

**THEME 6 RIVER MANAGEMENT:
MANAGING LAND AND WATER
SUSTAINABILITY**

ABSTRACT

Legal systems and organizations are necessary to manage river areas and water in an appropriate manner. In Japan, the River Management Office (RMO)¹ permits using rivers in a way that promotes public welfare and interest. Permitted river uses include the occupation of flowing water and land, collection of riverine products such as gravel, the reconstruction and construction of structures such as bridges and weirs, the harvest and transportation of timber, and passage through navigation locks. The river offices on the site conduct river management; the Minister of Land, Infrastructure, Transport and Tourism administers the major rivers of class A rivers, and the prefectural governor administers class B rivers. Penalties are imposed for illegal river use.

For rivers and river structures, the RMO should establish a system to maintain facilities in sound condition. The system should include the inspection of facilities, weeding and removal of obstacles in the river area, and the investigation of the gate condition. If any issues are observed with the river facilities, necessary measures should be adopted to rectify them.

When a flood is expected to occur, the RMO should adopt a precautionary approach, and patrol the river, check facilities, and operate the dam and gate. In collaboration with the Meteorological Agency, the RMO should announce flood forecasts and convey flood information to relevant organizations; the RMO should also support flood-fighting teams via organizing volunteers from the community.

¹ Rivers are for public use and river administrators are the authorities that have the power and are obliged to manage the rivers. River administrators are explained in detail in "Theme 6: River Management."

CHAPTER 1 INTRODUCTION

The RMO should establish organizations and processes of managing land and water associated with river systems according to the legal systems.

The land and water associated with riverine ecosystems cannot be managed properly if the river area and management body are not clearly defined. These ecosystems are exposed to a number of potential issues. Excessive gravel mining from a river may damage structures such as levees and bridges. Structures and bridges in rivers may impede flood flows and increase flood damage. The discharge of harmful substances may disrupt the ecosystem and negatively impact water supply. Along with cities in developing countries, Japan once faced similar issues, such as building houses in riverine areas and occupying river channels (Theme 5: Urban Water Management); even in present day Japan, problems such as the mooring of boats in rivers still occur.

Legal systems, organizations, and processes need to manage land and water. The following chapters describe how river management systems have been developed for flood protection, water use, and the management of environmental issues. They explain how to ensure safety when constructing structures such as bridges and weirs, how to prevent and manage excessive gravel mining, and how to manage river facilities.

River management systems and policies differ depending on the topographic and historical context. In Japan, the risk of flooding is high because localized torrential downpours are likely to occur owing to weather fronts and typhoons. Two-thirds of the land is mountainous; as such, there are many rivers with steep gradients. Riverside areas have been used as paddy fields to produce the staple crop, rice. Populations have increased, particularly in the alluvial plains where floodplains formerly developed. Urbanization was promoted by inland water transportation which supported the movement of goods. The construction of levees to protect agricultural and residential areas became a basic flood protection policy. However, the occurrence of severe floods could not be eliminated and flood protection consistently remained a key issue in river management. Climate change has also increased the frequency of flood disasters.

Occasionally, water conflicts occurred prior to modernization, along with the development of new paddy fields. Japan developed common-use facilities such as small reservoirs and irrigation canals, and formed customary water use practices. The river-management system was first legislated after the Meiji Restoration with customary practices as the prototype in the background. This has been revised appropriately according to the needs of the present time (Theme 1-2: Water Rights).

Houses Built along River Course

The images below showcase examples of houses that were built along the river course, obstructing flood flow. Historically, municipalities permitted these constructions without considering disaster risks. Once houses were built, relocation was often difficult. Therefore, it is necessary to manage river spaces appropriately.



Source: Project Research Team

Water resource management and the Sustainable Development Goals (SDGs) are closely related. The relationship between river management, technology, and the SDGs is shown in the following box.

