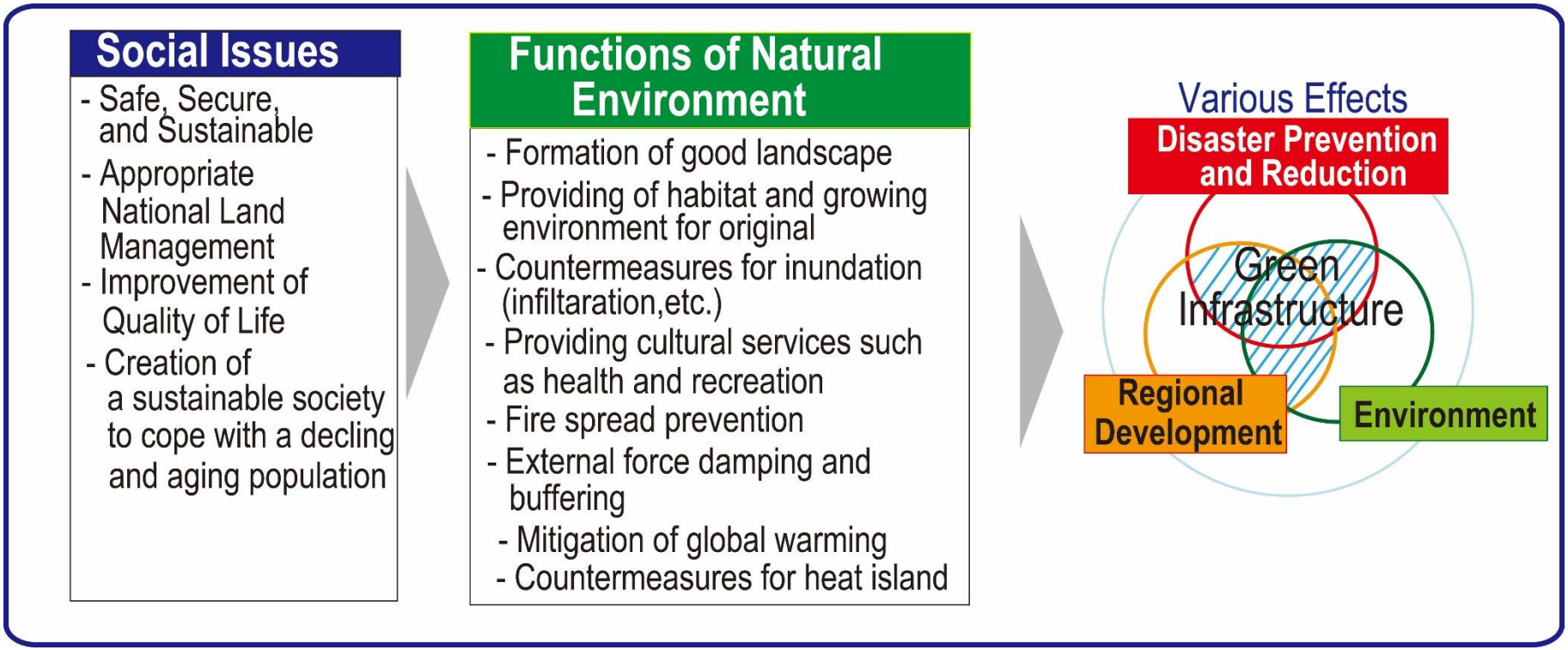
Kama II Weir (Afghanistan)

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)

