

bottlenecks on arterial roads in cities, controlling automobile traffic in central built-up areas and conserving the roadside environment. In addition, countermeasures such as the development of bypasses and ring roads, the improvement of intersections at major congested points and continuous grade separation projects to remove railway crossings will be specifically promoted.

In order to avoid an influx of freight traffic such as trailers loading international-standard containers, the construction of international logistics arterial networks, the development of access roads which allow rapid connection from expressway interchanges to ports and airports, and the creation of large-scale logistics bases at traffic juncture points will be specifically promoted.

Moreover, in order to facilitate automobile traffic in built-up areas and to ensure safety, the development of parking lots and parking guide systems utilizing parking facilities and road spaces for loading and unloading for business purposes, the reinforcing of the Vehicle Information and Communication System (VICS) and the Electronic Toll Collection System (ETC) will be promoted. As accidents tend to happen in specific sections of arterial roads, measures for preventing accidents will also be intensively promoted in sections with high accident rates based on inspections of the causes of accidents through the objective analysis of accident data. Moreover, the introduction of a safe driving support system utilizing Intelligent Transport System (ITS) technology will be promoted together with these measures.

(3) Transportation supporting daily life

In each living sphere, as a basis for safety and security, road developments to secure movement essential for daily life such as commuting to work or school and shopping, and the convenience of traffic access to important institutions such as hospitals will be promoted. In particular, as for roads which link bases in merged municipalities and emergency transportation roads essential for rescue activities and emergency rehabilitation activities, efforts will be made to prevent regional division and isolation in the event of an emergency by specifically promoting anti-seismic reinforcement as well as the improvement of bridges, and developing disaster-prevention facilities. In particular, in areas with difficult geographical, natural and social conditions, it is important to secure emergency transportation in the event of medical crisis and to speed up evacuation at the time of disaster. Also, it is important to appropriately address this by combining a variety of methods such as ensuring road reliability which are lifelines as mentioned above, effectively utilizing and further developing existing emergency exists on expressways, and providing doctor helicopters. Moreover, on remote islands, ports and airports will be promoted by improving the in-service rate of the sea as well as air transportations from the viewpoint of stabilizing islanders' life through emergency medical care, cargo shipment and tourism.

On the other hand, as public transport management is expected to become more difficult with increased car ownership, the declining birthrate and depopulation, in most non-urban areas, public transport, which has been a means of transport for those with restricted mobility, is likely to decline. Considering this situation, rural areas should proactively and comprehensively think about the future course of regional transportation to meet real demands for the purpose of securing mobility. There is consensus that it is necessary to systematically and strategically

combine existing transportation such as railways and buses and a wide range of transportation means such as buses and taxi sharing, and boost and revitalize regional public transport through local support and the participation of a wide range of actors.

In doing so, it is necessary to promote efforts for the purpose of the practical use of new modes of transport such as Dual Mode Vehicles (DMV - a vehicle which can run both on railways and roads) and Intelligent Multimode Transit System (IMTS - a new transportation system integrating the rail transit system and bus system) which contribute to the sustainable management of transportation.

Chapter 5 Basic Measures Concerning Disaster Prevention

Japan has national land structure prone to disasters because over half of the population is concentrated in flood flow zones, which account for 10 percent of the national land area. On the other hand, as mentioned in part 1, we are seeing increased public awareness concerning disasters following the weakening of communities associated with the declining and aging population, and increased disaster risks associated with global warming in recent years. Therefore, it is necessary to promote the creation of safe and secure national land where even those requiring support at a time of disaster can independently safeguard their own lives and receive support from others and society as a whole. This can be achieved by creating a national land structure with long-term resistance to disasters.

To achieve this, it is necessary to instigate nationwide campaigns to encourage daily disaster prevention on an individual, family, area, company and institutional level, regardless of sex or age and balancing self-remedial, mutual-help and public-help measures.

Meanwhile, post-disaster measures require considerable costs as disaster recovery and new countermeasures are needed. Therefore, disaster-prevention measures are important. From the viewpoint of avoidance and alleviation of human suffering as well as serious damage to lives and socioeconomic activities, priority should be placed on the development of equipment and facilities. It is also important to further strengthen the maintenance and management of disaster-prevention systems managed by local governments. Moreover, as for disasters such as earthquakes, which have wide-area, complex and long-term effects, it is necessary to address a variety of soft measures integrated with the development of equipment and facilities emphasizing disaster mitigation to minimize damage, and to establish disaster prevention/crisis-management systems on a wide-area basis. Furthermore, it is necessary to facilitate the quick recovery of damaged areas and to take measures to prevent a recurrence.

Section 1 Comprehensive Disaster-Prevention Measures

(1) Efficient and Effective Disaster-Prevention Facilities

Efficient and effective disaster-prevention measures will be promoted with respect to potentially serious disasters. As prioritized preventive measures to prevent serious damage to human life as well as economic and social damage, the development of disaster-prevention facilities which accurately respond to regional characteristics such as natural and social

conditions will be pushed forward. In addition, the effective utilization of existing stocks, diversification of function on any facilities which are expected disaster preventive effects and the upgrading of disaster-prevention measures utilizing information and communication technology such as a sensor network technology will be pushed forward.

