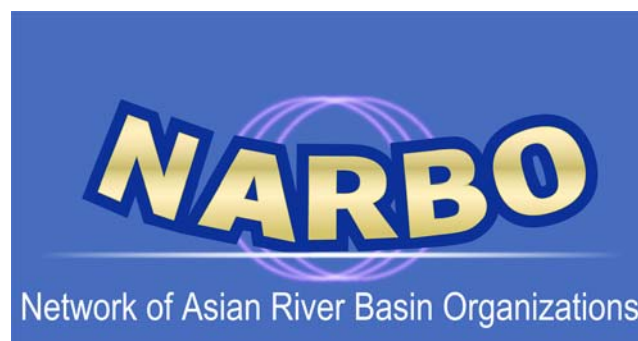


Water-Related Disaster and its Management in Asian Countries

Outcome of a series of thematic workshop
on Water-Related Disaster and its Management in Asian Countries
(2007 - 2009)

March 2009



Organized by:

**Network of Asian River Basin Organizations
(NARBO)**

Abbreviation

ADB: Asian Development Bank

DRM: Disaster Risk Management

DWR: Department of Water Resources, Thailand / Viet Nam

IWRM: Integrated Water Resources Management

JWA: Japan Water Agency

LLDA: Laguna Lake Development Authority, Philippines

MASL: Mahaweli Authority of Sri Lanka

MLIT: Ministry of Land, Infrastructure, Transport and Tourism

NARBO: Network of Asian River Basin Organizations

PJT II: Jasa Tirta II Public Corporation, Indonesia

RBO: River Basin Organization

Preface

Natural disasters (e.g. floods, droughts, landslides, volcanic eruptions, earthquakes, tsunamis, typhoons, cyclones and other extreme weather phenomena) often hit Monsoon Asia. These disasters have inflicted catastrophic losses of human lives and the economies of countries which NARBO member organizations belong to.

Conducting thematic workshops was considered at The 2nd NARBO General Meeting in Indonesia in February 2006 as one of the important activities of NARBO. Based on the NARBO Action Plan 2006-2007, NARBO has carried out a series of workshops on the theme of **Water-Related Disaster and its Management in Asian Countries** since 2007. This activity was incorporated in the subsequent Action Plan 2008-2009 and has been continued.

This serial workshop on Water-Related Disaster and its Management in Asian Countries was held two times during 2007-2008 in Indonesia and Philippines, and a follow-up workshop was held in 2009 in Viet Nam. Several delegates from Asian countries such as Bangladesh, Indonesia, Lao PDR, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam have participated in this serial workshop. This workshop was definitely a good opportunity for the participants to learn each other about water-related disaster and its management.

The results of the serial workshop are summarized in this report which was jointly prepared by the participants of the follow-up workshop held in February 2009 as well as NARBO secretariat.

List of participants and NARBO secretariat

(The series of thematic workshop on Water-Related Disaster and its Management in Asian Countries)

1) 1st Workshop

Date: November 25-29, 2007

Venue: Yogyakarta, Indonesia

Host Organization: Serayu-Opa River Basin Office of Yogyakarta

Participants

No	Name	M/F	Country	Organization	Category	Job-Title
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							Component 2, LISCOP
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8	Participant	Ahmad Darus	M	Malaysia	Department of Irrigation and Drainage (DID)	GOV	Senior Assistant Director
9	Participant	Le Quang Tuan	M	Vietnam	Administrative Division, Department of Water Resources	GOV	Deputy Chief
10	Participant	Marzuki Surahmat	M	Indonesia	Jasa Tirta II Public Corporation	RBO	
11	Participant	Agung Nugroho DP	M	Indonesia	Jasa Tirta I Public Corporation	RBO	
12	Participant	Erwando Rachmadi	M	Indonesia	Jasa Tirta I Public Corporation	RBO	
13	Participant	Fahmi Hidayat	M	Indonesia	Jasa Tirta I Public Corporation	RBO	
14	Participant	Tri Joko Saptono	M	Indonesia	Serayu Opak River Basin Office, Ministry of Public Works	RBO	
15	Participant	Singgih Nurcahya	M	Indonesia	Serayu Opak River Basin Office, Ministry of Public Works	RBO	
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19	Lecturer	Dr. Neil Britton	M		Asian Development Bank	DCA	
20	Lecturer	Hiroyoshi Tanaka	M	Japan	Japan Water Agency	RBO	Lead Water Resources Specialist
21	Secretariat	Atsushi Suzuki	M	Japan	Japan Water Agency	RBO	Deputy Director

2) 2nd Workshop

Date: October 7-10, 2008

Venue: Metro Manila, Philippines

Host Organization: LLDA

Participants

No	Name	M/ F	Country	Organization	Category	Job-Title
1	Participant Elakanda Sudharma	M	Sri Lanka	Mahaweli Authority of Sri Lanka (MASL)	RBO	Project Director
2	Participant Srisunee Wuthiwongyothin	F	Thailand	Policy and Planning Bureau, Department of Water Resources	GOV	Water Resources Engineer
3	Participant Alicia E. Bongco	F	Philippines	Laguna Lake Development Authority (LLDA)	RBO	Division Chief III and Asst. Project Manager Component 2, LISCOP
4	Participant Wawan Hermawan	M	Indonesia	Jasa Tirta II Public Corporation (PJT II)	RBO	Head of technical, Planning Bureau
5	Participant Rohani Ahmad	F	Malaysia	Department of Irrigation and Drainage (DID)	GOV	Principal Assistant Director
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7	Participant Shamsul Huda Khan	M	Bangladesh	Bangladesh Water Development Board (BWDB)	GOV	Superintending Engineer, Comilla O & M Circle
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13	Participant Maria Antonia Borna	F	Philippines	Philippine Institute of Volcanology & Seismology (PhiVolcs)		
14	Participant Hilton Hernando	M	Philippines	Philippine Atmospheric,		

					Geophysical, Astronomical and Seismology Administration (PAGASA)		
15	Participant	Saida V. Almedora	F	Philippines	National Irrigation Adm		
16	Participant	Hermingildo S. Tabares	M	Philippines	National Irrigation Adm		
17	Lecturer	Akira Terakawa	M	Japan	The International Centre for Water Hazard and Risk Management (ICHARM)	RKP	Deputy Director
18	Lecturer	Dr. Neil Britton	M	Philippines	Asian Development Bank (ADB)	DCA	Senior Disaster Risk Management Specialist
19	Secretariat	Dennis Von Custodio	M	Philippines	Asian Development Bank (ADB)	DCA	Water Operations Adviser
20	Secretariat	Wouter T. Lincklaen Arriens	M	Philippines	Asian Development Bank (ADB)	DCA	Lead Water Resources Specialist
21	Secretariat	Michio Ota	M	Japan	Japan Water Agency (JWA) Vice-Secretary General of NARBO	RBO	Director, International Affairs Division
22	Secretariat	Akira Nishimura	M	Japan	Japan Water Agency (JWA)	RBO	Staff, International Affairs Division
23	Secretariat	Tadashige Kawasaki	M	Japan	Asian Development Bank Institute (ADBI)	IRKP	NARBO Associate

3) Follow-up Workshop

Date: February 17-21, 2009

Venue: Hoi An, Viet Nam

Host Organization: Vu Gia – Thu Bon RBO

Participants

No	Name	M/F	Country	Organization	Category	Job-Title
1	Participant Elakanda Sudharma	M	Sri Lanka	Mahaweli Authority of Sri Lanka (MASL)	RBO	Project Director
2	Participant Srisunee Wuthiwongyothin	F	Thailand	Policy and Planning Bureau, Department of Water Resources	GOV	Water Resources Engineer
3	Participant Alicia E. Bongco	F	Philippines	Laguna Lake Development Authority (LLDA)	RBO	Division Chief III and Asst. Project Manager Component 2, LISCOP

4	Participant	Herman Idrus	M	Indonesia	Jasa Tirta II Public Corporation (PJT II)	RBO	Head of technical, Planning Bureau
5	Participant	Le Thi Huyen	F	Vietnam	Water Resources Department – General Office for River Basin Management	GOV	Water Resources Expert (River Basin Management)
6	Secretariat	Michio Ota	M	Japan	Japan Water Agency (JWA) Vice-Secretary General of NARBO	RBO	Director, International Affairs Division
7	Secretariat	Akira Nishimura	M	Japan	Japan Water Agency (JWA)	RBO	Staff, International Affairs Division

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1. Introduction

This report shows the outcomes of the serial thematic workshop on Water-Related Disaster and its Management in Asian Countries which were implemented in accordance with the procedure mentioned below.

1.1 Concept of workshop

Natural disasters (e.g. floods, droughts, landslides, volcanic eruptions, earthquakes, tsunamis, typhoons, cyclones and other extreme weather phenomena) often hit Monsoon Asia. These disasters have inflicted catastrophic losses of human lives and the economies of countries which NARBO member organizations belong to.

Conducting thematic workshops was considered at The 2nd NARBO General Meeting in Indonesia in February 2006 as one of the important activities of NARBO. Based on the NARBO Action Plan 2006-2007, NARBO has carried out a series of workshops on the theme of **Water-Related Disaster and its Management in Asian Countries** since 2007. This activity was incorporated in the subsequent Action Plan 2008-2009 and has been continued.

In addition, governments around the world have committed to take action to reduce disaster risk, and have adopted a guideline to reduce vulnerabilities to natural hazards, called **the Hyogo Framework for Action 2005-2015 (HFA)**. The HFA assists the efforts of nations and communities to become more resilient to, and cope better with the hazards that threaten their development gains.

The HFA is the key instrument for implementing disaster risk reduction, adopted by the Member States of the United Nations. Its overarching goal is to build resilience of nations and communities to disasters, by achieving substantive reduction of disaster losses by 2015 - in lives, and in the social, economic, and environmental assets of communities and countries. The HFA offers five areas of priorities for action, guiding principles and practical means for achieving resilience against disasters for vulnerable communities in the context of sustainable development.

In the series of workshops, participants discussed the conditions and experiences of water-related disaster management of target countries; and evaluate the issues, challenges, and strategies. The goal of the workshop was to develop capacity of key organizations for water-related disaster management by (i) providing basic concepts and principles; (ii) sharing country challenges and strategies; and (iii) formulating an action plan.

NARBO secretariat believe that, in this thematic workshop, participants could discuss actively and share different experiences and information, by identifying the problems of each country and find its solution. This workshop included field visits namely, “advisory visit by other River Basin Organizations (RBOs)” and “exchange visit between RBOs”, so that participants could discuss actively its main issues on site.

The series of workshop was held in a small group and attended by several delegates from Asian

countries such as Bangladesh, Indonesia, Lao PDR, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam, keynote lecturers, some domestic participants and NARBO Secretariat. This workshop was definitely a good opportunity for the participants to learn each other about water-related disaster and its management.

1.2 Agenda items for the workshops

- (i) 1st workshop, Yogyakarta, Indonesia, November 26-29, 2007
 - identify and analyze the characteristics and issues on water-related disaster management in each country
- (ii) 2nd Workshop, Metro Manila, the Philippines, October 7-10, 2008
 - deeply analyze again the issues on water-related disaster management
 - investigate and evaluate the strategies and solutions to address the issues
- (iii) Follow-up Workshop, Hoi An, Viet Nam, February 17-21, 2009
 - discuss and consider the action plan, and formulate a report

1.3 Requirements for Participants

This serial workshop was held twice during 2007-2008, being organized by the organization the core members belonged to. The participants in this workshop satisfied the conditions below.

- (1) middle to senior level officials who currently engage in water resources management and have influence on disaster management activities and decisions;
- (2) willing and committed to take responsibility within the organization to promote and pursue disaster management approaches for water-related disasters; and
- (3) having good command of English language to be able to share experiences and participate in workshop discussions.

Participants had a responsibility for the following items aside from each workshop:

- (1) Preparing a country report on water-related disaster before the 1st workshop and several materials on disaster risk management before the 2nd workshop
- (2) Presenting the above report or materials at each workshop
- (3) Discussing the above subjects further in each organization after each workshop and reporting results of discussion in the next workshop.

It was announced at the beginning that 12 participants at the maximum would be selected from the 1st workshop and regarded as core members. The core members were the main participants for the 2nd workshop. The criteria to select the core group were as follows: (i) balance of country representations; (ii) relevance of workshop to country conditions; (iii) the participant's availability to attend the 2nd workshop; (iv) the participant's performance at the 1st workshop.

1.4 Framework of this report

This report provides the outcome of the serial workshop focused on 5 countries (Indonesia, Philippines, Sri Lanka, Thailand and Viet Nam) from which the participants attended the follow-up workshop held after the two serial workshops.

Chapter 2 summarizes issues of water-related disaster and its management which were identified by each participant at the workshop. Chapter 3 proposes action plans that elaborate on key activities to address the issues by each organization. Chapter 4 indicates consideration on the action plans based on their materials from the viewpoint of disaster risk management (DRM). Chapter 5 provides future directions for Governmental Organizations and RBOs, respectively, reflecting the outcomes discussed at this serial thematic workshop. Reports prepared by each participant are included in the Annex.

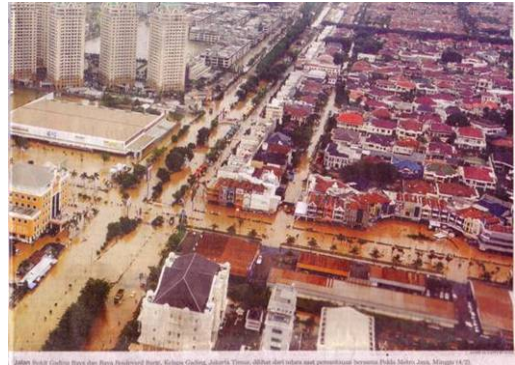
2. Issues of Water-Related Disaster and its Management

This chapter shows the issues of water-related disaster and its management identified by each organization.

2.1 Indonesia: identified by PJT II

General explanation on flood occurrences are poor natural drainage combined with high rainfall amounts, with more detailed information in the following:

- The increase in maximum flood water level is the result of reduction in the discharge capacity of the river and this decrease in discharge capacity is caused by sedimentation of the river bed and encroachment of river/canal due to illegal settlement.
- Higher maximum flood water level is also due to higher run off coefficient due to deforestation in upper part of the river.
- Inadequate information flow with sufficient lead time that can reduce the damages caused by floods.
- Inadequate infrastructure for mitigation such as using flood forecasting and warning system to reduce casualties.
- Lack of institutional arrangement to (1) encourage community to join to the flood response activities, (2) share the hydrologic data with other agencies, and (3) reinforcement of the working unit are challenges to improve disaster management within Citarum besides financial generation.



With distinct dry and rainy seasons, Citarum River Basin experienced high fluctuation on discharge during dry and rainy seasons, which should be accommodated with storage capacity to store water during rainy season and release water during dry season. Besides that, issues on drought management are in the following:

- Degraded watershed condition which impact on reducing base flow and higher peak flow. Thus, higher fluctuation on discharge will influence on higher needs on storage capacity. But in the meantime, erosion will accelerate the decreasing of storage capacity
- In irrigation infrastructure, sedimentation on the canal will induce higher losses which magnify the water demands to irrigation field. Thus, increasing the drought potential in the field.