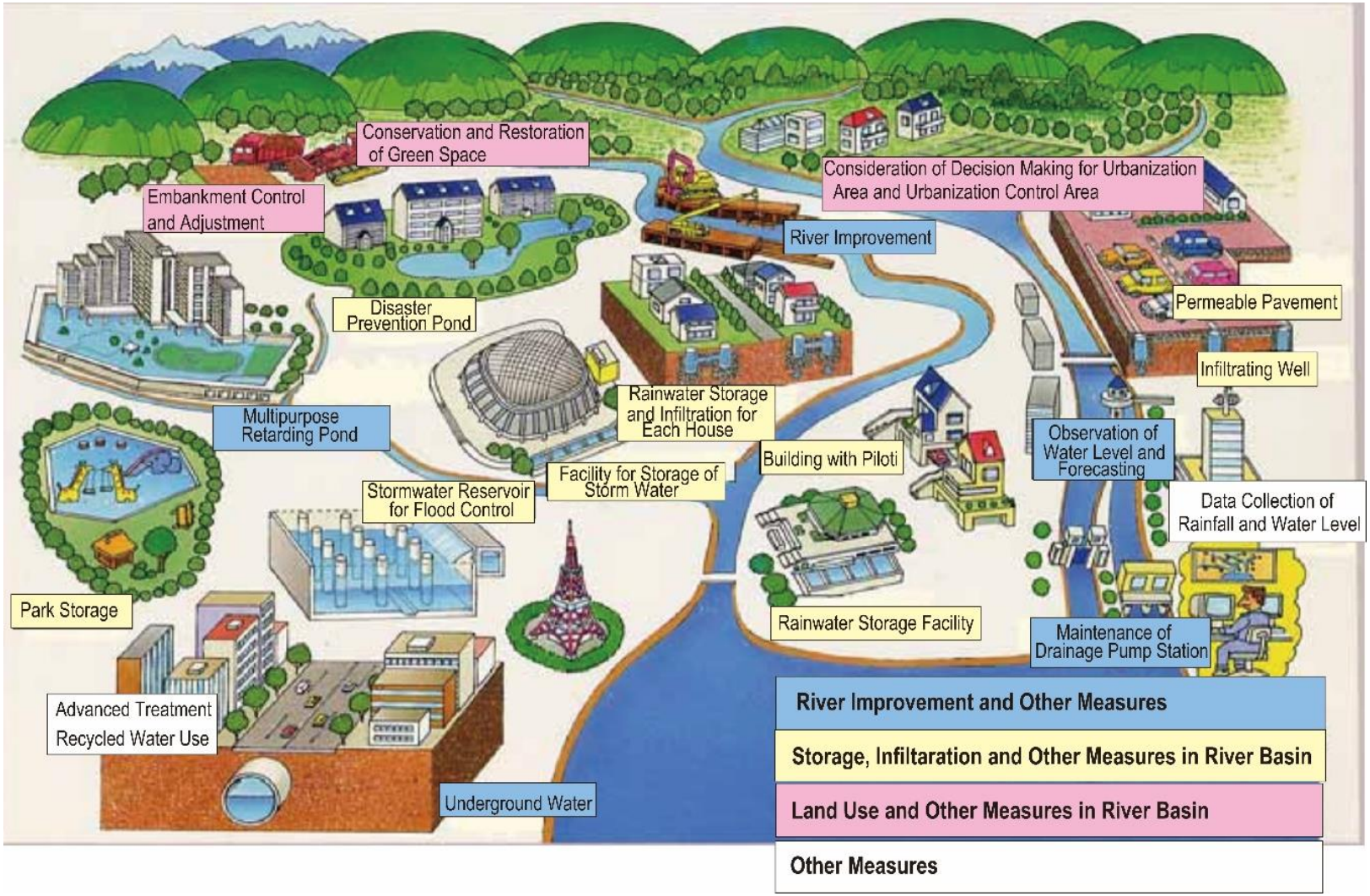
2.8 Improvement of the Urban Water Cycle (2)

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.