(Development of disaster-resilient facilities)

The development of disaster-prevention facilities will be steadily pushed forward taking into account previous disasters and the effects of development. In addition, as for other buildings and structures, the required disaster-prevention functions will be secured. In urban areas with concentrated populations, the development of transportation/information and communication networks with a good redundancy such as bypass routes and regional disaster-prevention bases will be pushed forward.

Moreover, in order to rapidly recover economic/social functions in disaster-affected areas as well as to prevent recurrence, the essential improvement and recovery of facilities should be rapidly carried out. Meanwhile, among facilities which were developed in a hurried manner between the mid-1950s and the mid-1970s, there are a number of facilities whose disaster-prevention functions are declining as a result of aging or cannot be fully utilized as they do not conform to current earthquake-resistant design standards. Therefore, disaster-prevention functions which can be expected of these existing constructions will be appropriately reviewed taking into account changes such as increased public awareness concerning disasters. Consideration will be given to the upgrading of disaster-prevention functions, and to the renovation of existing facilities. At the same time, a new maintenance and management system should be developed aiming at prolonging the life of existing constructions.

(Strengthening the information and communication infrastructure to upgrade disaster-prevention measures)

The management and operation of monitoring, prediction and warning systems of natural disasters as well as the functions of disaster-prevention facilities should be upgraded by utilizing sensor network and robot technologies. At the same time, the development of sound information and communication systems for collecting a wide range of disaster information and rapidly and accurately transmitting it to everyone in an easy way to understand will be promoted. This can be achieved by laying underground power lines and establishing lines for communication of emergency information by utilizing satellite communication and mobile phone networks.

(2) "Soft" measures for reducing disasters

"Soft" structural measures to be reinforced for the purpose of strengthening disaster mitigation measures are categorized as follows: "preliminary measures," a system which implements disaster prevention at ordinary times and prepares for the rapid implementation of disaster emergency responses; "ATOD¹⁹ measures," a system which implements disaster emergency

¹⁹ At time of disaster

responses for accurate responses to disasters; and "Ex post facto measures," a system which ensures safety and security based on disaster emergency responses and implements disaster recovery and rehabilitation.

(Preliminary measures)

The development and distribution of versatile hazard maps that are easy to use in the event of an emergency will be promoted to ensure rapid and safe evacuation at a time of disaster. Moreover, evacuation routes and zones will be secured by effectively utilizing existing facilities such as residential roads and schools. This will be achieved by stockpiling food, commodities, and materials/equipment for urgent recovery throughout evacuation zones.

Moreover, for the purpose of alleviating economic and social damage caused by severe disasters, the creation of business continuity plans as well as business contingency plans will be pushed forward in both the public and private sectors.

Furthermore, in order to strengthen mutual-help functions of companies and region-based communities, awareness concerning disasters which has been nurtured within the disaster-prone culture of Japan such as evacuation action and mutual support will be raised. Also, disaster education and practical disaster-prevention training will be implemented. In order to achieve this, universal design of evacuation systems will be promoted through easy-to-understand disaster and evacuation information using pictographs. In addition, monitoring and information collection/provision systems will be strengthened and studies concerning disaster prevention will be promoted in order to reinforce disaster prediction, risk assessment and disaster-prevention measures.

(ATOD measures)

In order to prevent damage and possible further damage resulting from a secondary disaster, rapid and accurate collection/transmission systems of disaster information which utilize a wide range of means such as disaster-prevention administration radio, mobile phone networks and the Internet will be developed. At the same time, systems to issue evacuation orders/direction and evacuation preparation information intended for those who are in need of support at a time of disaster will be developed.

(Ex post facto measures)

Accurate information about the disaster and someone's safety will be rapidly transmitted utilizing information and communication technology such as electronic bulletin boards. In addition, the development of systems for rescuing and protecting disaster victims, transferring them to medical facilities, treating them and also correctly dealing with PTSD (Posttraumatic Stress Disorder) will be promoted. Moreover, the quick restoration of lifelines will be promoted, and the development of wide-area systems for securing materials, equipment and human resources will be promoted as measures for those who have difficulty in returning to their home and of disaster recovery.

In order to encourage disaster victims to rebuild their lives and promote the rapid rehabilitation

of disaster-affected areas, support will be provided based on disaster victims' sense of independence and motivation to rebuild their life utilizing a wide range of systems such as natural disaster insurance, loans and donations. Moreover, in the event of a severe disaster which requires considerable time for recovery and rehabilitation, consideration should be given to a future course of restoration/rehabilitation measures, because indirect damage originating in post-disaster economic and social changes will be extremely heavy.

(3) Wide-area disaster-prevention/crisis management system and regional disaster-prevention capacities

Wide-area disaster-prevention/crisis management systems should be created in order to be able to accurately respond to a large-scale disaster. At the same time, "Disaster-Proof Living Zones," which are created with regional disaster-prevention bases as the core, will be further strengthened for the purpose of strengthening regional disaster-prevention capacities.