In the man-made water pollution related disaster management, some of the issues are:

- Inadequate wastewater and sewerage treatment facilities, solid waste facilities and sanitation facilities for domestic and industry

- Lack of institutional arrangement to quickly act whenever pollution is occurred.
- Lack of institutional arrangement to encourage community to participate on pollution control activities and synchronized program on pollution control.
- Weak and fragmented regulatory (law) enforcement system

2.2 Philippines: identified by LLDA

(1) Introduction

The Philippines, composed of about 7,100 islands, is the world's second largest archipelago. The country is vulnerable to almost all types of natural hazards because of its geographical location. It is located in the within the Circum-Pacific belt of fires and along typhoon path and exposed to natural perils like earthquakes, volcanic eruptions, typhoons and their resultant effects like tsunami, landslides, floods and flashfloods.

The Laguna de Bay Region is in the Southern part of the Luzon Region of the Philippines. It is managed by the Laguna Lake Development Authority or LLDA which was created in 1966 by virtue of Republic Act 4850 as a government-owned corporation, with the mandate to essentially provide the leadership in the environmental management of the Laguna de Bay Region. Quoting from RA 4850, LLDA's task is: "...to promote and accelerate the development and balanced growth of the Laguna de Bay area and the surrounding provinces, cities, and towns with due and adequate provisions for environmental management and control, preservation of the quality of human life and ecological systems, and the prevention of undue ecological disturbances, deterioration, and pollution."

(2) Water Related Hazards in the Laguna de Bay Region, Philippines

The risks that Laguna de Bay system faces is compounded each day as a result of economic growth and population increase, urbanization, industrialization, and changes in land use that are the major contributors to environmental degradation in the watershed, hence, threaten the ecological viability of the Laguna de Bay and its tributaries. Examples of observed changes are: occurrence of bacterial pollution and eutrophication phenomena, flooding problems and secondary impacts on public health. Left unaddressed, the water system is expected to gradually die; thus depriving society and the future generation the opportunity to use the lake for recreation and livelihood; and access to safe drinking water.

The importance of a strong legal institution to arrest



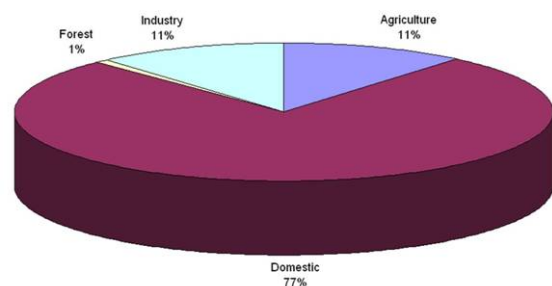
the degradation of the water quality of the lake cannot be overemphasized. Empirical evidence demonstrates that pollution control efforts may be hampered by the limited government capacity to enforce current environmental laws, rules and regulations. Although LLDA has some experience in implementing user fee programs, it still needs to improve its capability to undertake an effective permitting, monitoring and enforcement systems.

Organic Wastes -

A significant pressure on the water on the water quality of the lake and the river systems is contributed by organic pollution which comes from the discharge of house- holds of around 77% where urbanization is very evident. About 11% comes from industrial sources and 12% comes from agriculture and forestry (10%). Equally important is the inadequate environmental management water quality management program that is also crucial to pollution management and a shoreland management program to ensure the protection of the lake and the shoreland that must meet the formulated criteria as ecologically or environmentally friendly area.



BOD Waste Load Percentage Contribution, Year 2006
(76,202 MT/Year)



Deforestation and Sedimentation

Between the periods 1996-2000, 25 percent of the commercial and non-commercial forests was reduced to 5 percent, while 67 percent of the total watershed devoted for agricultural use was reduced to 53 percent. The reductions are mainly attributed to industrialization, among others. These changes in land use and land cover indicate the occurrence of deforestation, which in turn lead to soil erosion and sedimentation in the water system. It is significant to note that net sediment loading of 4 million cubic meters has been recorded for the lake (Delft Hydraulics, 2003) which could result in flooding especially in the low-lying areas.

Deforestation and lake sedimentation also impact the community's health and income opportunities. Anecdotal data indicate that the declining water quality in the Laguna de Bay has resulted in an increased occurrence of waterborne diseases in the community; and reduced income from tourism due to a decline in the number of tourists visiting the lake. This also results in the dramatic increase in the water treatment cost for tourists and domestic use.



2.3 Sri Lanka: identified by MASL

(1) Introduction

Sri Lanka was not a disaster prone country until recently. However, When Tsunami badly hit on coastal belt of the country on 26th December 2004, taking more than 40,000 lives, people of Sri Lanka were made to understand the serious impacts of natural disasters. Immediately after the recovery of the situation, GOSL established a separate Cabinet Ministry to handle this sector and enacted the Disaster Management Act No.13 of 2005 to address these challenges that can be arisen by natural disasters. This act facilitates to prevention, mitigation, preparedness and recovery from any kind of natural hazards in the country. However, this has still not been effectively implemented due to weaknesses of enforcement and inter-organizational co-ordination & information sharing.

(2) Water Related Hazards in Sri Lanka

There are three common water related disasters in Sri Lanka namely; Floods, Landslides and Droughts. Other occasional water related hazards are Tsunami, Water Pollution, Sea Water Intrusion, Coastal Erosion and Dam Breach.

1) Floods

High-intensity rainfall will produce more frequent extreme events – Flash floods that will cause serious damages to the properties. It will also concentrate the river runoff to a shorter period. In Sri Lanka, flood mainly affected in 4 districts namely Ratnapura, Kalutara, Colombo and Gampaha.



2) Landslides

Down slope transportation of soil and rock resulting from naturally occurring vibrations, changes in direct water content, removal of lateral support, loading with weight and weathering, or human manipulation of water and slope composition will influence landslides. Hill country of Sri Lanka becomes a landslide prone area due to ad-hoc land use management. After the Tsunami, in December 2004 , it was noticed that very un-usual behaviors of the ground of hill country of Sri Lanka., witnessing above facts.



3) Droughts

Sri Lanka's dry zone is affected by all kind of droughts such as Meteorological, Hydrological and Agricultural droughts by which rainfall will be reduced drastically, water resources would be affected badly and whole cultivation process will be significantly affected respectively.



2.4 Thailand: identified by DWR

(1) Introduction

Thailand is administratively divided into 76 provinces which further divided into district, sub-district and village consecutively. Province is the local administration unit headed by provincial governor. The provincial governor is appointed by the central government. The population of Thailand consists of over 30 ethnic groups of people making up approximately 63 millions. About 5.8 million people are registered in the capital city of Bangkok.

Topographically, Thailand is divided into four regions; the North, the Central or the Chao Phraya River Basin, the Northeast and the south or the Southern Peninsula. The northern region terrain is mountainous which render this region to be prone to water-related disasters such as flashflood, landslide and inundation. The northeastern region is an arid area and frequently suffers flashflood and inundation during rainy season, severe drought and cold spell during summer and cool season. The central region, the vast fertile land which is dubbed as the “Rice Bowl” of the country often encounters the repeated riverine flood and urban inundation during the rainy season. The southern region terrain is hilly on the west coast and the coastal plain on the east. This part of Thailand has occasionally frequented flashflood, mudslide, tropical storm and forest fire.

(2) Water-Related Disaster Issues in Thailand

1) Flood

In Thailand, flooding results from tropical disturbances, typhoons, or a combination of the two. The heavy rainfall cause overland flow which bursts their banks or creates severe flooding conditions along the tributaries from backwater effects. Flooding in river basins in Thailand is often occurred every year. Urban area along the mainstream is regularly flooded. The peak flood period lasts from early June in the North to early December in the South. Hence heavy local rains throughout the region and typhoon-induced surges of water in the river system are main causes contribute to the overflow of riverbanks. In addition, a range of natural and man-made factors presently affect flooding. However, climate change, particularly global warming effects, is believed to be a contributing factor to increased frequency and intensity of severe flooding. Increased rainfall amount and sea-level rises will result in greater risk of flooding in low-lying coastal and estuary areas.



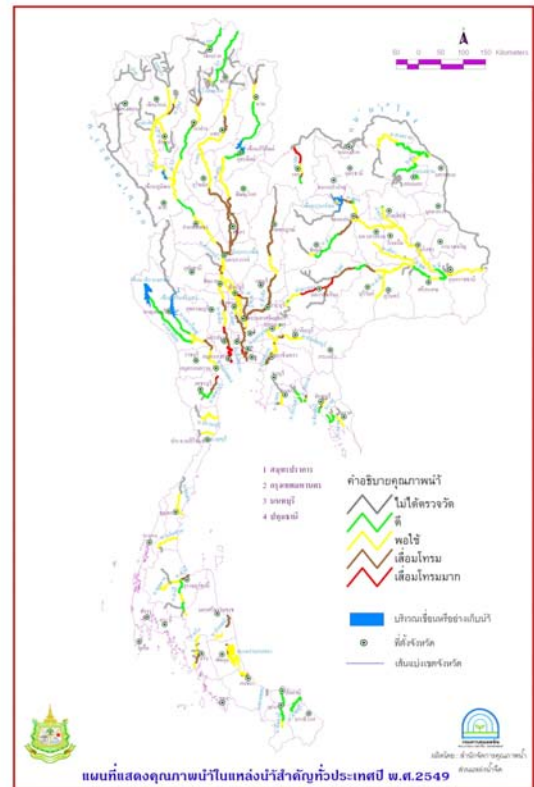
Warming of the water temperature in the sea would result in an increase in the number and intensity of typhoons causing sea surges that would also contribute to inundation of low-lying areas.

2) Droughts

Droughts during dry season in Thailand occur frequently every year. This is due to continuous increase of water demand caused by population and economic growth of the country while the natural and man-made storage have insufficient capacity for the whole year. Most of the areas suffering droughts are the areas which water consumption and uses rely on rainfall and natural stream

3) Water pollution

Thailand is considered that severe water pollution occurs in major streams. Waste water from community and economic activities cause pollution problems to many sources of surface water and may cause danger to people in the area. In general, water pollution is severe in dry season due to loss of water to dilute waste and dirt. Results from the water quality monitoring in 48 major rivers and 4 large ponds in 2002 shown that most of surface water sources are moderate, 39%, to low, 35%, quality. Only 17% of water sources are in good condition. Lower Chao Phraya, Ta Chin and Songkhla lake river basins are very low quality. For BOD load, total BOD load in Thailand is about 6.19 M kg BOD/day. The BOD load divided from three major sources. There are source from community load 2.6 M kg BOD/day (42 %), source from industrial load 2.7 M kg BOD/day (44 %), and source form agriculture 0.8 M kg BOD/day (14 %).



2.5 Viet Nam: identified by DWR

(1) Introduction

Disasters are natural phenomena; their magnitude and consequences have increased due to human activities in the socio-economic growth, technological development, urbanization, population boom, natural resources and environmental degradation. In recent decades, natural disasters have happened at an increasingly serious level over the world. Vietnam is no exception, with its location is in the tropical monsoon area, one of the five storm-prone



areas of the Asia Pacific region, the country often faces natural disasters of various types. And in recent years, disasters have continually occurred all over the country, causing vast losses in human life, property, socio-economic and cultural infrastructure as well as environmental degradation. Natural disasters in Vietnam have been increasing in terms of magnitude, frequency and volatility.



(2) Issues on water – related disaster and its management

1) Issues

In recent years, considerable efforts have been made for disaster prevention; infrastructure, facilities and technical capacity have been improved; the leadership and coordination in response to natural disasters at central and local levels have had substantial progress. However, with regard to the consequences of natural disasters and the socio-economic development goals, the following issues need to be addressed and overcome in the near future:

1. Disaster prevention, response and mitigation activities are reactive and mainly focus on problem response.
2. The response to disasters is slow due to objective and subjective reasons.
3. Unstable production system, inappropriate production structure.
4. Poor infrastructure results in vulnerability to disaster risks.
5. Forecasting and warning systems do not meet standard requirements, particularly with regard to such disasters as flash floods, landslides, whirlwinds, etc.
6. Emergency relief, damage recovery and reconstruction are insufficient, lack of direction and coordination.
7. Search and rescue operations are unprofessional and limited due to lack of equipments and facilities, thus they cannot take advantage of the combined strengths of all forces and people.

2) Reasons

1. Awareness

- Inadequate public awareness of natural disasters and sustainable development, especially living in harmony with the nature.
- Dependent and reactive attitude, disregard and inexperience in facing natural disasters.
- Dissemination activities to raise community awareness of disaster prevention, response and mitigation are infrequent and disorganized. The knowledge on disaster prevention is mostly spread throughout the mass media and has not been included in school curriculum.

2. Planning

- Lack of integrated planning and coordination among ministries, sectors and localities. Lack of due attention to the integration of natural disaster prevention, response and mitigation into

local and sector's socio-economic development programs.

- In construction planning, lack of due attention to flood and storm avoidance and safety, particularly in industrial zones, tourism areas, urban areas, coastal and mountainous areas, residential areas and roads.
- The encroachment on sea and rivers for construction or setting structured projects in areas highly prone to floods, flash floods, storms, sea water rising and landslides make them more vulnerable. Therefore, it is costly for protection and maintenance.
- Development planning has not been integrated with environment and landscape preservation. For example, natural sand dunes on the sea shore, watershed protective forests are and mangrove forests have been destroyed for aquaculture.

3. *Policy and mechanism*

- Lack of penalties for failure to obey laws, regulations, and the orders of relevant authorities.
- Overlaps of functions and duties amongst different agencies, and lack of clear responsibilities.
- Lack of measures to encourage disaster-related insurance purchases.
- Lack of encouragement and incentives for individuals and organizations volunteering and participating in search, rescue and response activities in natural disasters.
- Lack of rules and regulations for organizations on the appeal, collection, receipt and distribution of disaster relief.
- Lack of improved policies on the mobilization of resources for disaster prevention and mitigation.

4. *Investment*

- Investment in natural disaster prevention, response and mitigation is scattered and has not satisfied the requirements of disaster mitigation.
- Investment in the maintenance, management and utilization of existing structures is not corresponding to that in new construction.
- Disbursement for some critical, approved projects such as reservoirs, parking place for boats and ships, dyke protection, etc. is slow and does not meet current requirements.

5. *Direction and management*

- The directions and orders in response to natural disasters have not yet been seriously executed. The implementation is slow and dependent way of thinking still exists.
- The direction and implementation of four "on-the-spot" principles are not serious.
- There have been inappropriate directions where economic development was separated from natural disaster prevention, response and mitigation. For instance, coastal protective forests were destroyed for aquaculture while watershed protective forests were cleared for crop production.
- Ineffective management and protection of watershed forests, coastal and riverside protective forests led to the degradation of forest coverage in some areas. As a result, the effectiveness of flood, storm and drought prevention and control was limited. Consequently, this resulted in unexpected dangers.

- The poor management of sand exploitation and other activities on river banks have led to harmful impacts on flood discharge and caused erosion.
- The shortcomings of vehicle management on rivers and at sea, particularly pelagic fishing boats resulted in unexpected damage when disasters occur.
- The effectiveness of quality control in some particular construction project was limited. Therefore, they were damaged by disaster though at low intensity. Some structures even prevent flood discharge or make flood worse.
- Slow project progress and disbursement, especially ODA.
- The management and utilization of disaster recovery resources are limited, lack of transparency or for inappropriate purposes.