Relationships between River Management and the SDGs:



- (1) Early response to problems in river structures through river management, such as regular patrols to ensure the proper function of river structures and mitigate flood disasters.
- (2) Reduce the number of flood victims by collaborating with organizations (flood fighting groups)
SDG 11 “Sustainable Cities and Communities”: 11.5 “Significantly reduce the number of deaths and victims due to flood disasters”
SDG 13 “Climate Action”: 13.1 “Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters”
- (3) Partner with organizations that have been established for river maintenance and emergency responses.
SDG 17 “Partnerships for the Goals”: 17.7 “Encourage and promote effective partnerships among public, public-private and civil society”
- (4) Government is collaborating with private groups relating to river management such as environmental and disaster prevention education groups and riverine ecosystem researchers.
SDG 4 “Quality Education”: 4.7 “All learners acquire the knowledge and skills needed to promote sustainable development.”
SDG 6 “Clean Water and Sanitation”: 6.6 “Protect and restore the river ecosystems.”

CHAPTER 2 PURPOSE OF RIVER MANAGEMENT AND MANAGEMENT BODY

2.1 Purpose and Administration

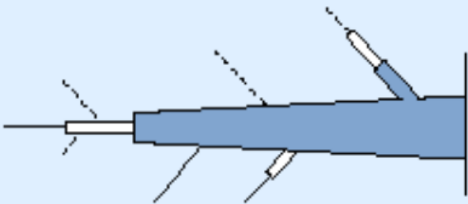


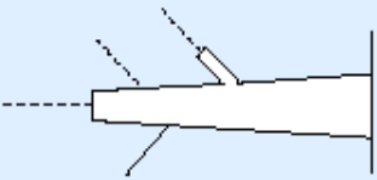

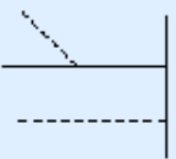
Japan manages rivers from the flood protection, river utility, and ecosystem perspectives.

There are three key purposes of river management in Japan: 1) to prevent disasters caused by floods, tsunamis, storm surges, and other disaster incidents; 2) to properly utilize rivers and maintain the function of streamflow; and 3) to plan the development and conservation of riverine ecosystems. The term “river use” includes the use of the streamflow, along with the riverine land and its products such as gravel and timber. Streamflow is recognized to carry out ten key functions: 1) inland navigation; 2) fisheries; 3) tourism; 4) water purification; 5) salinity intrusion control; 6) prevention of river-mouth clogging; 7) protection of facilities; 8) groundwater conservation; 9) animal and plant protection; and 10) water supply. The River Law applies to the natural environment and the relationship between people and rivers. Owing to the unique natural conditions, flood protection has consistently been the main subject of river management. Preservation of the river environment is highlighted along with the loss of nature caused by urbanization.

Rivers are classified into Classes A and B² (Figure 2.1) (Theme 1-1: Legislation and Organization). The Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) manages Class A river systems that are important from the national land conservation and economy perspectives; there are 109 Class A rivers, most of which flow across multiple prefectures. The ministry manages conflicting interests between upstream and downstream prefectures within the same river system or between prefectures on the left and right of the river bank. For example, upstream river improvement works for flood protection should be systematically implemented such that it does not adversely affect the downstream reaches. Conflicts between water source and water consumption areas should be prevented. The prefectural governments manage Class B rivers. Prefectural governments also share in the responsibility of river management works through the department supervising works at the local office; municipalities manage other rivers (Figure 2.2).

The total river length of Class A and B rivers and Class Provisional rivers is 144 000 km. Class A rivers comprise approximately 61% of the total. In contrast, Class B and Class Provisional rivers comprise approximately 25% and 14%, respectively. The Japanese government subsidizes projects in Class B, although this does not include maintenance works.

² The River Law defines the rivers as Classes A and B. Class Provisional rivers are those to which the River Law may be partially applied. Class Ordinary rivers are those outside the River Law.

River System	Schematic Diagram	River Classification	Administrator
Class A River System		Class A River System Section Directly Administered by MLIT  Designated Sections  Provisional Class River Ordinary Rivers	Minister of MLIT Prefectural Governor Head of Municipality Local Public Organizations
Class B River System		Class B River  Provisional Class River Ordinary Rivers	Prefectural Governor Head of Municipality Local Public Organizations
Independent River System		Provisional Class River Ordinary Rivers	Head of Municipality Local Public Organizations