(Wide-area disaster-prevention/crisis management systems)

Disaster-prevention-related organizations such as the government and multiple local governments will promote further strengthening of wide-area disaster-prevention/crisis-management systems for mutual cooperation and linkage including backups concerning emergency transportation of relief supplies, human resources and equipment. The purpose of this is to transmit disaster information and protect disaster victims for the purpose of effective and smooth response to disasters. In particular, in key metropolitan and regional cities which function as national and regional economic and social centers, it is necessary to promote mutual networking of central corporate functions based on BCP created by public organizations as well as individual companies, and transforming wide-area infrastructure functions such as transportation, information and communication and lifelines into multiple/multidimensional entities in order to support maintenance and recovery. In addition, the development of arterial regional disaster-prevention bases, the strengthening of operation systems, and the strengthening of backup systems should be promoted through alternatives to central functions. Moreover, in challenging areas, countermeasures against isolation will be implemented with a wide-area system promoting the utilization of information and communication technology because of the risk of transportation and information channels being cut off in the event of a disaster. Meanwhile, the government reinforces and strengthens technical support for local governments by developing systems for sending human resources, materials and equipment for the rapid recovery of affected social infrastructure facilities and the prevention of a secondary disaster.

In order to minimize damage by a potentially global-scale disaster as in the case of the Asian Tsunami, the government takes the lead in providing excellent knowledge and techniques concerning disaster prevention which have been nurtured in our disaster-prone country, and advances the development of cooperative observation systems and of international frameworks for promoting disaster/disaster-prevention studies within international networks.

(Disaster-proof living environments)

In order for residents and communities to further strengthen disaster-proof living zones and basic units which conduct activities such as fire drills, disaster prevention and evacuation, a national campaign will be promoted to encourage everyone to proactively and supportively practice various disaster-prevention measures in everyday life. Therefore, an evacuation guiding system will be reinforced for those who are in need of support at a time of disaster. This includes familiarization with disaster-prevention and a safety information channel for those affected, disaster-prevention education concerning a variety of characteristics of and measures for disasters which vary according to area and the creation of an evacuation manual. Moreover, because of the decrease in numbers and aging of members of the fire/water brigades, which play a central role in regional disaster prevention, a support system for securing members will be developed. At the same time, fire brigades will promote the introduction of member and squad systems by strengthening linkage with volunteer fire prevention organizations and private establishments. Water brigades will reinforce and strengthen regional disaster-prevention systems by reinforcing cooperation systems with NPOs.

(4) Disaster-resilient national land spaces

In order to create disaster-resilient national land, disaster risks will be reduced. This can be achieved by promoting a conversion to an intensive urban structure, reducing disaster-vulnerable areas and by directing the population and assets to safer areas. In addition, damage should be minimized even in the event of a disaster so that rapid recovery and projects can continue. In doing so, it is important to effectively utilize free spaces, which are expected to increase due to the declining population, and to regard the reconstruction due to aging as a good opportunity. Moreover, in promoting these efforts, it is important to develop and effectively utilize highly accurate disaster-prevention information, such as hazard maps, to evaluate disaster risks. Also, it is important to review the location of free spaces and the function of national land by envisioning the development of disaster-resilient areas.

(National land use reducing disaster risks)

In order to reduce disaster-risk areas, the development of dikes and circle levees, and bank raising of housing lots will be carried out taking into account regional characteristics such as existing land shapes. At the same time, the improvement of defense functions against inundation will be promoted by effectively utilizing embankment structures such as existing railways and roads. Moreover, the utilization of school yards, introduction of permeable pavement, and strengthening of reservoir/penetration functions such as the establishment of infiltration inlets at private facilities will be promoted. Furthermore, fire spread prevention at a time of earthquake or fire will be promoted through control measures such as regulations for the purpose of securing open spaces in concentrated built-up areas.

In order to direct the population and assets from areas with disaster risks to safer areas, location control of new housing will be promoted by designating calamity danger zones and

special restricted areas due to sediment-related disasters.

Meanwhile, in metropolitan areas, national land use will focus on minimizing damage taking into account the fact that urban functions are concentrated in zero-meter areas - fragile areas below sea level. Also, risks due to rises in sea level will be considered and effects of large-scale earthquakes, tsunamis, storm surges or floods will be inspected and evaluated.

(National land use for rapid recovery and continuation of business)

Taking into account disaster risks and the vulnerability of geological conditions such as land shape, the securing of evacuation routes/areas, of the situating of disaster-prevention bases such as municipal offices, police stations, fire stations and yards for flood prevention materials, the securing of regional networks which connect these bases utilizing roads, dikes and river beds, and the conservation of facilities for those who are in need of support at a time of disaster will be properly implemented.

Moreover, in order to prevent excessive numbers of disaster victims, consideration will be given to, for example, the development and conservation of riparian forests and woodlands for controlling the influx of flooded water and garbage into built-up areas, city developments adapted for snow removal, the utilization of buildings as evacuation areas in areas with shorter tsunami arrival time and the securing of shelters against falling objects following a volcanic eruption.