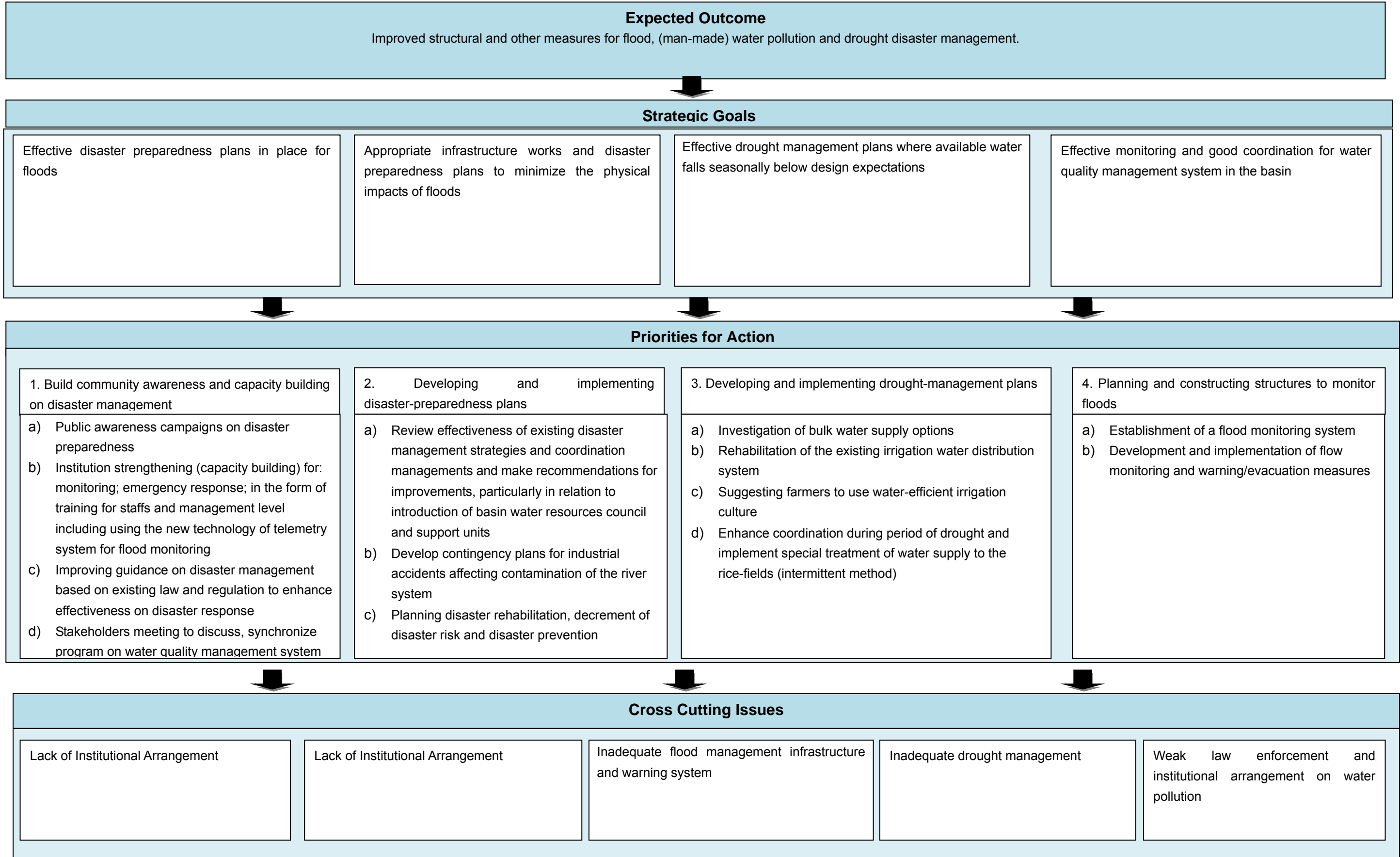
3. Action Plan

This chapter shows the action plans prepared by each organization to cope with the issues summarized in the previous chapter.

In the case of Thailand, the participant from DWR proposed several kinds of action plan, but in this report it focuses on only Flood/Land slide/Flash flood risk and considers the disaster deeply.

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Proposal for DRM Action Plan



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Implementation Process for 10 years

Expected Outcome: Improved structural and other measures for flood, (man-made) water pollution and drought disaster management.

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Build Community awareness and capacity building										
a). Public awareness campaigns on disaster preparedness										
b) Institution strengthening (capacity building) for: monitoring; emergency response; in the form of training for staffs and management level including using the new technology of telemetry system for flood monitoring										
c) Improving guidance on disaster management based on existing law and regulation to enhance effectiveness on disaster response										
d). Stakeholders meeting to discuss, synchronize program on water quality management system and increase awareness and participation from the stakeholders										
2. Developing and implementing disaster - preparedness plans										
a. Review effectiveness of existing disaster management strategies and coordination managements and make recommendations for improvements, particularly in relation to introduction of basin water resources council and support units										
b. Develop contingency plans for industrial accidents affecting contamination of the river system										

b) Institution strengthening (capacity building) for: monitoring; emergency response; in the form of training for staffs and management level including using the new technology of telemetry system for flood monitoring	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
c) Improving guidance on disaster management based on existing law and regulation to enhance effectiveness on disaster response	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
d). Stakeholders meeting to discuss, synchronize program on water quality management system and increase awareness and participation from the stakeholders	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
2. Developing and implementing disaster - preparedness plans			
a. Review effectiveness of existing disaster management strategies and coordination managements and make recommendations for improvements, particularly in relation to introduction of basin water resources council and support units	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
b. Develop contingency plans for industrial accidents affecting contamination of the river syste	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
c. Planning disaster rehabilitation, decrement of disaster risk and disaster prevention	National,Regional and Community	BANAS BP, BPB Propinsi and Kabupaten	community
4. Developing and implementing drought - management plans			
a. Investigation of bulk water supply options	National and Regional	National and Regional Unit on water resources	community
b. Rehabilitation of the existing irrigation water distribution system	National and Regional	National and Regional Unit on water resources	Farmer
c. Suggesting farmers to use water-efficient irrigation culture	National and Regional	National and Regional Unit on water resources	Farmer
d. Enhance coordination during period of drought and implement special treatment of water supply to the rice-fields (intermittent method)	National and Regional	National and Regional Unit on water resources	community
4. Planning and constructing structures to monitor floods			
a. Establishment of a flood monitoring system			
b. Development and implementation of flow monitoring and warning/evacuation measures	National and Regional	National and Regional Unit on water resources	community

DEFINITION

Level: Please indicate one or more item(s) from International, National, Regional, or Community

Implementing Organization: Coordinating organizations to implement the activity

Stakeholders: Coordinated organizations/people to implement the activity

Explanations:

National level

(1) BANAS PB: Badan Nasional Penanggulangan Bencana (national coordinating body for disaster management). BANAS PB is governmental agency non department with similar level with department. The body consists of steering committee and tasks force team. The steering committee is comprised from related government officers and professionals, while the tasks force team comprises professionals and experts. The steering committee has tasks to establish the national disaster management policy concept, monitoring and evaluation. Meanwhile, the tasks force team has functions of coordination, command and disaster response prior, during and post disaster. The overall tasks of the BANAS PB are:

- a. Providing guidance and steering related to disaster mitigation which covers disaster prevention, disaster response, rehabilitation and reconstruction.
- b. Determine standards and necessities for conducting disaster management based on laws and regulations.
- c. Information dissemination to communities
- d. Reporting the disaster management activities to the President once a month during normal period and every time it is necessary during disaster.
- e. Responsible for using and reporting financial expenditure sourced from the national or international donors.
- f. Responsible for reporting financial expenditure sourced from the national budget.

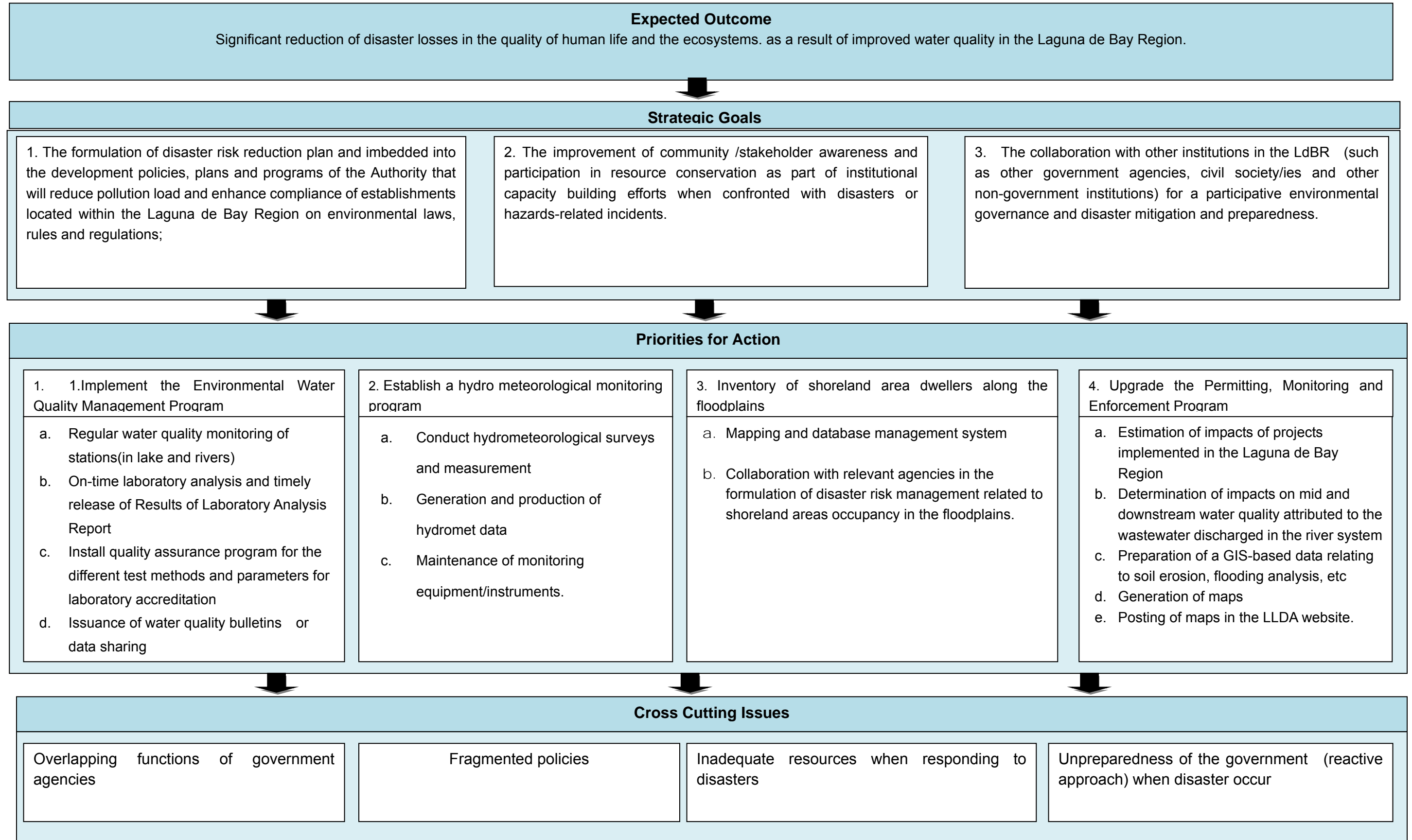
Regional Level

(2) BPB PROVINSI: Badan Penanggulangan Bencana Tingkat Provinsi . Provincial coordinating body for disaster management. The BPB Provinsi has similar composition, those are steering committee and tasks force team, and also similar on formation for steering committee and the tasks force team. BPB Provinsi is headed by government officer one level lower than governor. The BPB Provinsi has similar tasks and responsibilities with BANAS PB except reporting to the governor and using provincial budget.

(3) BPB KABUPATEN / KOTA: Badan Penanggulangan Bencana Tingkat Kabupaten/Kota. District coordinating body for disaster management. The BPB KABUPATEN / KOTA has similar composition, those are steering committee and tasks force team, and also similar on formation for steering committee and the tasks force team. BPB KABUPATEN / KOTA is headed by government officer one level lower than bupati/mayor. The BPB KABUPATEN / KOTA has similar tasks and responsibilities with BANAS PB or BPB Province except reporting to the bupati / mayor and using district budget.

3.2 Philippines: proposed by LLDA

Proposal for DRM Action Plan



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Implementation Process for 10 years

Expected Outcome: Significant reduction of disaster losses in the quality of human life and the ecosystems as a result of improved water quality in the Laguna de Bay Region.

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Implement the Environmental Water Quality Management Program										
a) Regular water quality monitoring of stations (in lake and rivers)										
b) On-time laboratory analysis and timely release of results of Laboratory Analysis Report										
c) Install assurance program for the different test methods and parameters for laboratory accreditation										
d) Issuance of water quality bulletins or data sharing.										
2. Establish a hydrometeorological monitoring program										
a) Conduct hydrometeorological surveys and measurement										
b) Generation and production of hydromet data										
c) Maintenance of monitoring equipment/instruments.										
3. Inventory of shoreland area dwellers along the floodplains										
a) Mapping and database management system										
b) Collaboration with relevant agencies in the formulation of disaster risk management related to shoreland areas occupancy in the floodplains.										
4. Upgrade the Permitting, Monitoring and Enforcement Program										

	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
a) Estimation of impacts (favorable or adverse) of projects implemented in the Laguna de Bay Region										
Key Activities for Action										
b) Determination of impacts on mid and downstream water quality attributed to the wastewater discharged in the river system										
c) Preparation of a GIS-based data relating to soil erosion, flooding analysis, etc										
d) Generation of maps										
e) Posting of maps in the LLDA website.										

Related Organizations/Individuals for Implementation

Expected Outcome: Significant reduction of disaster losses in the quality of human life and the ecosystems as a result of improved water quality in the Laguna de Bay Region.

Key Activities for Action	Level	Implementing Organizations	Stakeholders
1. Implement the Environmental Water Quality Management Program			
a) Regular water quality monitoring of stations (in lake and rivers)	National, Regional	LLDA	NGOs, RCs
b) On-time laboratory analysis and timely release of results of Laboratory Analysis Report	Regional	LLDA	NGOs, RCs
c) Install quality assurance program for the different test methods and parameters for laboratory accreditation	National	LLDA	DTI, EMB- DENR
d) Issuance of water quality bulletins or data sharing.	Regional	LLDA,	EMB, RCs

2. Establish a hydro meteorological monitoring program				
a) Conduct hydro meteorological surveys and measurement	National, Regional	LLDA, PAGASA, DOST, UP-Laguna		
b) Generation and production of hydro meteorological data		LLDA, PAGASA		
c) Maintenance of monitoring equipment/instruments.		LLDA, PAGASA		
3. Inventory of shoreland area dwellers along the floodplains				
a) Mapping and database management system	National, Regional	LLDA, NAMRIA, DENR	LGUs	
b) Collaboration with relevant agencies in the formulation of disaster risk management related to shoreland areas occupancy in the floodplains.		LLDA, Phivocs, PAGASA	LGUs, DSWD, DPWH, DBM, NDCC - DND	
4. Upgrade the Permitting, Monitoring and Enforcement Program				
a) Estimation of impacts of projects implemented in the Laguna de Bay Region	National, Regional, Community	LLDA, LGUs	EMB, DENR,	
b) Determination of impacts on mid and downstream water quality attributed to the wastewater discharged in the river system		LLDA	EMB, DTI	
c) Preparation of a GIS-based data relating to soil erosion, flooding analysis, etc		LLDA, NAMRIA	LGUs BSWM-DA, PAGASA	
d) Generation of maps		LLDA, NAMRIA	LGUs BSWM-DA, PAGASA	
e) Posting of maps in the LLDA website.	National, Regional	LLDA		

DEFINITION

Level: Please indicate one or more item(s) from International, National, Regional, or Community

Implementing Organization: Coordinating organizations to implement the activity

Stakeholders: Coordinated organizations/people to implement the activity

LEGEND:

- BSWM - Bureau of Soil and Water Management,
- DA - Department of Agriculture
- DBM - Department of Budget & Management
- DND - Department of National Defence
- DPWH - Department of Public Works & Highways
- DSWD - Department of Social Services, Welfare & Development
- DTI - Department of Trade & Industry
- EMB - Environmental Management Bureau
- LGUs - Local Government Units
- NDCC - National Disaster Coordinating Council
- NAMRIA - National Mapping Resource Information Agency
- NGOs - Non-Government Organizations
- PAGASA - Phil Atmospheric, Geophysical Services Administration
- RC - River Councils

3.3 Sri Lanka: proposed by MASL

Proposal for DRM Action Plan

Expected Outcome

To minimize water related disasters & the impacts of disasters. Similarly minimize the potential losses to the human lives and to the social and environment assets and finally to the economy of the country

Strategic Goals

Integration of policies & guidelines for disaster risk reduction into water resources planning for sustainable development in the water sector in the country.