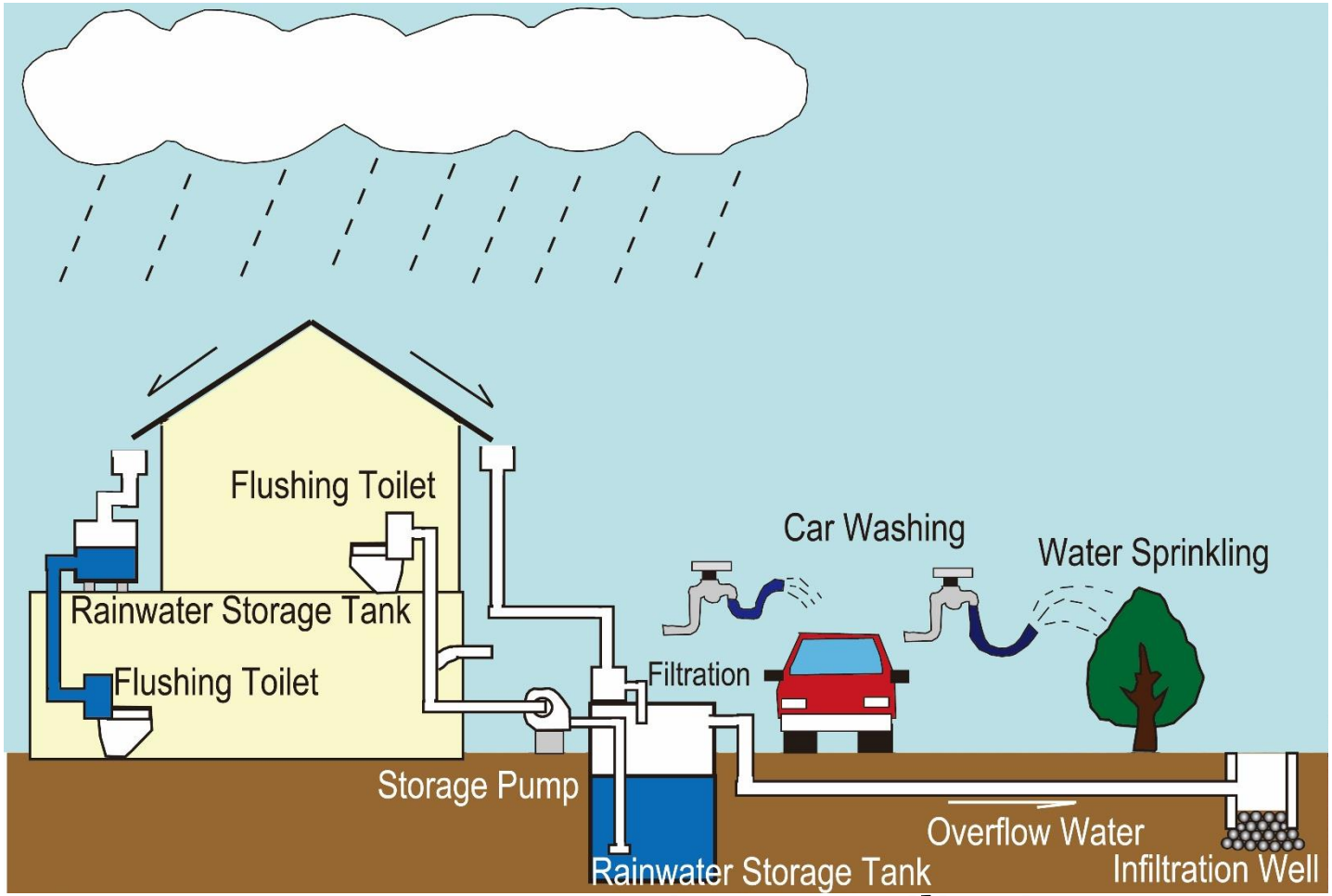
Average leakage ratio of the water distribution system: <5%