Section 2 Specific Measures for Accurately Responding to a Wide Range of Natural Disasters

Appropriate measures will be taken to deal with earthquakes, tsunamis, flood and wind damage, heavy snowfall, storm surges and volcanic eruptions according to regional characteristics and the type, strength and size of the disasters.

(1) Countermeasures against earthquakes and tsunamis

(Earthquake countermeasures)

As large-scale earthquakes have occurred nationwide even after the Great Hanshin-Awaji Earthquake in 1995, it is necessary to strengthen earthquake countermeasures. Since enormous and serious damage is anticipated in the case of a large-scale earthquake, practical crisis-management systems by disaster-prevention-related organizations as well as open spaces as evacuation areas will be secured. Moreover, a cooperative disaster-prevention society will be realized where not only the government but also a wide range of entities such as residents, companies and NPOs will take the lead in addressing disaster-prevention measures in a cooperative manner on a local level. Furthermore, efficient and effective disaster-prevention measures will be promoted utilizing advanced information and communication technology such as emergency earthquake warning systems.

In order to protect disaster-prevention facilities such as dikes for protecting people's lives and assets, seismic measures will be promoted. As for arterial transportation such as major railways, roads, ports and airports, seismic reinforcement will be implemented from the viewpoint of

securing safe and secure transportation services and preventing disruptions to rescue/relief activities and the transportation of emergency materials. Efforts will also be made to reinforce transportation networks. In addition, seismic retrofit strategies for public buildings including disaster-prevention bases such as schools, houses, communication facilities and lifeline facilities will be promoted. As for nuclear power plants, it is necessary to continue to fully secure their seismic safety. Meanwhile, as for facilities located on soft sand ground, liquefaction countermeasures will be implemented. Moreover, slope failure countermeasures will be specifically and systematically promoted in order to prevent sediment-related damage caused by earthquakes.

In densely built-up areas, the demolition and renovation of aging housing will be promoted. Also, the development of roads suitable for evacuation and fire spread prevention will be steadily promoted. In doing so, the creation of a disaster-prevention axis - evacuation routes and fire spread blocking zones - will be pushed forward by promoting the construction of non-flammable roadside buildings together with the development of urban planning roads.

The reinforcement of earthquake prevention measures will be promoted given that it is thought that a large ocean-trench earthquake and or an earthquake directly beneath a big city are imminent. They include measures against the recurrence of a Tonankai/Nankai earthquake, subsequent earthquake countermeasures considering the time lag of earthquake energy release, securing of core capital functions to prevent an earthquake directly beneath the capital, measures for serious damage and long-term rehabilitation assistance measures in response to disaster victims' needs.

(Tsunami countermeasures)

As for tsunamis caused by large-scale earthquakes, the development of facilities will be accurately and steadily carried out in order to increase safety at an early stage and to minimize damage caused by tsunamis. At the same time, measures will be taken to increase soft functions such as disaster-prevention and earthquake resistance systems.

Therefore, tsunami warnings and information concerning tsunamis will be rapidly and appropriately provided. At the same time, the reinforcement of evacuation measures through hazard maps, prevention measures such as the development of tsunami protection facilities, and the development and wider use of tsunami-related disaster-prevention technologies/knowledge will be promoted. Post-disaster measures such as the securing of wide-area transportation networks will also be reinforced.

(2) Countermeasures against wind and flood damage, heavy snowfall and storm surges

(Responses to new issues such as concerns about worsening disasters due to climate change)

In addition to a disaster-prone national land structure and weakened local communities, the possibility of more frequent heavy rains and a sea level rise due to global warming and of more intense typhoons has been pointed out. In implementing measures, it is important not only to

curbs greenhouse gas emissions but also to adapt to new issues such as concerns surrounding increased risks in zero-meter areas. Therefore, research and studies regarding the effects of climate change on national land use and disaster-prevention measures will be pushed forward. At the same time, the timely development of equipment and facilities as preventive measures will specifically be pushed forward from the viewpoint of avoiding human suffering serious damage to people's lives and socioeconomic activities. In addition, soft measures to minimize damage in case of a disaster will also be implemented. As for disaster-affected areas, disaster-prevention measures will be pushed forward again. Moreover, measures to reduce damage will be taken in case large-scale flooding occurs. Also, support will be given to protecting local residents' lives and assets, and implementing companies' BCP. In doing so, predictions of large-scale flood damage through accurate weather reporting concerning localized heavy rain should be linked to appropriate acts of residents and effective responses of administrative offices.

(Countermeasures against flood and wind damage and heavy snowfall)

The specific development of facilities will be implemented for the purpose of preventing fatal damage caused by inundation above floor level and sediment-related disasters. At the same time, the development of warning and evacuation systems and restriction of specific development action are promoted. As for high-risk flood areas, necessary development will be promoted to enable anyone to be able to utilize hazard maps anywhere. In addition, disaster-mitigation measures combining equipment, facilities and soft measures on a catchment-basin level are strongly promoted by making efforts for strengthening transmission systems of such information through river-level and warning information about sediment-related disasters and awareness raising of potential disaster areas.