Collaboration of inter- government agency & strengthening of institutional mechanisms and there capacities to build resilience to hazards.

Development of community base programmes for emergency preparedness, response and recovery to minimize the disaster risk.

Priorities for Action

1. Political & Institutional factors on DRR
DRR

- a. Enforcement of law & Guidelines
- b. Collaboration of inter-government agencies & information sharing
- c. Institutional strengthening & capacity building
- d. Fund Allocation for DRM
- e. Community base management
- f. Awareness Programme at all level

2. Identify, assess & monitor DR & enhance early warning

- a. Risk assessment & hazard mapping
- b. Develop indicators on vulnerability
- c. Data & statistical information system
- d. Scientific & technological development (climate forecasting & early warning)
- e. Regional emerging risk

3. Reduce potential risk factors

- a. Integrated water resource Mgt. & Water resource planning
- b. DRR strategies integrated with climate change adaptation
- c. Land use planning & building codes
- d. Private-public partnership
- e. Protection of constructed structures (eg: Dams, Sluice gates etc.)

4. Strengthen disaster preparedness for effective response at all level

- a. District preparedness response plan & DM capacities
- b. Emergency Funds
- c. Coordination & information exchange between DM & development sector
- d. Food security for resilience
- e. Volunteer participation

Cross Cutting Issues

Multi-hazard approach

Gender perspective & cultural diversity

Community & Volunteers participation

Capacity Building & Technology Transfer

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Implementation Process for 10 years

Expected Outcome: To minimize water related disasters & the impacts of disasters. similarly minimize the potential losses to the human lives and to the social and environment assets and finally to the economy of the country

Key Activities for Action	Year										
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
1. Political & Institutional factors on DRR											
a) Enforcement of law & guideline	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
b) Collaboration of inter-government agencies	5%	15%	25%	35%	45%	55%	65%	75%	85%	95%	
c) Institutional strengthening & capacity Building	5%	15%	30%	40%	50%	60%	70%	80%	90%	100%	
2. Identify assess & Monitor DR & enhance early warning system											
a) Risk assessment & hazard mapping	5%	15%	25%	35%	45%	60%	70%	85%	95%	100%	
b) Develop indicators on vulnerability	5%	15%	25%	35%	45%	60%	80%	100%			
c) Enhance early warning system & scientific technological development	5%	15%	25%	40%	60%	80%	90%	100%			
3. Reduce Potential Risk Factors											
a) Water resource planning with IWRM	5%	20%	40%	60%	80%	95%	100%				
b) DRR straggles integrated with climate change adaptation	5%	15%	25%	35%	45%	55%	65%	75%	85%	95%	

c) Land use planning & building codes	5%	10%	15%	20%	25%	30%	35%	40	45%	50%	60%	65%	70%	80%	85%	90%	95%	100%		
d) Protection of construct structures (Dams., Sluice gates, etc.)	10%	20%	30%	40%	50%	60%	70%	80%	85%	90%	95%	100%								
4. Strengthen disaster preparedness for effective response at all level																				
a) District preparedness response plan & DM capabilities	5%	15%	20%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%		
b) Emergency funds	10%		20%		30%		40%		50%		60%		70%		80%		90%		100%	
c) Volunteer Participation	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%

Related Organizations/Individuals for Implementation

Expected Outcome: To minimize water related disasters & the impacts of disasters. similarly minimize the potential losses to the human lives and to the social and environment assets and finally to the economy of the country

Key Activities for Action	Level	Implementing Organizations	Stakeholders
1. Political & Institutional factors on DRR			
a) Enforcement of Law & Guideline	National	DMC	Cabinet of Ministers of Government
b) Collaboration of Inter-government Agencies	National	DMC	Ministry of Social Welfare, Health, Rehabilitation and Reconstruction, Coast conservation, Defense etc.
c) Institutional Strengthening & Capacity Building	National/Regional	DMC	Ministry of Land, Water Supply, Irrigation, Urban Development, Education, Science & Technology.
2. Identify, Assess & Monitor DR & Enhance Early Warning System			
a) Risk Assessment & Hazard Mapping	National /Regional	DMC/ LUPPD/MASL	District Managers, LUP, Engineers
b) Develop Indicators on Vulnerability	National /Regional	DMC	Irrigation Dept., MASL, NBRO
c) Enhance Early Warning System & Scientific/Technological Development	National /Regional	DMC	Ministry of Science & Technology, DSWRPP, Meteorological Dept, Irrigation Dept.
3. Reduce Potential Risk Factors			
a) Water Resources Planning with IWRM	National /Regional	Ministry of Irrigation & Water Management	MASL, DSWRPP, ID, WRB
b) DRR Strategies Integrated with Climate Change Adaptation	National /Regional	Ministry of Irrigation & Water Management, MADAS	MASL, Irrigation Dept. Water Supply & Drainage, Agriculture Dept.
c) Land use Planning & Building Codes	National /Regional	DMC/ LUPPD	LUPPD, Forest department, MASL

d) Protection of Existing Structures (Dams, Sluices & Gates, etc.)	National /Regional	Ministry of Irrigation & Water Management	ID, MASL, CEB, NWSDB
4. Strengthen Disaster Preparedness for Effective Response at all level			
a) District Preparedness Response Plan & DM capabilities	National /Regional	DMC	LUPPD
b) Emergency Funds	National /Regional/Community	DMC	Ministry of Social welfare, Ministry of Finance
c) Volunteer Participation	National /Regional/Community	DMC	CBOs, NGOs, School children, Teachers

DEFINITION

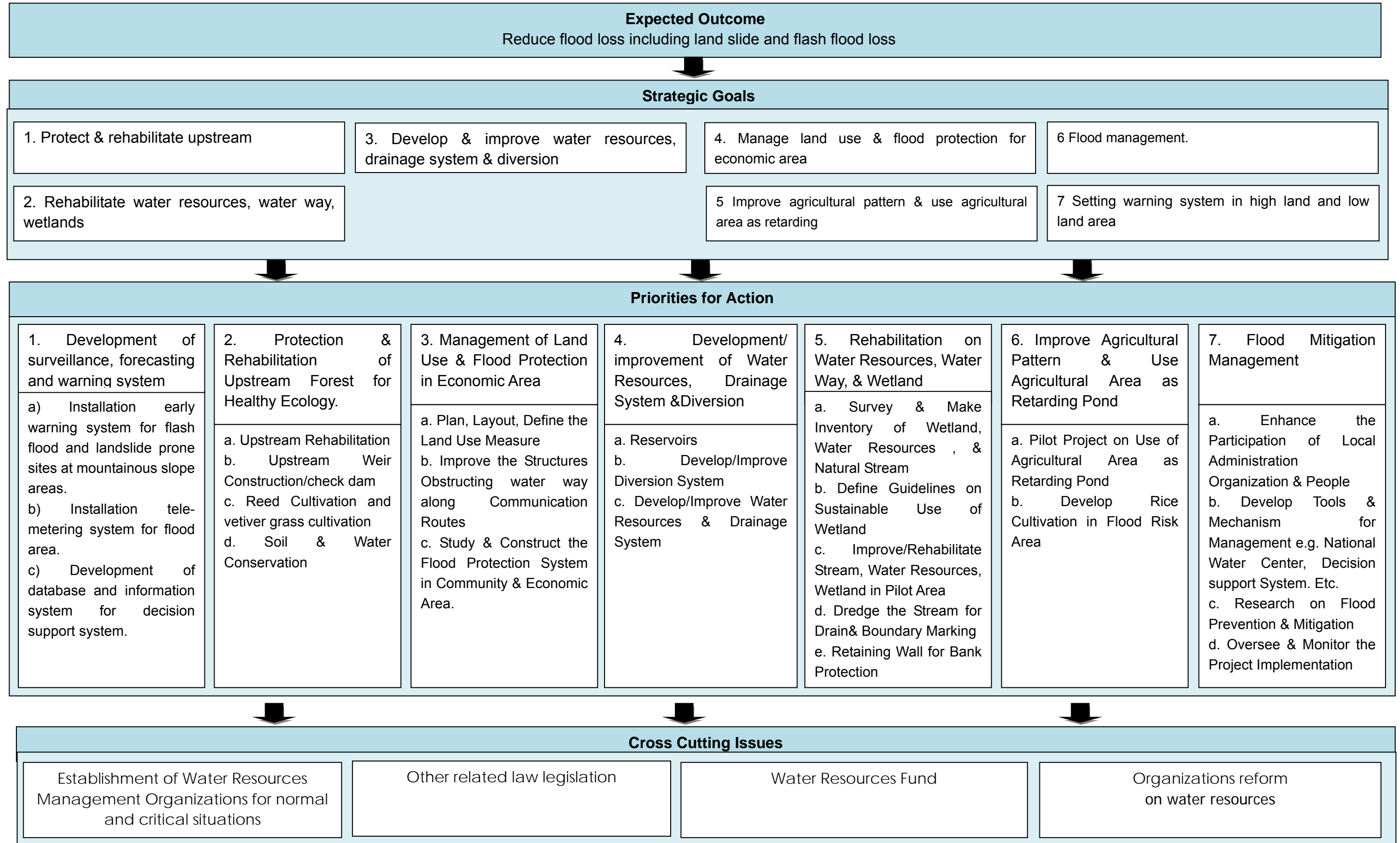
Level: Please indicate one or more item(s) from International, National, Regional, or Community

Implementing Organization: Coordinating organizations to implement the activity

Stakeholders: Coordinated organizations/people to implement the activity

3.4 Thailand: proposed by DWR

Proposal for DRM Action Plan



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Implementation Process for 10 years

Expected Outcome: 1. Reduce flood loss including land slide and flash flood loss

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Development of surveillance, forecasting and warning system										
a) Installation early warning system for flash flood and landslide prone sites at mountainous slope areas.	↓				↑					
b) Installation tele-metering system for flood area.	↓									↑
c) Development of database and information system for decision support system.			↓				↑			
d) Encourage of capacity building for people and regional organization.	↓									↑
2. Protection & Rehabilitation of Upstream Forest for Healthy Ecology.										
a) Upstream Rehabilitation	↓									↑
b) Upstream Weir Construction/check dam	↓									↑
c) Reed Cultivation and vetiver grass cultivation	↓									↑
d) Soil & Water Conservation										↓
3. Management of Land Use & Flood Protection in Economic Area										
a) Plan, Layout, Define the Land Use Measure									↓	
b) Improve the Structures Obstructing water way along Communication Routes									↓	
c) Study & Construct the Flood Protection System in Community & Economic Area.	↓									↑

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
4. Development/Improvement of Water Resources, Drainage System & Diversion										
a) Reservoirs					↓					↑
b) Develop/Improve Diversion System				↓						↑
c) Develop/Improve Water Resources & Drainage System			↓				↑			
5. Rehabilitation on Water Resources, Water Way, & Wetland										
a) Survey & Make Inventory of Wetland, Water Resources, & Natural Stream		↓					↑			
b) Define Guidelines on Sustainable Use of Wetland					↓			↑		
c) Improve/Rehabilitate Stream, Water Resources, Wetland in <u>Pilot Area</u>				↓						
d) Dredge the Stream for Drain & Boundary Marking							↓			↑
e) Retaining Wall for Bank Protection					↓					↑
6. Improve Agricultural Pattern & Use Agricultural Area as Retarding Pond										
a. Pilot Project on Use of Agricultural Area as Retarding Pond								↓		↑
b. Develop Rice Cultivation in Flood Risk Area									↑	
7. Flood Mitigation Management										
a. Enhance the Participation of Local Administration Organization & People		↓								↑
b. Develop Tools & Mechanism for Management e.g. National Water Center, Decision support System, Etc.						↓				↑

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
c. Research on Flood Prevention & Mitigation						◀				▶
d. Oversee & Monitor the Project Implementation						◀				▶

Remark: 25 main river basins in Thailand

Starting year: 2008

Related Organizations/Individuals for Implementation

Expected Outcome: Reduce flood loss including land slide and flash flood loss

Key Activities for Action	Year	Key Activities for Action	Year
1. Development of surveillance, forecasting and warning system			
e) Installation early warning system for flash flood and landslide prone sites at mountainous slope areas.	National	DWR	Head of villages or Local administration
f) Installation tele-metering system for flood area.	National	DWR,RID,TMD	Provincial and Local administration
g) Development of database and information system for decision support system.	National, Regional	DWR,RID,TMD, DPT,DDPM	Regional, Provincial, Local administration
h) Encourage of capacity building for people and regional organization.	National, Regional	DWR,RID,DPT, DDPM	Regional, Provincial, Local administration, Communities/Villages
2. Protection & Rehabilitation of Upstream Forest for Healthy Ecology.			
d) Upstream Rehabilitation	National	DNP,DAE	Communities/Villages
e) Upstream Weir Construction/check dam	National	DNP,DAE	Communities/Villages
f) Reed Cultivation and vetiver grass cultivation	National	DNP,DAE,LDD	Communities/Villages
d) Soil & Water Conservation	National, Regional	MNRE, MOAC	Regional, Provincial, Local administration, Communities/Villages
3. Management of Land Use & Flood Protection in Economic Area			
d) Plan, Layout, Define the Land Use Measure	National	DPT	MNRE,MOAC,MOI,
e) Improve the Structures Obstructing water way along Communication Routes	National, Regional	RID,DWR,DPT DOH,DOR	Regional, Provincial, Local administration
f) Study & Construct the Flood Protection System in Community & Economic Area.	National	DPT	Regional, Provincial, Local administration