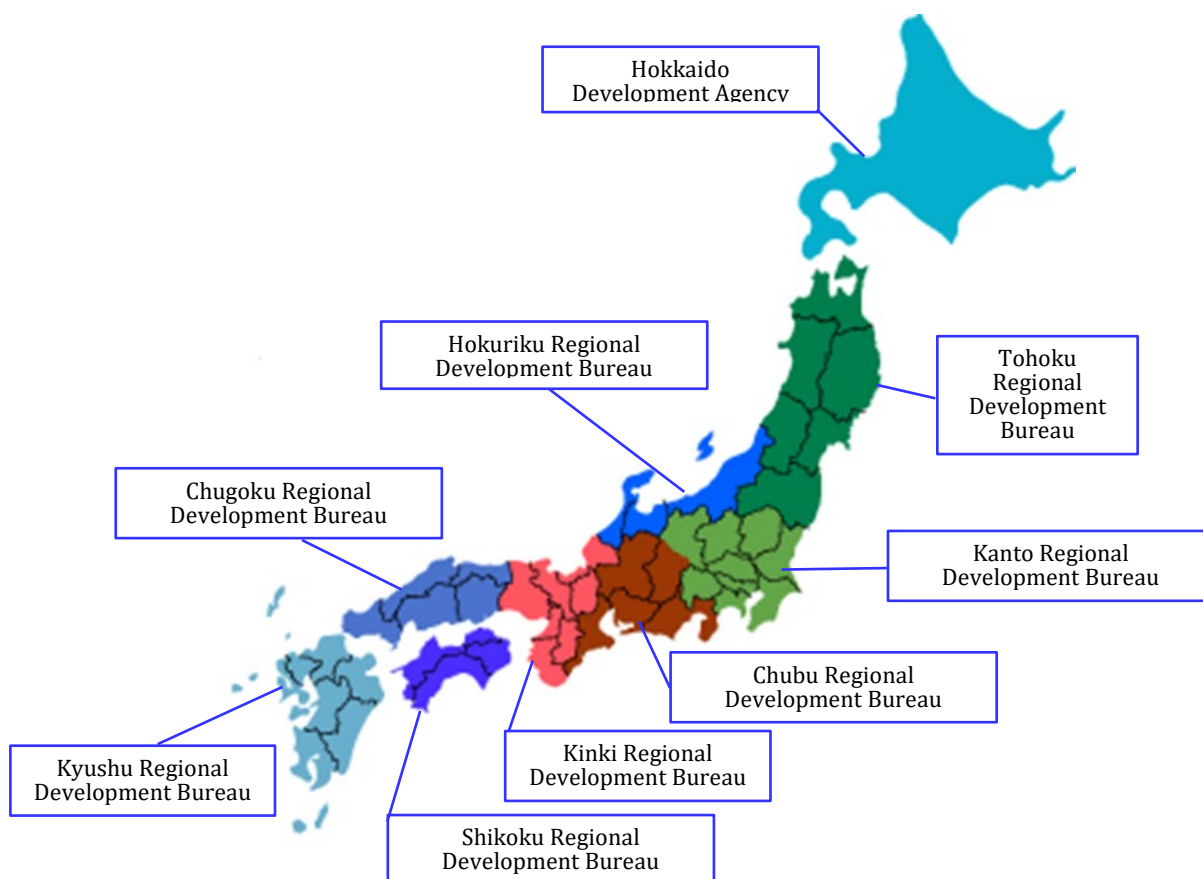
Source: Website of Yamato River Office, Kinki Regional Development Bureau, MLIT

Figure 2.1 Classification of Different River Systems and Corresponding Administrators

Water Use Conflicts on Dam Construction in the Ogouchi Dam Project

Under the former River Law, the Prefecture Governor had the authority to manage rivers. Therefore, it was difficult to resolve water conflicts between two prefectures. The Ogouchi Dam is a concrete gravity dam constructed by the Tokyo Metropolitan Government in 1957 on the Tama River. It supplies a maximum of 425 000 m³ of water daily to the metropolitan area; this corresponds to 20% of the daily water supply in this area. In 1932, the metropolitan government announced the construction of the Ogouchi Dam. In the following year, a water union in the Kanagawa Prefecture that extracts water for irrigation purposes downstream, appealed to the prefecture for the suspension of the project; this caused disputes between the Tokyo Metropolitan Government and Kanagawa Prefecture. Construction was postponed for three years until the issue was resolved by increasing water abstraction of Kanagawa from the river as compensation from Tokyo.

The River Law was amended such that the national government now managed major rivers. According to this amended law, applicants for new water rights were required to build consensus in advance with existing water right holders.