Moreover, disaster-mitigation measures according to national land use by urgently developing circle levees, and the introduction of a wide range of development methods for the fast improvement of disaster safety levels by, for example, by effectively restructuring existing dams will be promoted. Also, qualitative checks and the development of river dikes will be implemented.

Furthermore, it is also important to fully exercise the multifunctional roles of forests and agriculture from the viewpoint of creating flexible and disaster-resilient national land so that their appropriate development and conservation will be pushed forward. In addition, the safety and reliability of road transportation will be enhanced by promoting countermeasures for sloping roads against heavy rain.

Meanwhile, as for urban flood damage which is increasing following as increase in concentrated heavy rain and an increase in underground use in recent years, comprehensive flood control/inundation measures will be implemented by establishing reservoir/infiltration facilities to integrate the whole catchment basin.

In order to strengthen countermeasures against storm winds and gusts of wind, the development of windbreak facilities as well as knowledge about wind-related disasters, research and studies on generating-mechanisms and the reinforcement of monitoring/forecast systems will

be promoted. In frigid regions, which account for 60 percent of national land, the development of snow removal systems with the cooperation of local communities, the development of avalanche prevention facilities, and snow damage measures such as the removal of traffic hazards due to frost/snow damage will be promoted to secure safety and security during the winter season.

(Countermeasures against storm surges)

Japan's central functions are concentrated on low-lying areas such as zero-meter areas including the three major bays. Since upgraded land use methods are carried out, once a flood occurs, it may lead into a catastrophe. Therefore, complete countermeasures will be taken in line with conventional storm surge plans such as the steady development of coast conservation facilities, the ensuring of their reliability through countermeasures against their aging and seismic orientation and the strengthening of emergency management systems. Moreover, the minimization of large-scale inundation damage will be promoted. This can be achieved by controlling flood water utilizing railway embankments and river dikes, converting to a way of life that is resistant to damage through information provision via hazard maps, providing appropriate storm surge information, developing sure and rapid evacuation/relief systems utilizing this information, and maintaining the function of facilities taking rapid recovery and rehabilitation into consideration. Furthermore, storm surge countermeasures will be comprehensively promoted through close linkage between disaster-prevention-related organizations such as the government, local governments, managers of roads and railways, and managers of waterworks/electricity companies.

(3) Countermeasures against volcanic eruptions

As a concern related to a volcanic eruption includes its far-reaching and long-lasting effects, the reinforcement of evacuation measures for the purpose of alleviating damages will be promoted in addition to the development of facilities which control volcanic mudflow and debris.

Specifically, evacuation systems in response to volcanic information and hazard maps are established to reflect regional disaster-prevention plans of local governments near volcanoes. Moreover, residents' awareness should be raised through disaster-prevention training/education, and efforts will be made for the improvement of volcanic eruption prediction technologies. Furthermore, wide-area disaster-prevention systems will be developed by establishing a joint on-site countermeasures office to rapidly and accurately transmit volcanic conditions to related administrative offices and residents. At the same time, disaster emergency/recovery measures will be implemented using roads and railways to regulate traffic.

Chapter 6 Basic Measures Concerning Use and Conservation of National Land Resources and Sea Areas

In Japan, people have obtained essential water and food utilizing and conserving national land resources over many years through the development of new rice fields, drains, dams, dikes, and water and sewage, and afforestation. This has also played a role in sediment discharge and the

protection of water resources.

However, conditions surrounding the use and conservation of national land resources are deteriorating as a result of more frequent inundation damage caused by record-level rainfall, more frequent water shortages, the deterioration of ecosystems, disturbances to water circulation systems, the disruption of sand and soil flow, a decrease in coastlines of white sand and green pines, an increase in absentee owners, an increase in abandoned cultivated land as a result of aging principal farmers, and a lack of forests maintenance due decreased motivation of forest owners. In addition, effects of global warming are a concern.

Moreover, international prices of grain and lumber are on the rise as a result of worldwide climate change and the rapid economic growth of East Asia. This increases uncertainties surrounding future imports and so it is necessary to promote the appropriate use and conservation of national land resources.

In addition, it is necessary for Japan to promote the sustainable use and conservation of seas in order to pass their benefits on to the future generation as a "Maritime Nation" surrounded on all sides by water and blessed with a variety of resources in neighboring sea areas.

Therefore, in order to sustainably use national land resources in Japan and benefit from the seas and national land and watershed conservation for years to come, the following basic measures will be implemented by:

1. Promoting national land management by capturing catchment basins, related water-use areas and flood plains as river basin spheres.
2. Preparing for water shortage and improving the quality of water in watershed areas, and appropriately maintaining and managing/renovating facilities.
3. Passing beautiful forests on to future generations by pushing forward the development and conservation of a wide range of forests including afforestation in collaboration with the people.
4. Fostering the effective use of farmland and promoting the conservation and improvement of farmland/agricultural water through the participation of a wide range of entities.
5. Establishing comprehensive government policies concerning not only territorial seas under Japan's sovereignty but also exclusive economic zones and continental shelves and pushing forward strategic efforts.
6. Promoting "Whole Nation Land Care" supporting beautiful and rich national land cared for by the whole nation and passing it on to future generations.