Key Activities for Action	Year	Key Activities for Action	Year
4. Development/Improvement of Water Resources, Drainage System & Diversion			
a) Reservoirs	National, Regional	RID, DWR	Regional, Provincial, Local administration
b) Develop/Improve Diversion System	National, Regional	RID, DWR	Regional, Provincial, Local administration
c) Develop/Improve Water Resources & Drainage System	National, Regional	RID, DWR, MD, DPT	Regional, Provincial, Local administration
5. Rehabilitation on Water Resources, Water Way, & Wetland			
a) Survey & Make Inventory of Wetland, Water Resources , & Natural Stream	National	DWR, MNRE	RID, Regional, Provincial, Local administration
b) Define Guidelines on Sustainable Use of Wetland	National	DWR, MNRE	Regional, Provincial, Local administration
c) Improve/Rehabilitate Stream, Water Resources, Wetland in <u>Pilot Area</u>	National, Regional	DWR, MNRE	Regional, Provincial, Local administration
d) Dredge the Stream for Drain& Boundary Marking	National, Regional	NWRC	DWR, RID, DPT, MD, Provincial
e) Retaining Wall for Bank Protection	National, Regional	DPT	DWR, RID, Provincial, Local administration
6. Improve Agricultural Pattern & Use Agricultural Area as Retarding Pond			
a. Pilot Project on Use of Agricultural Area as Retarding Pond	National, Regional	RID	Provincial, Local administration
b. Develop Rice Cultivation in Flood Risk Area	National, Regional	DAE, DOA	Provincial, Local administration
7. Flood Mitigation Management			
a. Enhance the Participation of Local Administration Organization & People	National, Regional Community	DWR, RID	Local administration
b. Develop Tools & Mechanism for Management e.g. National Water Center, Decision support System. Etc.	National, Regional	Government	DWR, RID, MD, DPT, DDPM, DOH
c. Research on Flood Prevention & Mitigation	National, Regional	DWR, RID, DPT	Regional, Provincial, Local administration
d. Oversee & Monitor the Project Implementation	International	DWR, RID, DPT	Regional, Provincial, Local administration

DEFINITION

Level: Please indicate one or more item(s) from International, National, Regional, or Community

Implementing Organization: Coordinating organizations to implement the activity

Stakeholders: Coordinated organizations/people to implement the activity

Abbreviation

- MNRE = Ministry of Natural Resources and Environment
- DWR = Department of Water Resources
- RFD = Royal Forest Department
- DNP = National Park, Wildlife and Plant Conservation Department

- MOAC = Ministry of Agriculture and Cooperatives
- RID = Royal Irrigation Department
- LDD = Land Development Department
- DAE = Department of Agricultural Extension
- DOA = Department of Agriculture
- MOI = Ministry of Interior
- DLA = Department of Local Administration
- DPT = Department of Public works and Town and Country Planning
- DDPM = Department of Disaster Prevention and Mitigation
- TMD = Thai Meteorological Department
- DOH = Department of Highways
- DOR = Department of Rural Roads
- MD = Marine Department
- NWRC = National Water Resources Committee

Proposal for DRM Action Plan

Expected Outcome

Minimizing the losses of human life and properties, the damage of natural resources and cultural heritages, and the degradation of environment, contributing significantly to ensure the country sustainable development, national defense and security

Strategic Goals

Enhance the capacities of forecasting flood, storm, drought, seawater intrusion, of informing earthquake, of warning tsunami and hydro-meteorology phenomena and ensure that the development planning and building codes of socio-economic structures and residential areas in places frequently affected by disaster suit

Complete the relocation, arrangement and stabilization of the life for people in disaster prone areas according to the planning approved by authorized government agencies. Up to 2010, manage to relocate all population from flash flood and land slide high-risk areas and dangerous areas to safety places.

Ensure 100% of local staffs who directly work in the field of disaster prevention, response and mitigation at all levels to be trained and strengthened of capacities for disaster prevention, response and mitigation; ensure more than 70% of population living in disaster prone areas to be disseminated of knowledge on disaster mitigation

Priorities for Action

1. Complete the system of legal documents.

- a) Natural Disaster Prevention, Response and Mitigation Law
- b) Review, amend and supplement relevant legal documents.
- c) Promulgate policies on disaster relief and recovery after the disaster.
- d) Promulgate assistance policies for disaster prone areas.

2. Strengthen organizational mechanism

- d) Strengthen the steering mechanism for natural disaster prevention, response and mitigation at all levels
- e) Provide training courses to improve the capacity of staff in charge of natural disaster prevention, response and mitigation.
- f) Establish organizations supporting natural disaster management.

3. Non – structural measures.

- e) Program of establishing and reviewing plans.
- f) Program of enhancing forecast and warning capacity.
- g) Program of improving the community awareness.
- h) Program of planting and preserving protective forest
- i) Program of enhancing disaster management and science and technology application capacity.

4. Structural measures

- c) The program to review, upgrade and build structures for natural disaster prevention, response and mitigation.
- d) The program to build erosion prevention structures
- e) The program to strengthen and upgrade sea dyke systems
- f) The program to establish systems of structures prevent salt but preserve fresh water
- g) The program to build systems of storm shelters for boats, ships
- h) The program to upgrade dyke systems of Red river and Thai Binh river
- i) The program to expand flood discharge openings of bridges and sluices along road and railroad systems.

Cross Cutting Issues

Consolidate the system of laws, policies and mechanisms, organizational structure

Human resources development and social mobilization.

Financial resources, Community awareness raising.

Develop science and technologies related to natural disaster, prevention, response and mitigation

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Implementation Process for 10 years

Expected Outcome: Minimizing the losses of human life and properties, the damage of natural resources and cultural heritages, and the degradation of environment, contributing significantly to ensure the country sustainable development, national defense and security

Key Activities for Action	Year									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Complete the system of legal documents.										
a) Natural Disaster Prevention, Response and Mitigation Law.										
b) Policies on disaster relief and recovery after the disaster.										
c) Assistance policies for disaster prone areas.										
2. Strengthen organizational mechanism										
a) Strengthen the steering mechanism for natural disaster prevention, response and mitigation at all levels.										
b) Provide training courses to improve the capacity of staff in charge of natural disaster prevention, response and mitigation.										
c) Establish organizations supporting natural disaster management.										
3. Non – structural measures.										
a) Program of establishing and reviewing plans.										
b) Program of enhancing forecast and warning capacity.										

c) Program of improving the community awareness.	
d) Program of planting and preserving protective forest.	
e) Program of enhancing disaster management and science and technology application capacity.	
4. Structural measures	
a) The program to review, upgrade and build structures for natural disaster prevention, response and mitigation in line with designed standards and natural disaster characteristics of each region, each local.	
b) The program to build erosion prevention structures	
c) The program to strengthen and upgrade sea dyke systems	
d) The program to establish systems of structures prevent salt but preserve fresh water.	
e) The program to build systems of storm shelters for boats, ships.	
f) The program to upgrade dyke systems of Red river and Thai Binh river.	
g) The program expand flood discharge openings of bridges and sluices along road and railroad systems.	
h) Continue to build reservoirs for water flow adjustment and flood drainage	

Related Organizations/Individuals for Implementation

Expected Outcome: Minimizing the losses of human life and properties, the damage of natural resources and cultural heritages, and the degradation of environment, contributing significantly to ensure the country sustainable development, national defense and security

Key Activities for Action	Level	Implementing Organization	Stakeholders
1. Complete the system of legal documents			
a) Natural Disaster Prevention, Response and Mitigation Law	National	Ministry of Agriculture and rural development (MARD)	Related Governmental, regional agencies, social economic organizations
b) Promulgate policies on disaster relief and recovery after the disaster	National	Ministry of Labor, society	MARD, Related Governmental, regional agencies, social economic organizations
c) Promulgate assistance policies for disaster prone areas	National	Ministry of Labor, society	MARD, Related Governmental, regional agencies, social economic organizations
2. Strengthen organizational mechanism			
a) Strengthen the steering mechanism for natural disaster prevention, response and mitigation at all levels	National	Steering committee of flood control	Governmental, regional agencies, social economic organizations
b) Provide training courses to improve the capacity of staff in charge of natural disaster prevention, response and mitigation	National	MARD	Governmental, regional agencies, social economic organizations
c) Establish organizations supporting natural disaster management	Community	Ministry of (Bo Noi Vu?)	MARD, Related Governmental, regional agencies, social economic organizations
3. Non – structural measures			

a) Program of establishing and reviewing plans	National	Related Ministries	Related Ministries
b) Program of enhancing forecast and warning capacity	National	Ministry of natural resources and environment (MONRE)	Related Governmental, regional agencies, social economic organizations
c) Program of improving the community awareness	Community	Related Ministries (Ministry of Education, communication, etc)	Government agencies, social - economic organizations, armed forces, citizens, and foreign organizations and individuals
d) Program of planting and preserving protective forest	National	MARD, Locals	Related Governmental, regional agencies, social economic organizations
e) Program of enhancing disaster management and science and technology application capacity.	National	Related Ministries	Related Governmental, regional agencies, social economic organizations
4. Structural measures			
a) The program to review, upgrade and build structures for natural disaster prevention, response and mitigation in line with designed standards and natural disaster characteristics of each region, each local.	National	MARD	Related Governmental, regional agencies, social economic organizations
b) The program to build erosion prevention structures	National	Provincial Committee	Related Governmental, regional agencies, social economic organizations
c) The program to strengthen and upgrade sea dyke systems	National	Provincial Committee, cities in coastal regions	Related Governmental, regional agencies, social economic organizations
d) The program to establish systems of structures prevent salt but preserve fresh water	National	MARD	Related Governmental, regional agencies, social economic organizations

e) The program to build systems of storm shelters for boats, ships	National	MARD	Related Governmental, regional agencies, social economic organizations
f) The program to upgrade dyke systems of Red river and Thai Binh river	National	MARD	Related Governmental, regional agencies, social economic organizations
g) The program expand flood discharge openings of bridges and sluices along road and railroad systems	National	Ministry of Navigation and transportation	Related Governmental, regional agencies, social economic organizations
h) Continue to build reservoirs for water flow adjustment and flood drainage	National	Ministry of Construction and MARD	Related Governmental, regional agencies, social economic organizations

DEFINITION

Level: Please indicate one or more item(s) from International, National, Regional, or Community

Implementing Organization: Coordinating organizations to implement the activity

Stakeholders: Coordinated organizations/people to implement the activity

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4. Consideration on the Action Plans from the viewpoint of Disaster Risk Management

This chapter shows some individual considerations on each action plan from the viewpoint of vulnerability of disaster risk, interaction between the action plans and disaster risk, and progress status in implementing Disaster Risk Management (DRM). Through these works, the participants verified whether their action plans could improve the current situation of DRM and modified the action plans if necessary.

In the case of Thailand, DWR proposed several kinds of action plan, but in this report it focuses on only Flood/Land slide/Flash flood risk and considers the disaster deeply as same as Chapter 3.

Consideration (1): Vulnerability related to the Disaster Risk

The participants summarized the vulnerability related to the disaster risks in their country. Activities in the Action Plan they prepared can have any effects of overcoming the vulnerability.

Therefore, the participants evaluated the effects and put every item of the Activities to relevant columns in their judgment, where, large: act directly on vulnerability, effective / small: act indirectly on vulnerability but not very effective.

Consideration (2): Indicators under DPSIR Framework

The participants summarized the indicators under DPSIR framework in their country. Activities of the Action Plan they prepared can have relations with indicators.

Therefore, the participants evaluated the degree of relations and put every item of the Activities to relevant columns in their judgment, where, large: the degree of relations with indicators is large / small: the degree of relations is small.

Consideration (3): Progress in Implementing DRM

The participants summarized the progress status in implementing DRM in their country. Activities in the Action Plan they prepared can improve some negative status.

Therefore, firstly, the participants checked if the indicator is Inadequate or Poor/Non-existence at either level in their country. Secondly, as to the indicators they checked, they evaluated which activities they proposed could improve them, where, large: improve the indicator directly / small: improve the indicator but not so much.

4.1 Indonesia: identified by PJT II

Consideration (1): Vulnerability related to the Disaster Risk

		Effect	
		large	small
1. Political-institutional Factor			
√	a) Legislation is lacking in regional development, land use, etc.	1a,1c,2c,3d	2a,3d
√	b) The human and financial resources are inadequate.	1b,1d,2a,3b	1a,1b,2b,2c,3a
√	c) Actors' roles are not properly assigned.	1b,1d,2a,	2b,2c,3a,3d
√	d) The political culture is not matured for consistent disaster risk management.	1a,1d,2a,3c	2b,2c,
	e) Democratic institutions are not developed.		
	f) Proper mechanisms for financial risks are lacking.		
	g) A culture of prevention is insufficiently promoted.		
2. Economic Factor			
√	a) Financial resources are insufficient.	1b,1c,1d,2a,2b,2c, 3a,3b	1a,3c,3d
√	b) Poverty limits the self-help capabilities.		1d,3b,
√	c) The economies remain at the low level diversification and are vulnerable to disaster.	1b,1c,1d,2a,2b,2c, 3a,3b	1a,3c,3d
	d) The influence of economic activities on disaster risk is not carefully considered.		
3. Socio-cultural Factor			
√	a) People with poor education and insufficient knowledge of the cause-effect are less able to respond in a changing environment.	1a,2a3d	
√	b) People tend to treat natural disasters as inevitable.	1a,1d,2b,2c,3c	2b,2b,3b
	c) The tradition of the application of out-dated production methods is still widespread.		
√	d) People are not prepared to engage in mutual support schemes and organize themselves.	1a,1d,2b,2c,3c	2b,2b,3b

Consideration (2)-1 – Indicators under DPSIR Framework on Floods

		Degree	
		large	small
Driving Force (D)	- Population growth	1a,1b,1d,3a,3b	1c,2a,2b,2c,3a
	- Land use changes especially in the catchment area on the hilly mountain	1a,1b,1c,1d,2c	2a,2b,3a,3b
	- Urbanization /slump (canal/river encroachment)	1a,1b,1c,1b,2a,2b,2c,3a,3b	
	- Untreated solid waste disposal (special case)	1c,1d,2b	2c,3b
Pressures (P)	- transition of population exposed to the flood risk	1a,1b,1c,1b,2a,2c	2b,3a,3c
	- transition of land cover area with forest	1b,1c,3b	1a,1d,2a,2c
State (S)	- change in the number of people and its area living with 100-year flood	1b,2b,2c,3a,3c	1a,1c,1d,2a
	- change in river peak discharge	1b,2c,3a,3c	1c,1d,2a
Impact (I)	- losses in human life (number/ year; % of population, etc.)	1a,1b,1c,1d,2d,2a,2c,3a,3b	2b,
	- losses in assets (\$/year; % of GNP, etc.)	1a,1b,1c,1d,2d,2a,2c,3a,3b	2b,
Response (R)	- Enhance capacity building and coordination among related institutions on disaster management	1a,1b,1d,2a	1c,1b
	- budget allocation for flood risk mitigation	1b,1d,3c	2a,2b,2c
	- formulation of an action plan for risk reduction and preparedness	2a,2c,3b	2b
	- improvement of infrastructures for flood monitoring	1b,3a,3b	1d

Consideration (2)-2 – Indicators under DPSIR Framework on Drought

		Degree	
		large	small
Driving Force (D)	- Population growth	1a,1b,1d,3a,3b	1c,2a,2b,2c,3a
	- Increasing agricultural activities	1b,1c,1d,2b,3a,3b,3c,3d	2a,2c
	- Increasing demand on industrial waters	1b,1c,1d,2b,3a,3b,3c,3d	2a,2c
	- Decreasing base flow due to decreasing forest area for horticulture activities (land use changes)	1a,1b,1c,1d,3a,3b,3c,3d	2a,2b,2c
Pressures (P)	- Increasing of agriculture area exposed to the drought risk	1a,1b,1c,1d,2a,2b,2c,3a,3b,3c,	
	- Increasing of farmers and urban population exposed to the drought risk / shortage of water supply	1a,1b,1c,1d,2a,2b,2c,3a,3b,3c,	
State (S)	- change in the number of people and its area vulnerable to drought	1a,1b,1c,1d,2a,2b,2c,3a,3b,3c,	
	- change in base flow	1a,1b,1c,1d,2a,2b,2c,	