Source: Project Research Team

Figure 2.2 Regional Development Bureaus Jurisdictions and the Hokkaido Development Agency

2.2 Regulations on River Use

The RMO permits river usage that promotes public welfare and interest, on the premise that this use does not interfere with river management.

(1) River Areas

The river area spans the area in which: 1) streamflow is continuous; 2) river management facilities are situated; 3) the land to be managed integrates these areas. The river area spans to the feet of the urban side on the left and right levees (Figure 2.4). Within the river area, permission from the RMOs is required for actions, as described in Section (2). River-use regulation is applied to privately owned lands. For interior land, land use is regulated for river management as a conservation area, alongside areas that may be incorporated into the river area in future.

(2) Actions Requiring Permission

River users need to obtain permission from the RMO when conducting the following actions in the river area⁶; any action that is likely to impede proper river management is prohibited:

- 1) New acquisition, change, and renewal of water use (occupation of flowing water)

⁶ As for aquatic products, inland waterways are effectively managed by the fisheries cooperative associations, which are obligated by the prefectural government to propagate aquatic products in accordance with the Fisheries Law.

- 2) Exclusive and continuous⁷ use of the river area (occupation of land)
- 3) Collection of river products such as gravel and wood
- 4) Construction and reconstruction of river structures such as bridges and weirs
- 5) Excavation of land
- 6) Transport of timber and passage through navigation lock using the river channel and streamflow

Water cannot be privately owned, although ownership of some land in the river area is permitted (Theme 1-2: Water Rights). Section 2.3 discusses the construction of new river structures.

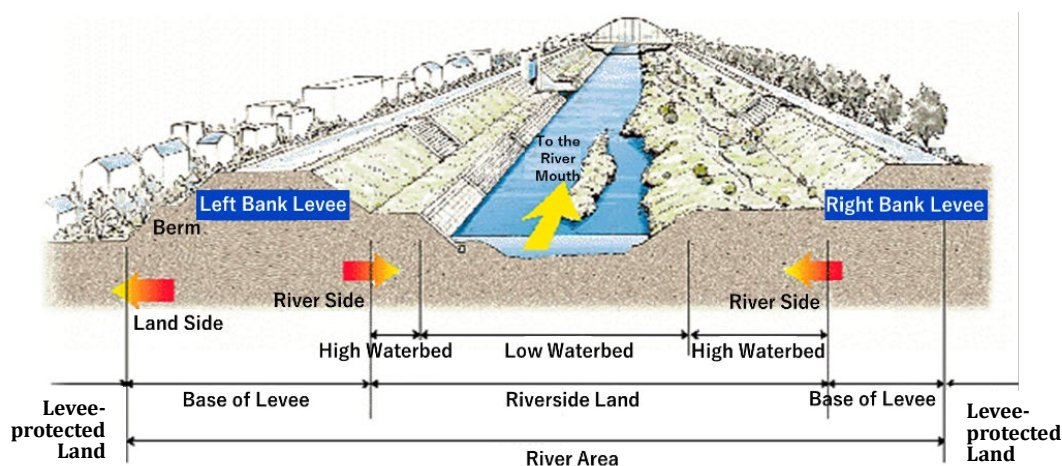
(3) Occupation of Land in the River Area

An application is necessary to occupy land. The land includes infrastructure (e.g., roads, railways, water supply and sewerage pipes, electric power transmission lines, gas pipelines), public facilities (e.g., parks, green spaces, golf courses), and flood protection facilities. The permitting rules are amended according to changing social needs. In recent years, the river area has become open to the public under deregulation. This supports the activities of local governments and enterprises, such as open cafes and barbecue areas (Figure 2.3) (Theme 5: Urban Water Management).