Section 1 National Land Management Focusing on River Basin Spheres

River basin spheres are not a kind of ecosystem and water and material circulation system but also the foundation for the development of beautiful national land. In river basin spheres, a number of cities rich in nature have developed. However, river basin spheres have considerably changed due to increased environmental burdens as a result of population and industrial concentration. Therefore, national land management focusing on river basin spheres is necessary in order to pass on river basin spheres where nature and socioeconomic activities exist in harmony to future generations.

(1) Sound water circulation systems

Water circulation systems, which are closely related to people's lives, are systems whereby natural systems of evapotranspiration, precipitation, deep percolation and runoff are organically connected to artificial systems consisting of water and sewage, industrial water systems, agricultural water and wastewater channels. As for natural systems, there are concerns surrounding an increase in precipitation fluctuation in recent years, a decline in basin recharge functions due to an increased in ill-maintained forests, storage penetration of land due to the expansion of built-up areas and an increase in the flow of rainwater into rivers due to reduced retarding function. Moreover, as for artificial systems, while it is expected that water demand and supply will be completely balanced thanks to the declining population and changes in industrial structure leading to the restoration of a lost natural environment and the improvement of the living environment, there are concerns that water supply will continue to not meet demands and its functions will decline as a result of aging facilities and shortage of people to manage them in some river basin spheres. Furthermore, looking at the water circulation system as a whole - as a combination of natural and artificial systems -, responses to fluctuations of the volume of water and to the deterioration of the quality of water are required. In order to appropriately address these problems and to create an environmentally sound water cycle, the comprehensive implementation of measures will be promoted in river basin spheres through linkage between a wide range of entities centered on basin recharge, appropriate management of groundwater conservation, efficient use of water resources, securing of the good quality of water and safe and affluent waterfronts. In doing so, consideration should be given to the integration of natural and artificial systems.

(Basin recharge and appropriate management of groundwater conservation)

The conservation and improvement of storage penetration and recharge functions will be promoted through the whole catchment basin and the appropriate management of groundwater conservation will be promoted taking into account regional characteristics.

In mountain areas, in order to maintain and improve the basin recharge functions of forests, forests will be developed and conserved. This can be achieved by utilizing legal systems such as the systematic designation of basin recharge preservation forests and the proper operation of diversion control and logging control in preservation forests from the viewpoint of the whole catchment basin, the promotion of thinning, and the development of forest conservation facilities. In rural and suburban areas, it is necessary to promote the development/conservation of satoyama forests around habitation areas, the utilization of a city planning system, the conservation of green areas by local government laws and the afforestation of public facilities/private land. Moreover, the abandoning of cultivated land will be controlled as basin recharge functions are secured through the maintenance of agricultural production activities. In built-up areas, the development of rainfall infiltration facilities and a reduced discharge sewer system, and permeable pavement will be promoted.

Moreover, groundwater will be monitored continuously. At the same time, in areas where groundwater use is controlled because of subsidence, the rationalization of groundwater use, alternative measures including the conversion to surface water, restricted location of new wells and water-saving education with regard to existing wells will be promoted. Moreover, in areas affected by rise in groundwater levels because of construction uplift, consideration will be given to monitoring systems and proper groundwater management strategies. Furthermore, considerations will be given to groundwater use measures in the event of an earthquake.

(Efficient use of water resources; water quality)

From the viewpoint of the efficient use of water resources and alleviating the burden on watershed areas, domestic water will be efficiently promoted. This can be achieved through the efficient use of agricultural water by developing/modernizing agricultural water use facilities, the rationalization of water use by promoting industrial water recycling, the increased use of water-saving equipment and the reuse of rainwater/treated sewage water. Moreover, the elastic operation of dams for the environmental conservation of downstream rivers on a scale which does not affect flood control and the return of advanced treated sewage sludge to rivers will be promoted. At the same time, the conversion of waste will be implemented as necessary with the mutual understanding of concerned parties to meet the actual conditions of the area.

From the viewpoint of securing of water quality, the development of wastewater disposal facilities and the improvement of combined sewer systems will be pushed forward, and water purification in agricultural water and wastewater channels, river/dam reservoirs will be promoted. In particular, in catchment basins flowing into enclosed water areas in urgent need of improvement, countermeasures against plane source loads of built-up areas and farmland will be promoted by designating discharged water action areas in addition to countermeasures against point source loads of living sewage, sewage from factories and businesses and livestock sewage. Moreover, efforts will be made to remove sludge accumulated in rivers and lakes to prevent the elution of hazardous substances and to improve the water environment.