		3a,3b,3c,	
Impact (I)	- losses in agricultural (rice) production	1a,1b,2a	3c,3d
	- losses in income	1a,1b,2a	3c,3d
	- Reduce quality of life	1a,1b,2a	3c,3d
Response (R)	- Enhance coordination and applying water efficient method for supplying water to the fields during period of drought	3a,3b,3c,3d	1a,1d,2a
	- formulation of an action plan for risk reduction and preparedness	2a,2c,	1c,2b
	- improvement of irrigation infrastructures and increasing capacity building to reduce losses (conveyance and operational losses)	3a,3b,3c,3d	1a,1d,2a

Consideration (2)-3 – Indicators under DPSIR Framework on Water Pollution

		Degree	
		large	small
Driving Force (D)	- Population growth	1d,3c	1a,1b,1c,2a,2b
	- Increasing industrial and manufacturing activities	1b,1d,2a,2b,2c	1a,1c
	- Deforestation	1a,1b,1c,1d,2a,2b,2c	
	- Poverty	1a,2c	1c,1d
	- Untreated domestic (solid) waste	1b,2b	2c
	- Industrial wastewater treatment plants	1b,2b	2c
Pressures (P)	- Decreasing of water availability	1b,1c,1d,2a,2c	1a
	- Increasing urban population exposed to the hygiene and sanitation problems	1b,1d,2c	1a,1b,1c,2a,2b
State (S)	- change in the number of people and its area vulnerable to poor quality of life	1a,2c	1c,1d
	- change in the number of people and its area with inadequate access to water supply	1a,2c	1c,1d
Impact (I)	- Poor quality of life (human health)	1a,1c,1d,2a,2b,2c	1b
	- Degraded environment	1a,1b,1c,1d,2a,2b,2c	
	- Shortage of water supply	1b,1c,1d,2a,2c	1a
Response (R)	- Institutional strengthening on water quality management system	1b,1c,1d,1c	1a,2a
	- Enhancing institutions coordination in the form of synchronized program on water quality management	1a,1c,1d,2a,2b,2c	1b
	- Information dissemination to increase awareness and participation from the community	1a,1d	2a,2c

Consideration (3): Progress in Implementing DRM

Thematic Area	ISDR Indicators	Inadequate or Poor/NE	Degree	
			large	small
Institutional Framework	A legal framework for DRM exists with explicit responsibilities defined for all levels of government.			
	Multi-sectoral platforms for DRM are operational across levels.			
	A national policy framework for DRM exists that requires plans and activities at all administrative levels.			
	Adequate resources are available to implement DRM plans at all administrative levels.			
Risk Assessment and Early Warning	Risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors.			
	Systems are in place to monitor, maintain and disseminate data on key hazards and vulnerabilities.	√	1b,4a,4b	1c,2a,2b,2c
	Early warning systems are in place for all major hazards.	√	1b,4a,4b	1a,1c,1d
	Early warnings reach and serve people at the community level.	√	1b,4a,4b	1a,1c,1d
Education and Awareness	Public awareness strategies for DRM exist and are implemented with vulnerable communities	√	1a,1b,1d	1c
	School curricula include DRM elements and instructors are trained in DRM.	√	1c,	
Reducing Risk in Key Sectors	Environmental protection, natural resource management (land and water) and climate change policies include DRM elements	√	2a,2b,2c	1a,1b,1c,1d, 2a,2b,2c
	Sectoral development plans (agriculture, water resources, health, environment, forestry, tourism, industry etc.) include DRM elements	√	2a,2b,2c	1a,1b,1c,1d, 2a,2b,2c
	Land-use zoning and plans, building codes and safety standards exist and include disaster risk-related elements which are rigorously enforced.	√	2a,2b,2c	1a,1b,1c,1d, 2a,2b,2c
	Technology options for DRM are available and applied	√	2c,4a,4b	1c,1d
	A long-term national programme is in place to protect critical infrastructure from common natural hazards			

	A procedure is in place to assess the disaster risk implications of major infrastructure and development project proposals.			
Disaster Preparedness and Response	An independent assessment of disaster preparedness capacities and mechanisms has been undertaken and the responsibility for the implementation of its recommendations has been assigned and resourced.			
	Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes	√	2c,4a,4b	1a,1d
	All organizations, personnel and volunteers responsible for maintaining preparedness are equipped and trained for effective disaster preparedness and response	√	1a,1b,1c,1d, 2c,4a,4b	2a,2b,
	Financial reserves and contingency mechanisms are in place to support effective response and recovery.	√	1a,1b,1c,1d	2a,2b,2c
	Procedures are in place to document experience during hazard events and disasters and to undertake post-event reviews.			

4.2 Philippines: identified by LLDA

Consideration (1): Vulnerability related to the Disaster Risk

		Effect	
		large	small
1. Political-institutional Factor			
√	a) Legislation is lacking in regional development, land use, etc.	1a, 1b,1c,1d / 2a / 3a, 3b / 4a, b, 4c, 4d /3b	2b / 4e
√	b) The human and financial resources are inadequate.	1a,1b / 2a,2b,2c / 3a,3b / 4a, 4b, 4c, 4d	1c, 1d / 4e
	c) Actors' roles are not properly assigned.		
√	d) The political culture is not matured for consistent disaster risk management.	1a, 1b,1c,1d / 2a,2b,2c / 3a, 3b / 4a, 4b, 4c, 4d	4e
	e) Democratic institutions are not developed.		
√	f) Proper mechanisms for financial risks are lacking.	1a, 1b,1c,1d / 2a,2b,2c / 3a, 3b / 4a, 4b, 4c, 4d	4e
√	g) A culture of prevention is insufficiently promoted.	1a, 1b,1c,1d / 2a,2b,2c / 3a, 3b / 4a, 4b, 4c, 4d	4e
2. Economic Factor			
√	a) Financial resources are insufficient.	1a, 1b,1c,1d /2a,2b, 2c / 3a,3b / 4a,4b,4c,4d	4e
√	b) Poverty limits the self-help capabilities.	1a, 1b,1c,1d /3a, 3b / 4a,4b,4c,4d	2a,2b,2c / 4e
√	c) The economies remain at the low level diversification and are vulnerable to disaster.	1a, 1b,1c,1d / 2a,2b,2c / 3a, 3b / 4a, 4b, 4c, 4d	4e
√	d) The influence of economic activities on disaster risk is not carefully considered.	1a, 1b,1c,1d / 3a,3b / 4a,4b,4c,4d	2a,2b,2c / 4e
3. Socio-cultural Factor			
√	a) People with poor education and insufficient knowledge of the cause-effect are less able to respond in a changing environment.	1a,1d /2a,2b / 3a,3b /4a,4b,4c,4d	1b, 1c / 2c / 4e
√	b) People tend to treat natural disasters as inevitable.	1a,1d / 3a,3b /	1b, 1c

		4a,4b,4c,4d, 4e	
√	c) The tradition of the application of out-dated production methods is still widespread.	1a,1d / 3a,3b / 4a,4b,4c,4d, 4e	1b, 1c
√	d) People are not prepared to engage in mutual support schemes and organize themselves.	1a,1d / 3a,3b / 4a,4b,4c,4d, 4e	1b, 1c

Consideration (2) – Indicators under DPSIR Framework on Water Pollution

DPSIR Framework	INDICATOR	Degree	
		large	small
Driving Force (D)	Increase in population growth/density.	1a, 1d; 4b,	1c
	Increase in the rate of land conversion for residential, industrial, and commercial use.	1a,1d	
	Increase in the rate of pollution load as a result of urbanization and land development.	1a, 1d	1c
Pressures (P)	Rate of watershed reduction due to urbanization and industrialization.	1d, 3a, 3b	
State (S)	Change in the water quality of the lake and its tributaries	1a, 1b,1d	
	Rate of declining water quality in the rivers and the lake. (While the lake still meets Class C based on the DENR standard, [i.e. for fishery use only], most of the rivers draining into it hardly meets Class D [for irrigation use]).	1a, 1b	
Impact (I)	Rate of increase of watershed destruction, nutrient and pollutant loading in rivers and the lake.	1a, 3a, 3b	
	Rate of incidence of water related diseases and impacts on aquatic resources.	1a, 1d, 3b	
	Rate of incidence of fish kills.	1a, 1d	
Response (R)	Legal and institutional provisions to regulate man made water pollution. Examples: EUFS, Public Disclosure Programs, Quick Response Team, proposals for Effluent Trading.	4a, 4b,4c,4e	
	Improvement of solid waste, sewerage/ waste water treatment and management. Example: assistance to LGUs in putting up material recovery facilities (MRF), river clean-ups, utilizing fisher folks, farmers as volunteers (known as environmental army) of about 400 of which 49 are women, among others.	1d, 3a, 3b	
	Inclusion of civil societies' representative in the policy making board of the LLDA.	1a, 1d, 3a,3b, 4b	

Consideration (3): Progress in Implementing DRM

Thematic Area	ISDR Indicators	Inadequate or Poor/NE	Degree	
			large	small
Institutional Framework	A legal framework for DRM exists with explicit responsibilities defined for all levels of government.	√	1a,3a,4b	
	Multi-sectoral platforms for DRM are operational across levels.	√	1a,3a, 4a,4b	
	A national policy framework for DRM exists that requires plans and activities at all administrative levels.	√	1a,2a,3a,3b, 4a,4b	
	Adequate resources are available to implement DRM plans at all administrative levels.	√	1a, 1b, 2a,2b,2c3a, 4b,4c,4d	
Risk Assessment and Early Warning	Risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors.	√	2a,2b,3a,4d	
	Systems are in place to monitor, maintain and disseminate data on key hazards and vulnerabilities.	√	1a,2a,3a,4c	–
	Early warning systems are in place for all major hazards.		–	–
	Early warnings reach and serve people at the community level.	√	1d,2b,3a,4d	
Education and Awareness	Public awareness strategies for DRM exist and are implemented with vulnerable communities	√	–	–
	School curricula include DRM elements and instructors are trained in DRM.	√	1d,2b,3a,4d, 4e	
Reducing Risk in Key Sectors	Environmental protection, natural resource management (land and water) and climate change policies include DRM elements	√	3b,4d,4c	–
	Sectoral development plans (agriculture, water resources, health, environment, forestry, tourism, industry etc.) include DRM elements	√	1a,2a,3a,4b 4c	–
	Land-use zoning and plans, building codes and safety standards exist and include disaster risk-related elements which are rigorously enforced.	√	1c,2a,4a,4b, 4c,4d,4e	
	Technology options for DRM are available and applied	√	1a,2a,3a,4b 4c	–
	A long-term national programme is in place to protect critical infrastructure from common natural hazards	√	1a,1c,2a,3a, 3b,4a,	
	A procedure is in place to assess the disaster risk implications of major infrastructure and development project proposals.	√	1a,1c,2a,3a, 4b	

Disaster Preparedness and Response	An independent assessment of disaster preparedness capacities and mechanisms has been undertaken and the responsibility for the implementation of its recommendations has been assigned and resourced.	√	1a,2a,4a,4b	
	Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes			
	All organizations, personnel and volunteers responsible for maintaining preparedness are equipped and trained for effective disaster preparedness and response	√	1a,2a,4b	
	Financial reserves and contingency mechanisms are in place to support effective response and recovery.	√	1a,2a,2c,4b,	
	Procedures are in place to document experience during hazard events and disasters and to undertake post-event reviews.	√	1a,2a,3a,4a,4b	—

4.3 Sri Lanka: identified by MASL

Consideration (1): Vulnerability related to the Disaster Risk

		Effect	
		large	small
1. Political-institutional Factor			
√	a) Legislation is lacking in regional development, land use, etc.	1a,1b,1c,1f, 3a,3c,3e,4a,4c	1d,1e, 2a,2c,3d
√	b) The human and financial resources are inadequate.	1c,1f,2a,2b,2d, 3e,4a,4b,4c,4d	4e
√	c) Actors' roles are not properly assigned.	1e,1f,2a,2b	3d,3e,4c
√	d) The political culture is not matured for consistent disaster risk management.	1b,1f,3b,3c	4a,4c
	e) Democratic institutions are not developed.		
	f) Proper mechanisms for financial risks are lacking.		
√	g) A culture of prevention is insufficiently promoted.	1c,1f,2c,3a,4a	1b,4e
2. Economic Factor			
√	a) Financial resources are insufficient.	1c,1f,2a,2c,2d, 3e,4b,4d	3c,4a
√	b) Poverty limits the self-help capabilities.	1e,3b,3d,4c,4e	2b
√	c) The economies remain at the low level diversification and are vulnerable to disaster.	1c,1f,2a,2d, 4a,4e	3d
√	d) The influence of economic activities on disaster risk is not carefully considered.	1e,1f,2e,3e	
3. Socio-cultural Factor			
√	a) People with poor education and insufficient knowledge of the cause-effect are less able to respond in a changing environment.	1e,2b,2e, 3a,3c,3d,4a,4e	
√	b) People tend to treat natural disasters as inevitable.	1f	2b,2c,2e
√	c) The tradition of the application of out-dated production methods is still widespread.	1c,1f,2d,3c	
	d) People are not prepared to engage in mutual support schemes and organize themselves.		