Source: General Incorporated Foundation Consultants of Landscape

Figure 2.3 Opening of River Space (Kano River)



Source: MLIT Website

Figure 2.4 River Area

(4) Products in River

Gravel is a typical product collected from rivers. During high economic growth from the mid-1950s to mid-1970s, the increasing demand for river aggregates as construction materials was lowering the

⁷ In general, the period of permission is within ten years. For applications from non-profit enthusiast groups (e.g. glider training grounds, motocross fields, or radio-controlled airplane gliding fields), the period is limited to five years. If the land is to be used continuously, the application should be resubmitted before the expiration date.

riverbed in many rivers. In 1968, the RMO established an approval standard for gravel mining. To maintain the river cross-section required to transport floodwaters and the reservoir capacity of dams, they established a system to grant permits for gravel mining in 1975. Every few years, the river offices of the MLIT formulate the “Control and Regulation Plan of Gravel Mining” to recruit enterprises to remove gravel deposits from river channels and dam reservoirs (Figure 2.5). The Gravel Mining Act stipulates that gravel mining companies (including hill-sands and sea gravels) should register with the Prefectural Governor. The Ministry of Economy, Trade and Industry (METI) is responsible for administering the Act.

(5) Penalty and Enforcement

Fines are imposed on illegal river use, and an RMO can remove illegal occupants. Some or all of the costs may be covered by taxes when the offender cannot be identified. A typical example of enforcement is with “Countermeasures against Illegal Mooring Ships.” The Civil Code was amended in 1995, simplifying the administrative execution system to remove ships and mooring facilities that hindered river management (Figure 2.6). Although the situation has improved significantly, the issue still remains unresolved.



Source: ISHIGAMIJARI LLC.

Figure 2.5 Gravel Mining



Source: Keihin River Office, Kanto Regional Development Bureau, MLIT

Figure 2.6 Removal of Illegally Moored Vessels

2.3 Management of River Structures

Common standards should be established to ensure safe river structures. The RMO should maintain river structures over the long-term; they should carry out patrols and periodic inspections at appropriate intervals, which should be followed-up by efficient maintenance works.

River structures are classified into two groups: (1) river management facilities constructed by the RMO; and (2) permitted structures, constructed by water users with permission from the RMO.

(1) River Management Facilities

River management facilities function to develop water resources, protect against floods, and improve the riverine environment, including dams, weirs, gates, levees, and bank protection (Figure 2.7). The Structural Standards describe the general standards for structures and the construction location of these facilities. For example, the Structural Standards provide guidance on the position of abutments, shape and depth of piers, span length, clearance below the girder bottom, and protection works. Technical criteria



Source: Fukushima Office of Rivers and National Highways, Tohoku Regional Development Bureau, MLIT

Figure 2.7 Green Belt as Riverine Buffer Zone (Agano River system, Arakawa River)

stipulate the planning and design methods. Consensus-building is required when constructing major river management facilities. The River Improvement Plan should describe the location and function of planned structures (Theme 2-2: River Basin Planning); it should also reflect the opinions of academic experts and residents through public hearings (Theme 1-3: Public Participation and Decision-Making Process).

(2) Permitted Structures

To construct structures such as bridges and weirs, organizations must obtain permission from the RMO. They must examine the appropriateness of the structure, its purpose and technical matters, and the effects of the structure on flood protection, water use, and riverine ecology. The structures should comply with technical criteria and standards; in particular, the River Law includes “Special Provisions” for dams to meet strict requirements (Theme 8: Dam Management). The use of structures is restricted until they pass the inspection, and dam operation should follow the instructions of the RMO.

(3) Maintenance

The River Law stipulates that the RMO maintains structures in sound condition. The RMO is responsible for patrolling facilities, carrying out river functions (e.g., weeding, removal of obstacles), and operating gates at an appropriate time. Appropriate countermeasures should be implemented when malfunctions are identified. For efficient repairs, inspections on structures (e.g., dams, weirs, levees, water gates, and sluices) should be carried out at least once a year.

2.4 Disaster Management

During flooding, the RMO should prevent and mitigate damage by supporting disaster management organizations. In drought conditions, necessary mediations should be carried out through coordination with water users.

The RMO issues flood alerts and conducts disaster management activities such as patrols, the inspection of river channels and facilities, and the operation of dams and floodgates. The RMO provides public

flood forecasts in cooperation with the Meteorological Agency. If the river water levels exceed dangerous thresholds, the RMO should notify relevant organizations. The RMO supports the activities of flood-fighting teams that are a community volunteer organization by carrying out tasks such as providing emergency information, accommodating the stock of equipment and materials, advising on disaster countermeasures, and dispatching liaison officers. During flooding, flood-fighting teams undertake urgent reinforcement of levees, provide warnings to residents, offer evacuation support, and operate the relevant facilities (Theme 1-3: Public Participation and Decision-Making Process, Chapter 4). The MLIT organizes the Technical Emergency Control Force and mobilizes various machinery for emergency operations, such as drainage pump vehicles, remote-controlled backhoes, satellite communications, and helicopters.