(Safe and affluent waterfronts)

Safe and affluent waterfronts will be restored utilizing a sound water circulation system through storage penetration, recharge and efficient water use in all river basin spheres. Specifically, the conservation of drainage basins will be promoted through national land use strategies considering disaster risks, and consideration will also be given to their normal function as a habitat of natural organisms. Moreover, living/natural environments will be conserved and improved by improving water quality, creating recreational water spaces and landscaping by securing of environmental water and developing sewer systems. At the same time, surface water as an energy source and water using the heat of vaporization will be promoted as countermeasures against heat-island phenomena in conjunction with water circulation systems. Furthermore, neo-natural river reconstructions will be promoted. This can be achieved by promoting the reproduction of nature flow fluctuations, the conservation of existing ecosystems

by increasing the submergence frequency of dry riverheads and by restoring wetlands, and preventing invasions of alien species. In addition, support will be given to securing habitats, city developments integrated with rivers, the development of waterfront parks and efforts for boosting areas such as through the utilization of river navigation. This can be achieved through the creation of good waterfront spaces by restoring water surfaces, rivers, water channels and springs which have dried up.

Meanwhile, in making these efforts, the creation of ecological networks and the maintenance/improvement of landscapes will be promoted through linkage and promoting harmonious ecosystems in the whole river basin sphere.

(Basin tie-up by a wide range of entities)

River basin spheres are connected to regional historical, cultural and natural factors. Residents in catchment basins and companies are connected in various ways with water. Combined efforts in river basin spheres against a variety of issues are needed through information sharing, exchange and linkage between a wide range of entities.

Therefore, in each area in the river basin sphere, the participation in planning related to water, the conservation/restoration of the natural environment, the development/conservation of forests, cleaning activities, water-saving, polluting emission controls, the handing down of water culture, and environmental/disaster prevention education will be promoted with the participation of a wide range of entities. At the same time, the conservation/boosting of water source areas, the creation of landscapes, a variety of civil activities such as regional boosting through inland navigation, local government activities and corporate activities will be promoted. Moreover, the effect of the efforts of these wide ranging entities will be improved through information sharing, exchange and linkage between river basin spheres such as between upstream and downstream basins or between regions, and the expansion of efforts to all river basin spheres. In this case, the strengthening of linkage between concerned parties will be promoted through, for instance, councils in river basin spheres. At the same time, common rulemaking such as landscape charters and financial support systems such as the utilization of funds will be promoted with the consensus of the parties involved.

Moreover, wide-area efforts such as support at a time of large-scale flood damage by sending disaster volunteers and building relationship between multiple river basin spheres flowing into enclosed water areas are required. Therefore, efforts are needed to strengthen the sharing of people and know-how concerning basin tie-ups and safety and environment covering plural river basin spheres by further promoting inter-basin tie-ups which have already started in some areas.

(2) Comprehensive measures for sediment management

The geological condition of Japan is fragile. Also, since geological creation is rapid, mountainous land is more likely to erode. Sediment is carried downstream from mountainous land creating alluvial cones and alluvial plains. Then, sediment reaches the seas and beach drifting forms coastlines. Sediment is different from water in that it moves in a discontinuous

manner, repeating cycles of deposition and movement to change the shape of the land.

In particular, rises in river bed levels and the closure of river-channels/river-mouths by sediment discharge has brought increased risk of flooding and inundation in recent years. In addition, armored river beds are more common in areas immediately downstream of dams as a result of sedimentation in dams, and this is detrimental to the river environment.

Furthermore, the blocking of upstream sediment movement, a decrease in sediment supply from land areas to sea areas due to gravel extraction in river channels, and changes in beach drifting on coasts have all helped coastal erosion. This has caused a reduction in disaster prevention qualities of sand beaches against storm surges and ocean waves, and of natural environments and coastal landscapes.

Therefore, in order to settle problems relating to safety and use originating from sediment flow and to conserve the natural environment and landscapes formed by sediment, the following measures will be implemented in cooperation with related organizations as part of an integrated sediment management program spanning the mountainside to the seaside.

(Proper flow-down and use of sediment; prevention of sediment-related disasters)

The development of sabo facilities for preventing harmful sediment discharge such as debris flow will be promoted taking into account geographic characteristics. Japan is prone to serious damage by sediment-related disasters. At the same time, consideration will be given to functions of sabo dams and downstream conservation targets to promote the establishment of sabo dams which can discharge sediment downstream that is appropriate from both a qualitative and quantitative viewpoint and the permeabilization of existing sabo dams by promoting production control and capturing of sediment damaging downstream areas. Furthermore, in order to maintain dam functions for as long as possible and to secure safety and the environment of downstream areas by properly supplying sediment, sediment measures considering life-cycle costs will be promoted. This can be achieved through a combination of measures such as reviewing the sedimentation plan in a dam reservoir plan, controlling sediment inflow to dam reservoirs, establishing reservoir dams immediately upstream of reservoirs, artificially removing sediment from reservoirs, as well as using sluices and ducts. In addition, in order to promote sand washout in, for example, dams for electric generation, consideration will be given to cooperation between relevant managers and support measures. Proper management of river beds will be carried out through measures concerning flow down sediment in sabo facilities or dams and the rationalization of gravel extraction in rivers. As for river crossing structures that are becoming unsafe as a result of declining river bed quality, reinforcement measures such as building revetments and streambed protection will be implemented as necessary. In order to prevent river-mouth closure as a result of sediment deposition, the establishment of training dikes and dredging of sediment will be carried out in order to effectively use sediment generated by dredging.