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

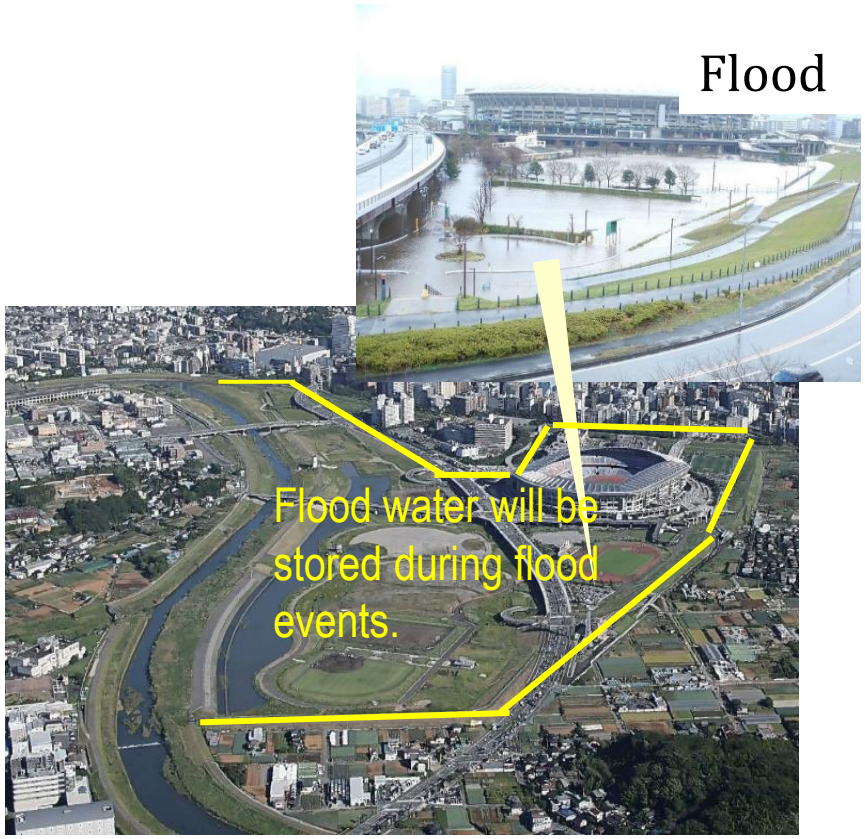
Conservation Area

Disaster Prevention Pond

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

Measures in River Basin

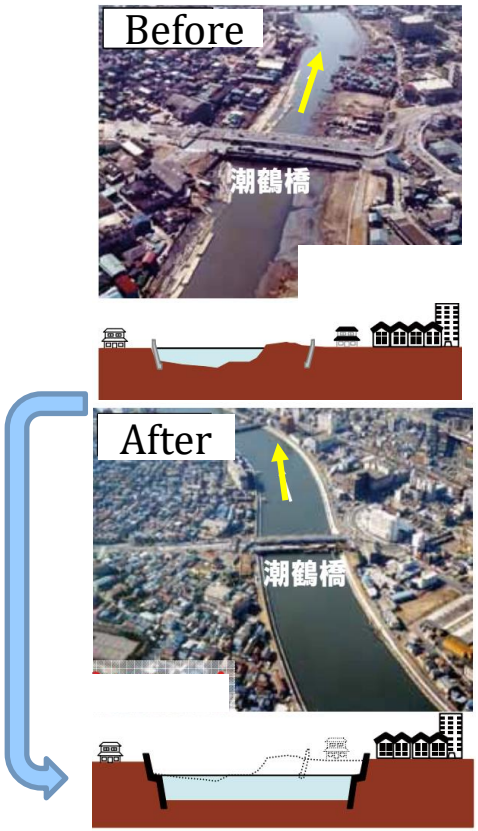
2.8 Improvement of the Urban Water Cycle (7)