During a severe drought, the RMO should provide information to water users to promote coordination among concerned parties. If discussions for coordination become difficult, the RMO executes mediation and consultation (Theme 1-2: Water Rights).

2.5 Collaboration with Private Sector

It is a prerequisite for river management to collaborate with local communities.

Collaboration with local communities is necessary for river management to meet actual local conditions (Theme 1-3: Public Participation and Decision-Making Process). The RMO promotes collaboration with private organizations involved in river management activities such as river beautification (e.g., weeding, cleaning, extermination of alien species), river-environment and disaster-prevention education, and riverine ecosystem investigation and research (Figure 2.8). Such an organization may be designated as the “River Collaboration Organization,” and the RMO supports its activities by relaxing water usage regulations.



Source: MLIT

**Figure 2.8 Activities of River Collaboration Organizations
(Left: Cleaning Activity, Right: Fish Survey)**

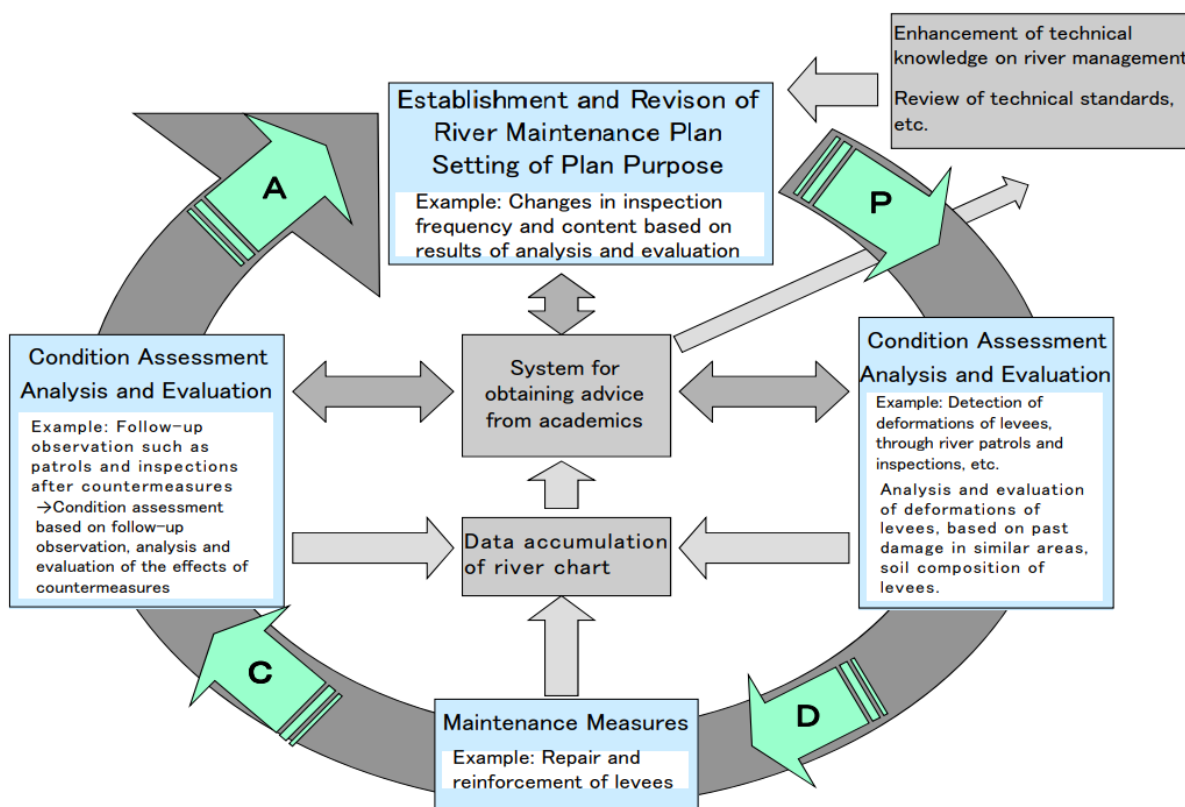
CHAPTER 3 NEW INITIATIVES

3.1 Extending Lifetime of River Management Facilities

The lifetime of river management facilities should be extended through efficient and effective maintenance. Laws and standards should be established to support long-term river management.