Furthermore, sediment dredged in ports and sea routes will be utilized for the natural restoration of sand beaches and wetland areas. As for coastal erosion, the restoration of sand

beaches through sand bypasses²⁰ and littoral nourishment as necessary as well as through the development of coast protection works will be promoted.

Meanwhile, afforestation and the maintenance of forests will be promoted to protect against mountainous disasters in order to further exercise the functions of sediment discharge and collapse protection.

(Consideration and evaluation of techniques; linkage between relevant organizations)

In order to carry out appropriate sediment management, the collection of existing data concerning past sediment movements, a sediment dynamics monitoring survey concerning the amount and quality of sediment, a soundness evaluation of sediment flow through streams, rivers to coasts by analyzing the results, future predictions using simulation models of sediment runoff and beach drifting which enable changes in geologic creation to be estimated by tracing sediment movement will be implemented. At the same time, consideration and evaluation of more effective techniques will be carried out. Moreover, integrated sediment management from the mountainside to the seaside will be addressed through linkage between individual businesses by formulating principles for business linkage with related organizations.

Section 2 Safe and Secure Water Resources and Their Use

Looking at the use of water resources in recent years in Japan, the usage of municipal water including domestic and industrial water has barely changed as the coverage of the water supply system was already over 90 percent in the 1950s and recycling of industrial water progressed. As for agricultural water, although there are some factors resulting in an increase in water requirement such as a decline in recycled water associated with the general-purpose use of rice paddies and the separation of water and wastewater, usage is declining following decreased rice-paddy acreage.

However, while the mean annual rainfall of Japan is almost as twice the world average, water resources per capita, which deduct evapotranspiration from rainfall, are less than half of the world average. This is because the geologic creation of Japan is rapid and river channels are short. Also, since rainfall is concentrated in the rainy season and the typhoon season, a large proportion of water resources overflow into the seas without being used. Furthermore, the gap between years with small amounts of rainfall and years with large amounts of rainfall has been widening in recent years, and large-scale droughts which occurred only once every 10 years in the 50s are tending to happen more frequently. Thus, water utilization safety is declining and the effects of global warming are a concern for the future. In addition, the water supply is still vulnerable to water-quality accidents or facility failures.

Taking these facts into account, it is important to promote the use of safe and secure water resources.

(1) Drought-resilient regional development

²⁰ A construction method to recover sand beaches by artificially moving sands from deposited spots to eroded spots.

In Japan, droughts which require water restrictions occur every year. The mean level of annual rainfall is falling with time, and the fluctuation range is increasing each year. Thus, it is a concern that a larger scale drought with more serious consequences may occur in the future. In this case, it may have a devastating long-term effect on socioeconomic activities. From such the viewpoint, it is necessary to make sufficient preparations for droughts and strengthen crisis management systems.

Therefore, in water systems with low water utilization safety levels, the securing of water resources will be promoted by developing facilities. Moreover, in order to promote risk avoidance of localized distribution of rainfall, multifunctional, stable water sources will be promoted with the cooperation of relevant parties through effectively utilizing existing stocks such as linking a group of dams and reviewing the water utilization capacity and seawater desalination. Furthermore, leakage prevention measures of water distribution pipes, the promotion of waver-saving equipment in every home, and effective use of rainwater and recycled wastewater will be pushed forward. In remote islands and peninsulas with scarce water resources, the securing of stable water resources will be promoted through, for example, living reservoirs, seawater desalination and groundwater dams. In addition, the effective use of potential excess water will be promoted by reorganizing agricultural water in conjunction with the renovation of agricultural water utilization facilities.

In order to minimize the effect on socioeconomic activities even at a time of drought, water accommodation among intended purposes and among the areas will be properly and smoothly carried out utilizing councils for drought adjustment. At the same time, appropriate information provision to residents and companies and consensus creation will be promoted.

(2) Clean and pleasant-tasting water

It is necessary to supply clean and good-tasting water to enable people to live healthy and safe lives as well as raise public awareness concerning health. In doing so, it is important to prevent the effects of hazardous chemical substances and pathogenic organisms.

Therefore, measures for supplying clean, good-tasting and odorless drinking water will be specifically implemented. This can be achieved through the reorganization of intake points for drinking water and the upgrading of water purification in response to the presence of hazardous chemical substances and pathogenic organisms. Moreover, the reinforcement of crisis management related to water quality such as appropriate responses to water-quality accidents will be promoted. As for groundwater, a thorough control of deep percolation of hazardous substances, a reduction in the nitrogen load and the smooth implementation of ground pollution countermeasures will be promoted.

(3) Steady maintenance, management and renovation of facilities related to water resources

As for facilities related to water resources such as reservoirs, water supply, water for agricultural use and industrial water, if the appropriate maintenance and management are not