Multipurpose Retarding Pond

Source: PRT and Tsurumi River Multipurpose Retarding Basin Pamphlet

Increased Flow Capacity: About 2 times



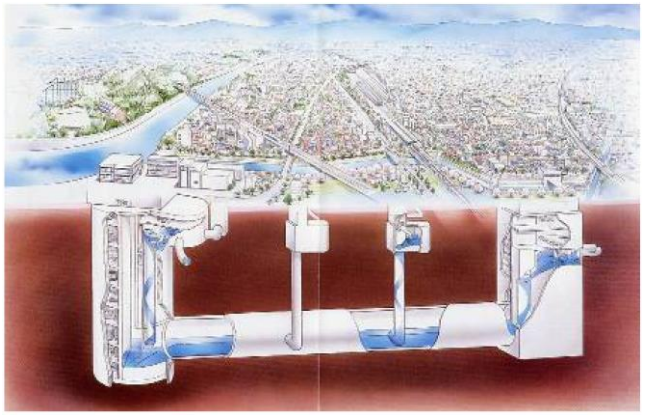
River Improvement

Source: PRT and Tsurumi River Management Office MLIT

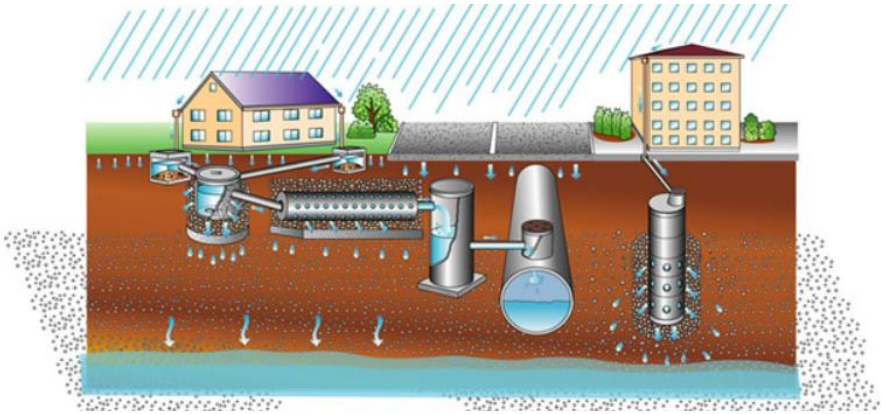
Measures in River

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

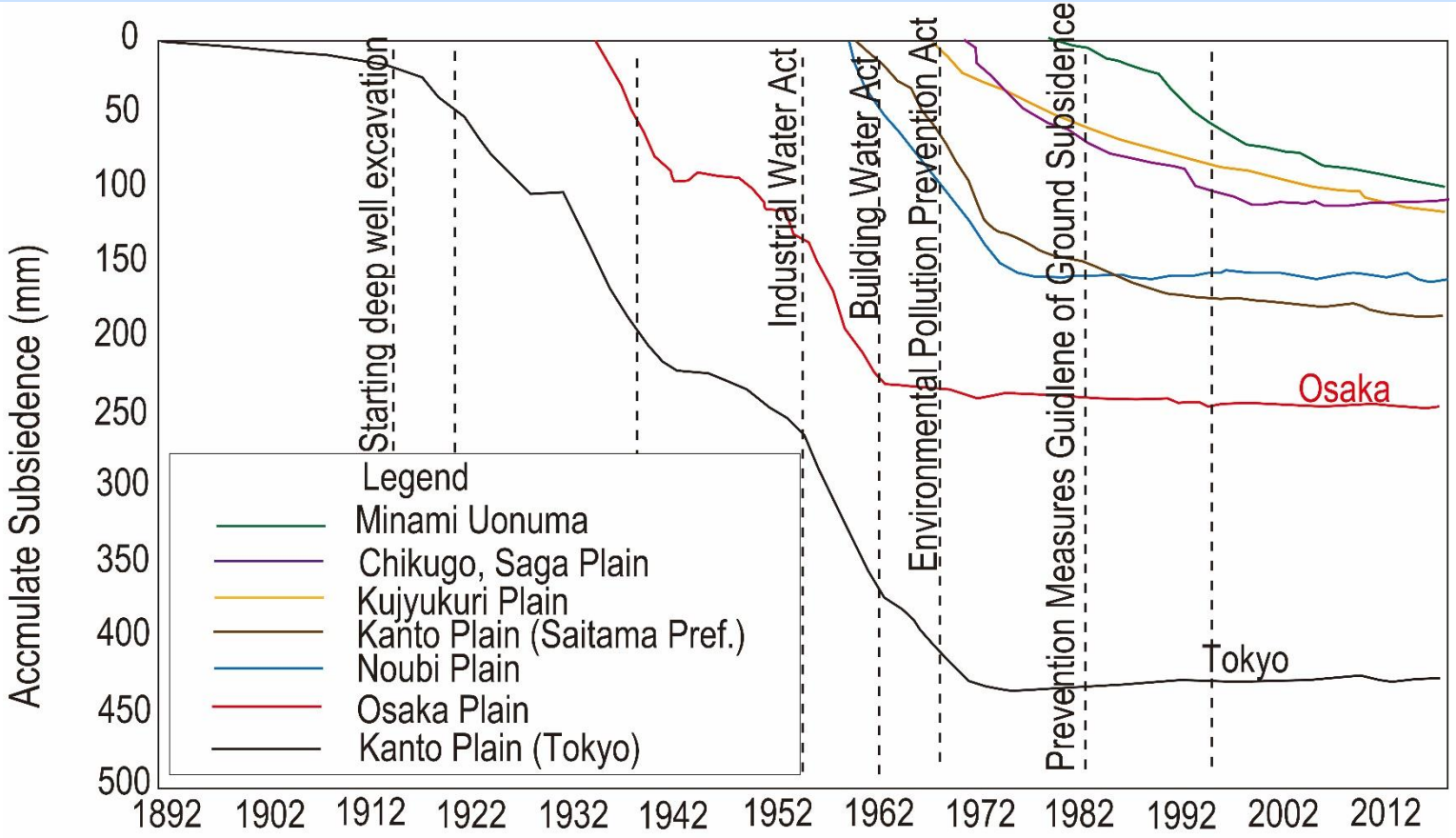
- Patrol of river facilities, and operation of dams and gates
- Announcement of flood forecasts
- Notice of flood information to relevant organizations
- Support to flood protection activities of local community

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.