Consideration (2)-1 – Indicators under DPSIR Framework on Landslides

		Degree	
		large	small
Driving Force (D)	- Unplanned Land Use for Agriculture & Construction.	1a,1f,2c,3a,3c,	1b,3d
	- Urbanization	1a,1d,2a,2b,2c, 3c,4a,4c	1b,1c,1f, 3c,4b
Pressures (P)	- Deforestation for Cultivation of Field crops in hilly areas	1a,1f,2c,3c,3d,4c	1b,1e
	- Infrastructure Development in Vulnerable Steep Slopes	1a,1f,2c,3c,3d	3d,4a,4c
State (S)	- Increased sediment on reservoir bed	2c,3a,3c,3e,4c	1e,1f,3d
	- Damage & block drainage system	1b,1f,3a,3c	3d,4c
Impact (I)	- Loss of Human Lives & properties due to Land Slide	1b,1f,1d,2c,3c,4b	4b,4c,4e
	- Loss of hydropower generation due to siltation of reservoir	1e,3a,3c,3e	1f,4c
Response (R)	- Formulation of Policies & Regulations for soil conservation	1b,1f,2b,2c,3d,4c	
	- Watershed Management Plan	1a,1b,1f,3a,3c	3d,4c,4e
	- Conservation of Protected areas	1a,1e,1f,2c,3a,3c	3d
	- Budget allocation for reforestation	1d,3c,4b	

Consideration (2)-2 – Indicators under DPSIR Framework on Droughts

		Degree	
		large	small
Driving Force (D)	- Forest clearing & forest fire for large scale Agricultural Development	1a,1c,1f,2b,2c,3c,	1e,3a,4e
	- Transition of population growth	3c,4a	1d,1f,
Pressures (P)	- Decrease Evaporation / Evapotranspiration rate due to deforestation	2c,3a,3e	
	- Over extraction of Ground water	1a,1b,1f,2c,3b,4b	3e
State (S)	- Change the seasonal rainfall pattern	1e,1f,2a,2d,3b	3d,4a,4b
	- Decrease of Ground water level & water quality	1e,1f,2b,	3b,4b,4e
Impact (I)	- Water scarcity in rivers & wells	1b,1f,2c,3a,4a	1e,3d,4c
	- Loss of crops & average yield	1d,1f,2c,3d,4b,4d	3a
Response (R)	- Legal & institutional arrangement	1a,1c,2c,3d	4a,4c
	- Practice climate change adaptation techniques	1b,1f,2d,3b,4a	3a
	- Formulation of Action plan for drought mitigation	1a,1b,1d,2a,4a	3c,4c

Consideration (2)-3 – Indicators under DPSIR Framework on Floods

		Degree	
		large	small
Driving Force (D)	Urban expansion & wetland filling	1a,1f,2b,2c,3c,4c	2a
	Transition of population growth	1f,2a,2c,3a,3c	2d,3a,3d
Pressures (P)	Blockage of drainage system	1a,1b,1f,	1c,3a,3d4b,4e
	Reduce infiltration due to concrete infrastructure & increase surface run off	1a,1f,2a,2c,3c,3e	2d3b,4d
State (S)	Change of water quality parameters	1e,1f,3a,3c	
	Change in river peak discharge & reservoir storage	3b,3c,3e	2a,2c,4e
Impact (I)	Loss of human lives & properties.	1b,1d,3d,4b,4b,4e	
	Loss of crop production	3c,4b,4d	1e,1f,3a
Response (R)	Legal institutional arrangement for flood mitigation	1a,1b,1f,	1d,3d,4d,4e
	Adequate budget allocation for flood risk mitigation	1d,1e,2a,2d, 3e,4b,4d	
	Formulation of an action plan for risk reduction and preparedness Improvement of infrastructures such as dams, reservoirs etc	1c,2b,3e,4a	2c,3b,3d,4b

Consideration (3): Progress in Implementing DRM

Thematic Area	ISDR Indicators	Inadequate or Poor/NE	Degree	
			large	small
Institutional Framework	A legal framework for DRM exists with explicit responsibilities defined for all levels of government.	√	1a,1f	4a,4e
	Multi-sectoral platforms for DRM are operational across levels.	√	1c,1f	3d,4a
	A national policy framework for DRM exists that requires plans and activities at all administrative levels.	√		1c,1f
	Adequate resources are available to implement DRM plans at all administrative levels.	√	1c,1f	1d,4e
Risk Assessment and Early Warning	Risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors.	√		1c,1f
	Systems are in place to monitor, maintain and disseminate data on key hazards and vulnerabilities.	√	1c,3d,4a	1d,4e
	Early warning systems are in place for all major hazards.	√	1c,3d,4a	1d,4e
	Early warnings reach and serve people at the community level.	√		1c,1e,3d
Education and Awareness	Public awareness strategies for DRM exist and are implemented with vulnerable communities		–	–

	School curricula include DRM elements and instructors are trained in DRM.			
Reducing Risk in Key Sectors	Environmental protection, natural resource management (land and water) and climate change policies include DRM elements		–	–
	Sectoral development plans (agriculture, water resources, health, environment, forestry, tourism, industry etc.) include DRM elements		–	–
	Land-use zoning and plans, building codes and safety standards exist and include disaster risk-related elements which are rigorously enforced.	√		1b,1c,1f
	Technology options for DRM are available and applied	√	1c,3d,4a	–
	A long-term national programme is in place to protect critical infrastructure from common natural hazards	√	1c,3c,4a	4b,4e
	A procedure is in place to assess the disaster risk implications of major infrastructure and development project proposals.	√	1c,1f,3d	
Disaster Preparedness and Response	An independent assessment of disaster preparedness capacities and mechanisms has been undertaken and the responsibility for the implementation of its recommendations has been assigned and resourced.	√	1c,id,4a	1e,1f,
	Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes	√	1b,1c,1d,3d,4a	1e,1f,
	All organizations, personnel and volunteers responsible for maintaining preparedness are equipped and trained for effective disaster preparedness and response	√	1c,1f	3d,4a,4e
	Financial reserves and contingency mechanisms are in place to support effective response and recovery.	√	1b,1c,1d,4b	1f
	Procedures are in place to document experience during hazard events and disasters and to undertake post-event reviews.	√	1b,1c,4b	–

4.4 Thailand: identified by DWR

Consideration (1): Vulnerability related to the Disaster Risk

		Effect	
		large	small
1. Political-institutional Factor			
	a) Legislation is lacking in regional development, land use, etc.		
√	b) The human and financial resources are inadequate.	1d,7a,1c	
	c) Actors' roles are not properly assigned.		
	d) The political culture is not matured for consistent disaster risk management.		
	e) Democratic institutions are not developed.		
√	f) Proper mechanisms for financial risks are lacking.	1a,1b	
√	g) A culture of prevention is insufficiently promoted.	1d,7a	
2. Economic Factor			
√	a) Financial resources are insufficient.	1d,7a,1c	
√	b) Poverty limits the self-help capabilities.	1d	
	c) The economies remain at the low level diversification and are vulnerable to disaster.		
	d) The influence of economic activities on disaster risk is not carefully considered.		
3. Socio-cultural Factor			
√	a) People with poor education and insufficient knowledge of the cause-effect are less able to respond in a changing environment.	7a	
	b) People tend to treat natural disasters as inevitable.		
	c) The tradition of the application of out-dated production methods is still widespread.		
	d) People are not prepared to engage in mutual support schemes and organize themselves.		

Consideration (2) – Indicators under DPSIR Framework on Flood

		Degree	
		large	small
Driving Force (D)	1. Increasing of population.		7a
	2. Increasing proportion of urban area /expansion of urban areas.	3a	
	3. Increasing of tourism in especially in upland areas.		7a
	4. Deforestation (to pilfer wood or to seek for high value plant)	2a	
	5. Land use change such as agriculture areas were developed to urban and industrial areas.	3a	
Pressures (P)	1. Transition of land covers area with forest e.g. decrease of forest areas	2a	
	2. Land use change cause of urban area expansion and industrial expansion.	3a	
	3. Invasion of river, flood way or flood area.	7a,5d	
	4. Communities locate in risk areas, e.g. living in floodplain areas, landslide zone, etc.	1d,7a	
	5. Inefficiency of drainage system	4c	
State (S)	1. Change in rainfall pattern & heavy rainfall	2a	
	2. Change in river peak discharge & flow rate.	5d,4b,6a	
	3. Change in the number of people and its area living with flood, flash flood and landslide.	7a	
Impact (I)	Losses in human life and assets, by the year 2006 flood occurred in 47 province (from 76) and losses in assets 7,077 million baht, include flood, flash flood and land slide) (remark : exchange rate on January 2009, 1Baht = 0.029 USD)	1,2,3	
Response (R)	1. Legal and institution provision for flood risk management.	7b	
	2. Prevention and rehabilitation of upstream.	2a,2c,2d	
	3. Promotion and public participation in forest conservation.	7a	
	4. Budget allocation for warning system.	1a,1b,1c	

Consideration (3): Progress in Implementing DRM (Flood Disaster only)

Thematic Area	ISDR Indicators	Inadequate or Poor/NE	Degree	
			large	small
Institutional Framework	A legal framework for DRM exists with explicit responsibilities defined for all levels of government.	/	7b,1c	
	Multi-sectoral platforms for DRM are operational across levels.	/	7b	
	A national policy framework for DRM exists that requires plans and activities at all administrative levels.	/	7b	
	Adequate resources are available to implement DRM plans at all administrative levels.	-	-	
Risk Assessment and Early Warning	Risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors.	/	1a,1b,1c,1d,3c	
	Systems are in place to monitor, maintain and disseminate data on key hazards and vulnerabilities.	/	1a,1b,1c,1d,	_
	Early warning systems are in place for all major hazards.	/	1a,1b,1c,1d,	_
	Early warnings reach and serve people at the community level.	/	1a,1c,1d,	
Education and Awareness	Public awareness strategies for DRM exist and are implemented with vulnerable communities	/	1d,7a	_
	School curricula include DRM elements and instructors are trained in DRM.	/	1d,7a	
Reducing Risk in Key Sectors	Environmental protection, natural resource management (land and water) and climate change policies include DRM elements	/	2a,2b,2c,2d	_
	Sectoral development plans (agriculture, water resources, health, environment, forestry, tourism, industry etc.) include DRM elements	/	7a,7b	_
	Land-use zoning and plans, building codes and safety standards exist and include disaster risk-related elements which are rigorously enforced.	/	3a,5a,5d	
	Technology options for DRM are available and applied	/	1a,1b,1c,7d	_
	A long-term national programme is in place to protect critical infrastructure from common natural hazards	/	4c,7c	
	A procedure is in place to assess the disaster risk implications of major infrastructure and development project proposals.	-	-	
Disaster Preparedness and	An independent assessment of disaster preparedness capacities and mechanisms has been undertaken and the responsibility for the implementation of its recommendations has been assigned	/	7a,3d	

Response	and resourced.			
	Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes	/	7a,3d	
	All organizations, personnel and volunteers responsible for maintaining preparedness are equipped and trained for effective disaster preparedness and response	/	7a,3d,7b,3c	
	Financial reserves and contingency mechanisms are in place to support effective response and recovery.	-	-	
	Procedures are in place to document experience during hazard events and disasters and to undertake post-event reviews.	-	-	-

4.5 Viet Nam: identified by DWR

Consideration (1): Vulnerability related to the Disaster Risk

		Effect	
		large	small
1. Political-institutional Factor			
	a) Legislation is lacking in regional development, land use, etc.		
√	b) The human and financial resources are inadequate.	2a,2b,2c,	1a,1b,1c
	c) Actors' roles are not properly assigned.		
	d) The political culture is not matured for consistent disaster risk management.		
	e) Democratic institutions are not developed.		
	f) Proper mechanisms for financial risks are lacking.		
	g) A culture of prevention is insufficiently promoted.		
2. Economic Factor			
√	a) Financial resources are insufficient.		3c,3d
√	b) Poverty limits the self-help capabilities.	1a,1b,1c,2a,2b,2c, 3b,3c,3d,3e	3a,
√	c) The economies remain at the low level diversification and are vulnerable to disaster.	1a,2a,2b,2c, 3b,3c,3d,3e	3a,
√	d) The influence of economic activities on disaster risk is not carefully considered.	1a,1b,1c,2a,2b,2c, 3b,3c,3d,3e	
3. Socio-cultural Factor			
√	a) People with poor education and insufficient knowledge of the cause-effect are less able to respond in a changing environment.	2a,2b,2c,3c	1a,1b,1c,
	b) People tend to treat natural disasters as inevitable.		
	c) The tradition of the application of out-dated production methods is still widespread.		
	d) People are not prepared to engage in mutual support schemes and organize themselves.		

Consideration (2)-1 – Indicators under DPSIR Framework on Flood

		Degree	
		large	small
Driving Force (D)	+ Great poverty of human who live in high mountain.	1a,1b,1c,2a,2b,2c, 3b,3c,3d,3e	3a,4a,4b,4h
	+ Transition of population growth.		
	+ Land use management	1a,3a,	2a,2b,2c,
	+ Expansion in development, urbanization and industrial sectors	1a,1b,1c, 3a,3c,3d,3e	2a,2b,2c,
Pressures (P)	+ Transition of land use purpose.	1a,3a,	2a,2b,2c,
	+ Regulation water sources of reservoirs are inadequate.	3b,3c,3d,3e,	2a,2b,2c,
	+River catchment encroachment.	1a,1b,1c, 3a,3b,3c,3d,3e	2a,2b,2c,
State (S)	+ Building hydraulic construction to decrease river flow.	1a,3a,3b,3d,3e, 4a,4h	2a,2b,2c
Impact (I)	+ Destroy infrastructures.	3a,3b,3c,3d,3e,,	1a,1b,1c, 2a,2b,2c
	+ Reduce of human life quality (number/ year; % of population, asset, etc.)	3a,3b,3c,3d,3e,	1a,1b,1c, 2a,2b,2c
Response (R)	+ Make planning for prevention, response and mitigation.	1a,1b,1c,2a,2b,2c, 3a,3b,3c,3d	4a,4b,4c,4d, 4e,4f,4g,4h
	+ Improvement of infrastructures (dams, reservoirs, river dikes, etc.)	3b,3c,3d,3e,4a,4b, 4c,4d,4e,4f,4g,4h	3a,1a, 2a,2b,2c

Consideration (2)-2 – Indicators under DPSIR Framework on Water Pollution

		Degree	
		large	small
Driving Force (D)	+ Transition of population growth,, proportion of urban population, etc.	1b,1c,3a,3c,	1a,2a,2b,2c,3b
	+ Change on water and soil resources planning, etc.	1a,1b,1c,3a,3d,	2a,2b,2c
Pressures (P)	Lacking awareness on environmental protection.	2a,2b,2c,3c,3d,3e,	4d,
	+ Irrational planning on water resources use.	3a,4d,	1a,1b,1c, 2a,2b,2c
State (S)	+ Change on ecosystems.	3a,3b,3d,,3c,	1c,2a,2b,2c
	+ Change water sources quality.	1a,1b,1c,2a,2b,2c, 3a,3c,3d,3e,4d	4a,4h
Impact (I)	+ Disease development in human life.	1a,1b,1c,2a,2b,2c, 3a,3c,3d,3e,4d	4a,4h
	+ Destroy the life environment.	1a,1b,1c,2a,2b,2c, 3a,3c,3d,3e,4d	4a,4h
Response (R)	+ Treatment waste water before discharge.	3c,	
	+ Protect the life environment.	1a,1b,1c,2a,2b,2c, 3a,3c,3d,3e,4d	4a,4h
	+ Promote awareness of community in environmental protection.	2b,3c	

Consideration (2)-3 – Indicators under DPSIR Framework on Sea Water Intrusion

		Degree	
		large	small
Driving Force (D)	+ Population planning of power hydraulic development.	3a, 3d, 3e, 4a	4d, 4h
	Climate change	1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c, 3d, 3e, 4a	4b, 4c, 4d, 4e, 4f, 4g, 4h
	Transition of population growth, proportion of urban population, etc	1b, 1c, 3a, 3c	1a, 2a, 2b, 2c, 3b
	Expansion in development, urbanization and industrial sectors	1a, 1b, 1c, 3a, 3d, 4a,	2a, 2b, 2c, 3c,
Pressures (P)	+ Water pollution in river flow.	2a, 2b, 3a, 3b, 3c, 3e, 4a, 4d, 4h	1a, 1c, 1b,
	Change in weather (temperature, rainfall, etc.)	1a, 3b, 3c, 3d, 3e	4a, 4b, 4c, 4d, 4e, 4f, 4g, 4h
	Change on agriculture and fishing production	1c, 3a, 3b, 3c, 3d, 3e, 4a, 4c, 4d, 4e, 4f,	2a, 2b, 2c, 3c,
	Water demand is higher than ever before.	3d, 4a, 4d, 4h	3a,
State (S)	+ Change on ecosystems.	3a, 3c, 3d,	3b, 3e
	Change water resources quality.	3c, 3d, 4a, 4b, 4c, 4d	3e, 4b, 4h
	Change seawater level	3d	1a, 2a, 2b, 2c, 3a, 3b, 3c,
	Lack of water at estuaries in dry season	3a, 3d, 4h	3c, 3e
Impact (I)	Loss in human life and assets.	1a, 1b, 1c, 2a, 2b, 2c, 3c, 3d, 4a	2a, 2b, 2c
	+ Change on life environment.	1a, 1b, 1c,	2a, 2b, 2c, 3d, 3e
	Decrease land area use for cultivation, living.	3a, 3b, 3c, 3d, 4a, 4c, 4f	3e, 4b, 4h
Response (R)	+ Regulation water sources of reservoirs are adequate.	3d, 3e, 4a,	3b,
	+ Building the sea water prevention gates.	4c	
	Promulgate assistance policies for disaster prone areas.	1a, 1b, 1c, 2a, 2b, 2c	
	Adequate Integrated water resources planning and management	3a, 3d, 4a	