In Japan, river management facilities and permitted structures were constructed post-World War 2. The number of these facilities and structures increased during the high economic growth period, and declined from 1980 to the present. Hence, the maintenance of an increasing number of deteriorating facilities is becoming an issue.

The national government established a new policy to determine the extent of damage through inspections, replacing or renewing defects at the right time, preventing fatal damage in advance. In 2013, the government introduced an information system (RiMaDIS: River Management Data Intelligent System) using tablets to record inspection results in the database for a streamlined assessment of conditions. The PDCA (Plan, Do, Check, Action) cycle-management system maintains the river channel and facilities efficiently, and reduces total costs (Figure 3.1).



Source: MLIT Website

Figure 3.1 PDCA-type Maintenance and Management System

In 2012, a fatal accident occurred due to the collapse of the ceiling board of a highway tunnel; this accident inspired an increased interest in facility maintenance. In 2014, the Cabinet formulated the “Basic Plan for Extending Lifetime of Infrastructures” to improve the safety of public facilities and promote efficient maintenance. The plan presents new technological development through industry-

university-government collaboration. New technologies were developed in accordance with this plan, including information and communication technology (ICT) (Theme 10: Development of Human Resources and Technology).

A basic plan seeks to increase the longevity of functional river facilities. The River Law states that facility owners have an obligation to maintain facilities, and established corresponding inspection standards. The government revised the technical criteria for River-Sabo Works to present methods to assess facility conditions. A qualification system was also established for private specialists to assist in maintenance work. The “River Facilities Supervision Service” for river maintenance engineers is being piloted as a qualification requirement to comprehensively evaluate inspection results.

3.2 Collaboration with Relevant Offices

Collaboration with relevant government offices is required to seek solutions to river management issues.

(1) Comprehensive Sediment Management Plan

For rivers with significant sediment discharge, the MLIT designates Sabo, sediment disaster management, areas to implement Sabo projects, such as the construction of Sabo dams (Figure 3.2), mountain slope works, channel works, and sand pockets, according to the Sabo Act (Figure 3.3). The prefectural government manages the Sabo area, and several activities are restricted within this area. For a large-scale project that the local governments are unable to implement due to financial limitations, the MLIT carries out the necessary construction work and facility management. In devastated forest areas, the Forestry Agency and local governments implement similar Sabo and afforestation projects.



Source: Niko Sabo Office, Kanto Regional Development Bureau, MLIT

Figure 3.2 Sabo Dam

The government formulated a comprehensive sediment management plan by specifying measures to be carried out by relevant organizations responsible for Sabo areas, dams, rivers, and coasts in river systems. There are increasing concerns regarding sedimentation problems in dam reservoirs and impacts on the riverine ecosystem, including changes to aquatic habitat due to coarse-grained riverbed materials, the destabilization of river structures due to riverbed lowering, and coastal erosion. These problems are caused by an imbalance in sediment transport throughout rivers. Overall, sediment management is important, requiring the collaboration of organizations related to the sediment transport system, from the headwaters of the river to the coast.

(2) Mitigating Large-scale Flood Inundation

The Flood Control Act has been amended in response to frequent heavy rainfall disasters in recent years. Japan recognizes strengthening non-structural measures as a crucial measure of adapting to flood risks increased by climate change. The Council for Mitigating Large-scale Flood Inundation (comprised of

the RMO and local government), was established in each river basin to collaborate on four key policies: 1) evacuation; 2) flood protection; 3) inundation control; and 4) information sharing. At annual meetings, members confirm the status of activities, and examine and improve on activities. One emergency measure is early evacuation based on observed data; the RBO (River Basin Organization) and local governments have installed low-cost water level gauges specialized for flood monitoring. Governments and local companies jointly completed the system by 2020, and installed approximately 9000 units nationwide.



Source: Chubu Regional Development Bureau, MLIT

Figure 3.3 Comprehensive Sediment Management Plan for Hino River Sabo and Forestation

CHAPTER 4 LESSONS LEARNED

- (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.
- (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.
- (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.