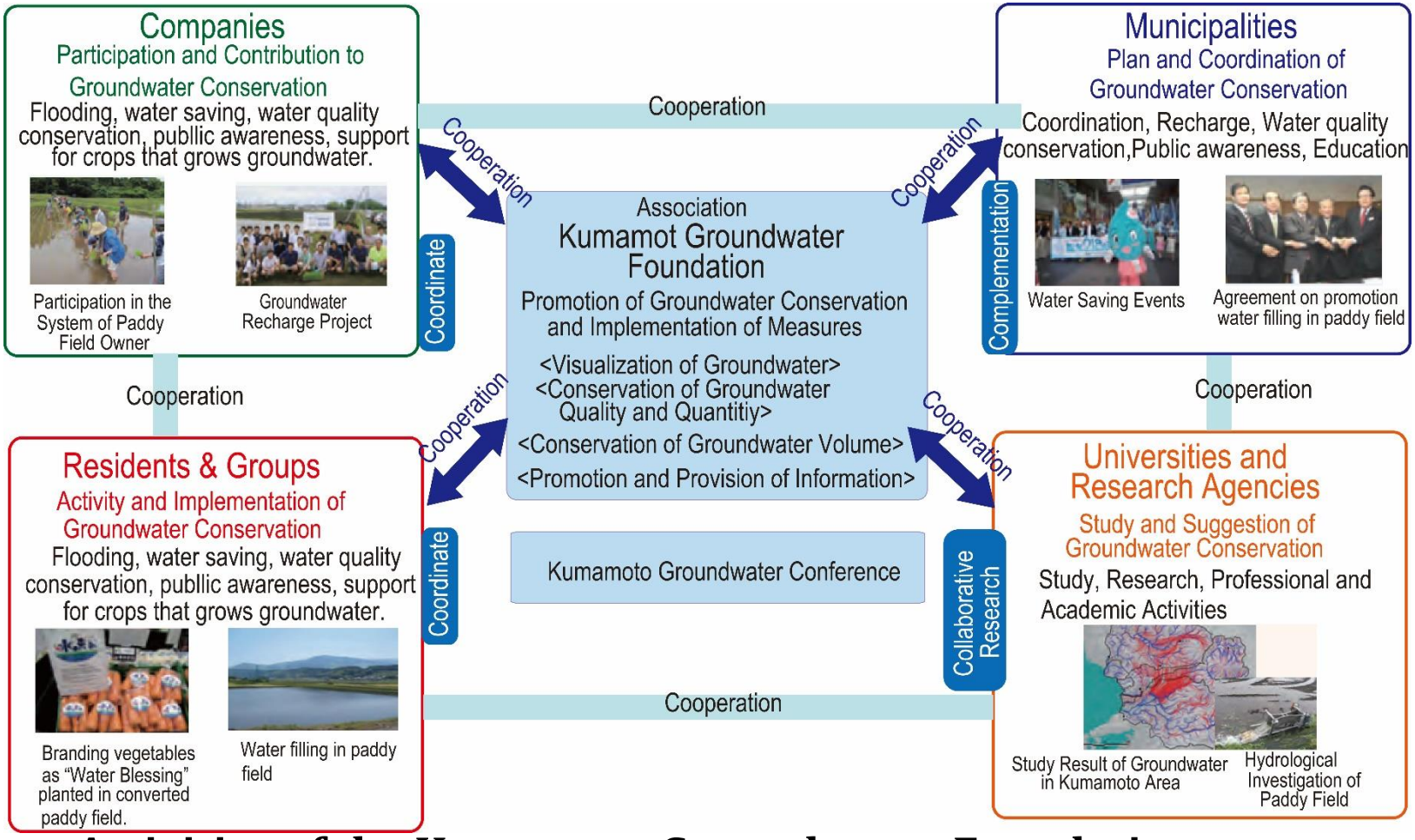


Changes in Land Subsidence at Representative Sites

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

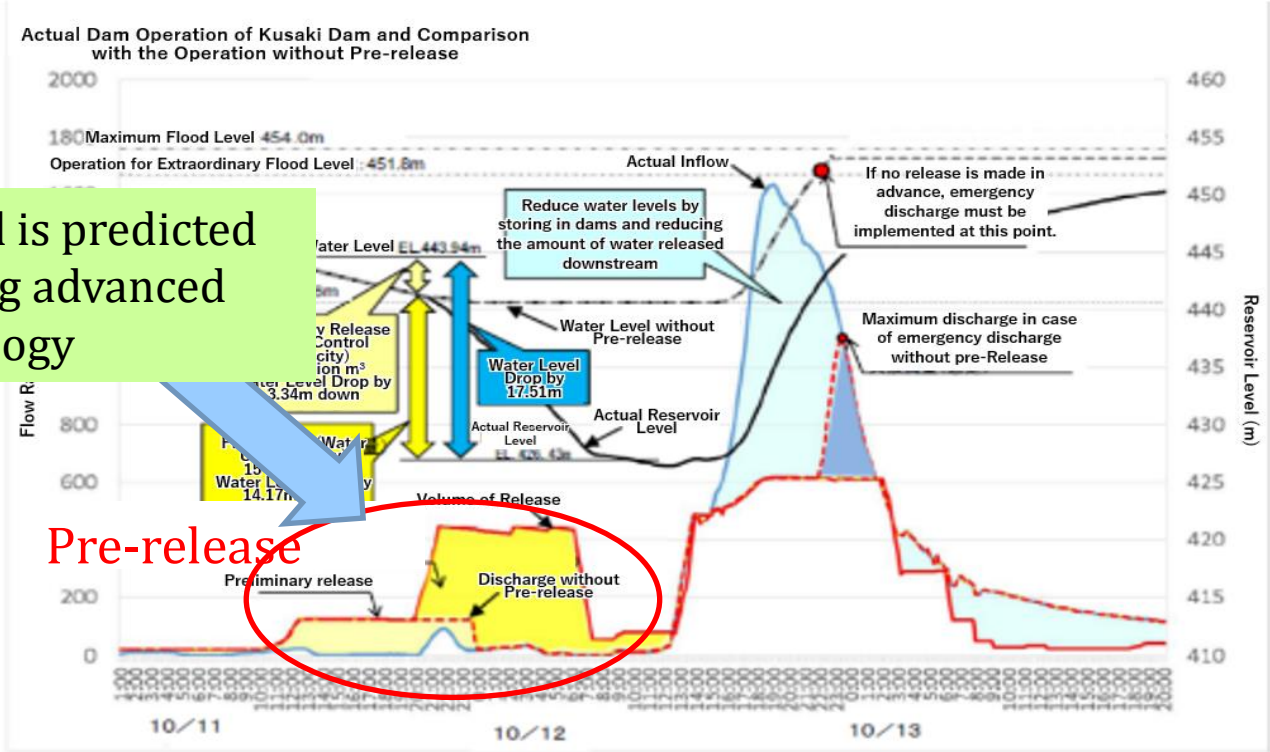
D/S water level <30cm in 30minutes

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

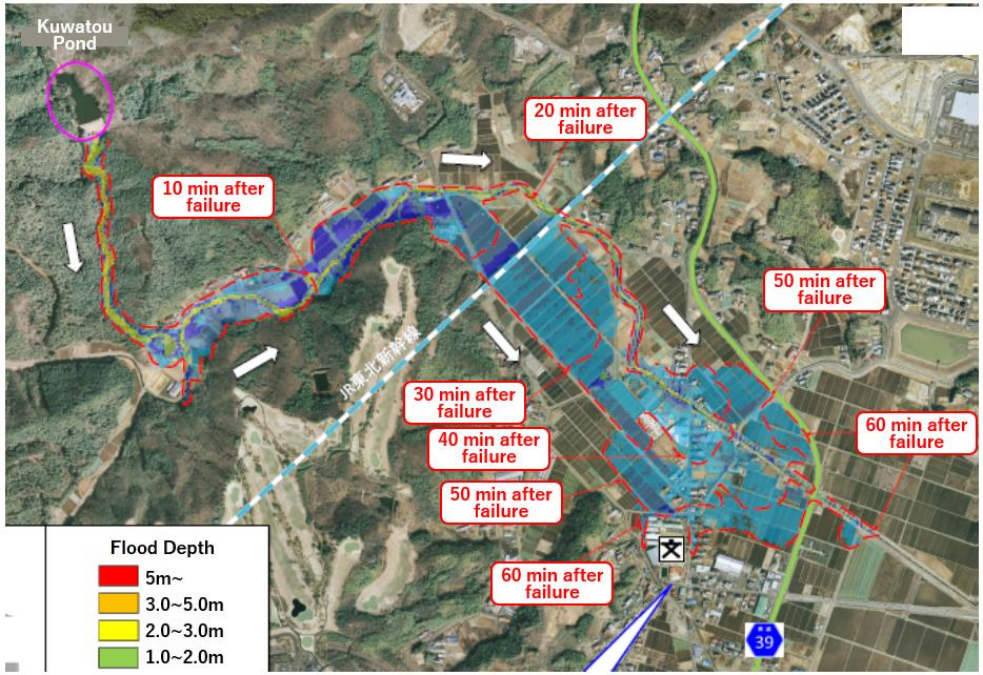


Source: MLIT

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

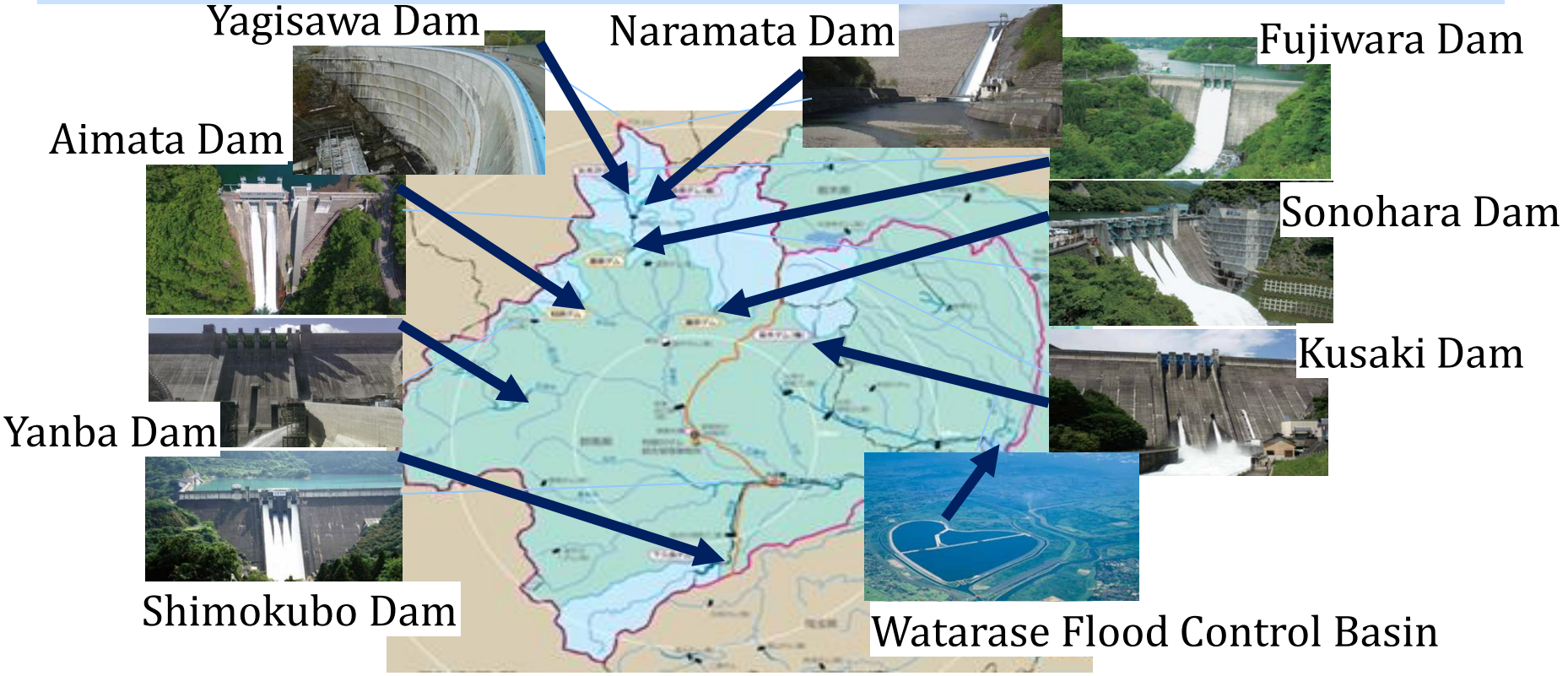
Source: Natori City Office

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

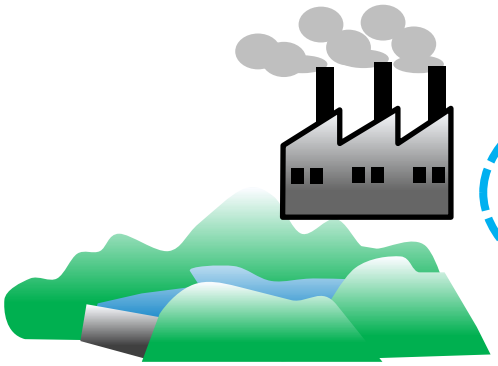
Source: Sapporo Development and Construction Office, Hokkaido Regional Development Bureau

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

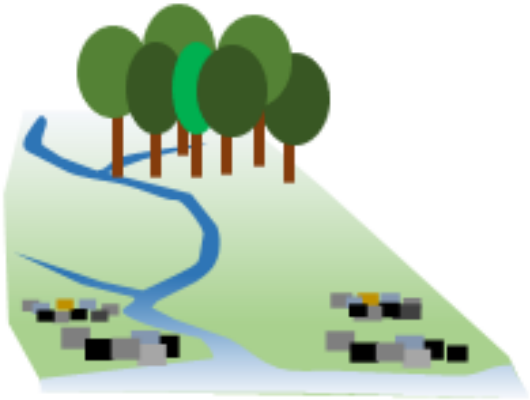
The government should support rebuilding of local communities submerged by large-scale project to avoid fracturing or disappearing.

Act on Special Measures for Water Source Areas

Forest Environmental Tax



Support for Water Source Area in Whole River Basin



Three Acts for Power Development

Water Source Area Development Fund

Water Resources Tax

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