Consideration (3): Progress in Implementing DRM

Thematic Area	ISDR Indicators	Inadequate or Poor/NE	Degree	
			large	small
Institutional Framework	A legal framework for DRM exists with explicit responsibilities defined for all levels of government.			
	Multi-sectoral platforms for DRM are operational across levels.			
	A national policy framework for DRM exists that requires plans and activities at all administrative levels.			
	Adequate resources are available to implement DRM plans at all administrative levels.			
Risk Assessment and Early Warning	Risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors.	√		3b,3e,
	Systems are in place to monitor, maintain and disseminate data on key hazards and vulnerabilities.	√	3b,	–
	Early warning systems are in place for all major hazards.	√	3b,	–
	Early warnings reach and serve people at the community level.	√	3b,	
Education and Awareness	Public awareness strategies for DRM exist and are implemented with vulnerable communities	√	3c	2b
	School curricula include DRM elements and instructors are trained in DRM.	√	2b,	
Reducing Risk in Key Sectors	Environmental protection, natural resource management (land and water) and climate change policies include DRM elements	√	1a,1b,1c, 2a,2b,2c, 3d,3e	4a,4b
	Sectoral development plans (agriculture, water resources, health, environment, forestry, tourism, industry etc.) include DRM elements	√	1b,1c,2a,2b,2c,	–
	Land-use zoning and plans, building codes and safety standards exist and include disaster risk-related elements which are rigorously enforced.	√	3a,3a,4a,	3c,
	Technology options for DRM are available and applied	√	3b,3e,4a,4b,4c,4d, 4e,4f,4g,4h	1a,2a,2b,2c
	A long-term national programme is in place to protect critical infrastructure from common natural	√	3b,3c,3e,3d,	3a,4a

	hazards			
	A procedure is in place to assess the disaster risk implications of major infrastructure and development project proposals.	√	3a,3b,3c,3d,3e	1a,1b,1c,2a,2b,2c
Disaster Preparedness and Response	An independent assessment of disaster preparedness capacities and mechanisms has been undertaken and the responsibility for the implementation of its recommendations has been assigned and resourced.	√	1a,1b,1c,2a,2b,2c,3a,3e	2b,3c,3d
	Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes			
	All organizations, personnel and volunteers responsible for maintaining preparedness are equipped and trained for effective disaster preparedness and response			
	Financial reserves and contingency mechanisms are in place to support effective response and recovery.	√	1c,2c	
	Procedures are in place to document experience during hazard events and disasters and to undertake post-event reviews.	√	1a,1b,1c,2a,2b,2c	3a,3b,3c,3d,3e

5. Future Direction

Through the two workshops, all the participants were divided into 2 groups (Governmental Organizations and RBOs) and discussed thoroughly common situation and ideal style of DRM to cope with water-related disaster. The purpose of this work was to give future direction on Water-Related Disaster and its Management for the Governmental Organizations and RBOs. The procedure was as follows:

1. The participants were divided into 2 groups; one is RBOs (PJT II, LLDA, MASL, etc.) and the other is Governmental Organizations (DWR, etc.).
2. The groups discussed their materials from (1) to (3) (These materials are considered with their own action plans at Chapter 4.) to formulate better action plans. Showing examples of each topic and further discussions based on the lectures at the workshop were required.
3. The groups made presentations to share the result of the discussion in each group. The result would show the common situation and ideal style of DRM by each group.

5.1 Governmental Organizations

Strategic Goal: To minimize risk hazard from water-related disaster

The kind of risk/disaster: Floods, Typhoon, Landslide, Drought, Volcanic, Eruption, Sea-Water Intrusion, Waste Water, Tsunamis

Disaster related issues

1. Political-Institutional issues
 - 1) Lack of enforcement of the "law"
 - 2) Inadequate of human & financial resources
 - 3) Lack of coordination and cooperation at all level
 - 4) Lack of communication, information, promotion, etc.
2. Economic issues
 - 1) Insufficient fund
 - 2) Poverty limits the self-help capacities
3. Social-Cultural issues
 - 1) Community base management
4. Environmental issues
 - 1) Natural hazard
 - 2) Manmade: encroachment of flood plain area, and encroachment of catchment area, pollution

Action Plan

1. Political-Institutional issues

- a. Strict enforcement of “law”
- b. Strengthen organizations
- c. Proper implementation of law, guidelines, manuals
- d. Clear roles and scope of work

2. Economic issues

Increase fund allocation

3. Socio-Cultural issues:

Community base management - forum, flyers, awareness program to the school-children, stakeholders' participation in seminar/workshop

4. Environmental issues:

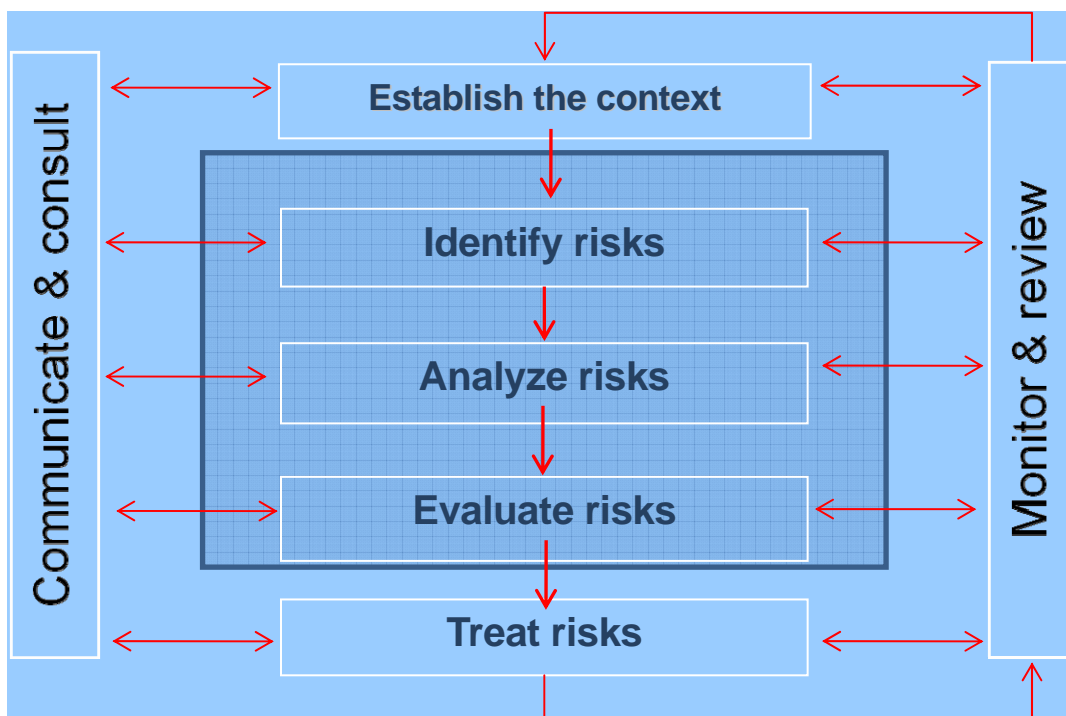
a. Non-Structural measures

- Coordination and cooperation at all levels
- Establish warning system
- Establish Hazard map
- Reforestation
- Integrated River Basin Management
- Improve database system management

b. Structural

- Construct structures
ex. dams, reservoirs, dikes, sluice gate, regulator, bank protection, etc.

5.2 RBOs



The above figure shows a process model of risk management provided by Dr. Neil Britton, Senior Disaster Risk Management Specialist of ADB. The RBO members discussed DRM according to this procedure.

1. Establish the Context

Goal: Reduce loss of lives and damage to properties brought about by tropical cyclone / floods

- Provide the necessary resources (money and people, etc; including resources from other g.a.)
- Strengthen collaboration among government agencies

2. Identify and Analyze Risks

- Political
 - Reactive responses
 - Weak implementation of guidelines, processes
 - Weak enforcement laws on disaster management (i.e environmental laws)
 - Weak inter-government agency collaboration handling (i.e. Napindan Hydraulic Control Structure and Manggahan Floodway)
- Social /Cultural
 - Poverty lead them to live in flood prone areas
 - No ownership of land to build homes
 - Poor education and/or insufficient knowledge
 - Not prepared/cooperative to engage in mutual support schemes and organize themselves
 - People are used to the disasters and treat this as inevitable
- Economic
 - Financial resources are inadequate
 - Poverty
 - Relatively low income

3. Assess Existing Risks

- Political – reactionary
- Social – traditional relief goods distribution
- Economic – no funds allocated for DRM

4. Prioritize Risks

- Support the IEC of relevant government agencies on DRM
- Areas of improvement
 - Revisit existing policies and processes and institutional set-up (establish DRM Division)
 - Formulate hazard information system with the corresponding Hazard Map in coordination with relevant government agencies
 - Reactivate Early Warning Information System

5. Treat Risks

- To improve the collaboration with government agencies with regard to DRM

- Targets
 - Timeframe - reduce retention time from 3 mos to 2 mos
 - Quantity - volume of water - n.a.
 - area covered - the same area but
 - less retention time.
 - Costs -
- Areas of improvement
 - Revisit existing policies and processes and institutional set-up (establish DRM Division)
 - Formulate hazard information system with the corresponding Hazard Map in coordination with relevant government agencies
 - Reactivate Early Warning Information System
 - Community Participation
 - Collaboration with government /non-government organizations/private institutions

Postscript

Through the serial thematic workshop on Water-Related Disaster and its Management in Asian countries, the participants discussed the conditions and experiences of water-related disaster management of target countries; and evaluate the issues, challenges, and strategies. The goal of the workshop was to develop capacity of key organizations for water-related disaster management by (i) providing basic concepts and principles; (ii) sharing country challenges and strategies; and (iii) formulating an action plan.

NARBO Secretariat hopes that the organizations which dispatched the delegates to this serial thematic workshop will put their action plans on water-related disaster and its management into practice, and continues to provide the organizations with necessary support to precede them.

Annex Report by each country

A-1 Indonesia: presented by PJT II

(1) Background Information

The Citarum River Basin (CRB) is considered as the most strategic river in Indonesia covering over 12,000 km² extending from the Bekasi River Basin at the most west of the basin to the Cilalanang River Basin on the east. The area lies between the Latitudes 7°57' and 7°15' South and the Longitudes 106°50' and 108°07' East. The CRB is home to some 9 million people, serving 390,000 ha of irrigation rice fields, three cascade dams with installed capacity 1,400 MW and major industrial centers around forth biggest city Bandung and satellite industrial zones to the east of Jakarta. In addition the CRB supplies some 80% of Jakarta's raw water.

CRB originates in mountainous range southern part of Bandung with a top height of 2,198 m above mean sea level and terminate at the river mouth in Java Sea in the northern region. The climate in the Citarum river basin is tropical and characterized by distinct rainy and dry seasons. The average annual rainfall in CRB varies from 1,500 mm in the coastal areas to 4,000 mm in mountainous range. As comparison, the average rainfall distribution in Indonesia is 3,000 mm in the western part and 2,500 mm per annum in eastern part.

The Citarum River Basin covers: (1) the Citarum river basin itself (7,001 km²), (2) a number of independent river basins such as Ciherang/Cilamaya, Cigadung, Cijengkol, Ciasem, Cipunegara and Cilalanang and other number of small river basins called Upper Jatiluhur (4,694 km²), and (3) river basins of the Cikarang and the Bekasi (1,452 km²) as part of the Ciliwung-Cisadane River Basin (Cilicis) (Figure 1).

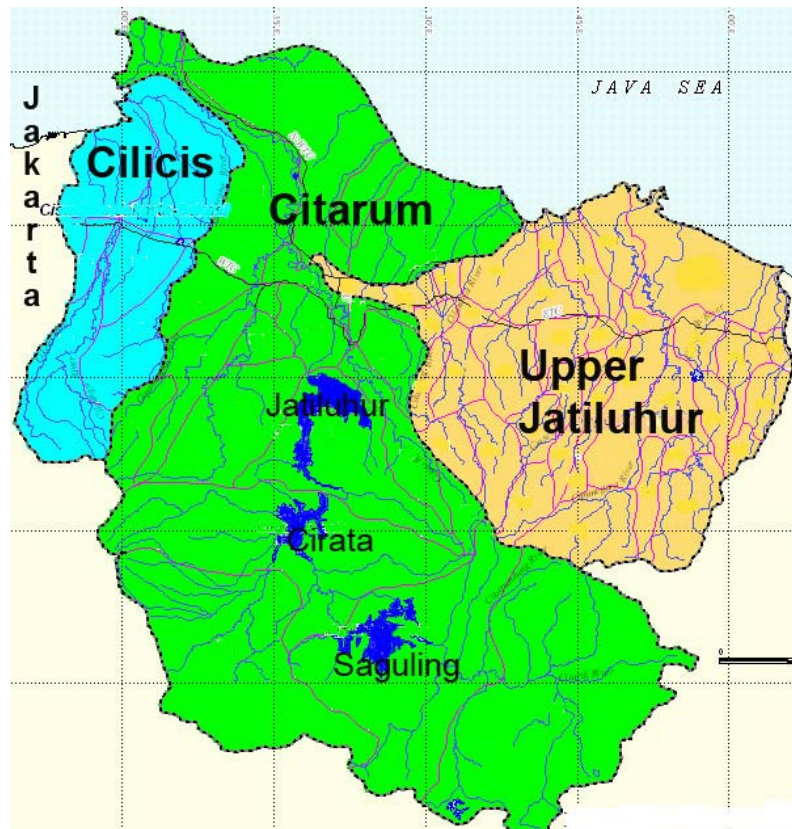


Figure 1. The interconnected Citarum River Basins.

(2) Rivers' Characteristics and Water Related Disaster in CRB

The Citarum River with its 270 km length characterizes by cascade reservoirs, namely Saguling, Cirata, and Jatiluhur. The Citarum River originates from mountainous area of Bandung region and flows northward to Java Sea through central portion of West Java Province. Bandung City, the capital of the West Java Province with inhabitants of some 7 million is located in the mouth of Saguling Reservoir. Topographically, the Citarum catchment upstream of Jatiluhur is characterized by a ring of high mountain ridges around a slightly undulating plain. Saguling dam is located in the upstream ridge while Cirata and Jatiluhur are in the downstream ridge.

Downstream of Jatiluhur reservoir two weirs across the Citarum divert water into the three main canals: the West Tarum Canal (WTC), the East Tarum Canal (ETC), and the North Tarum Canal (NTC). The WTC and ETC tap the Citarum at Curug weir, while the NTC gets its water at Walahar weir (Figure 2). The WTC serves an area under irrigation of 45,000 ha at present. The ETC area comprises 90,250 ha and the NTC area is 78,850 ha in size. Thus the total irrigation area served under the Jatiluhur reservoir is 240,000 ha. It is the largest contiguous irrigation system in Indonesia and is a major rice production area.

The canals also transports raw water for domestic, municipal and industry along the corridors of the canal, particularly contributes to 80% of raw water requirement of Metropolitan Jakarta, the capital city of Indonesia.

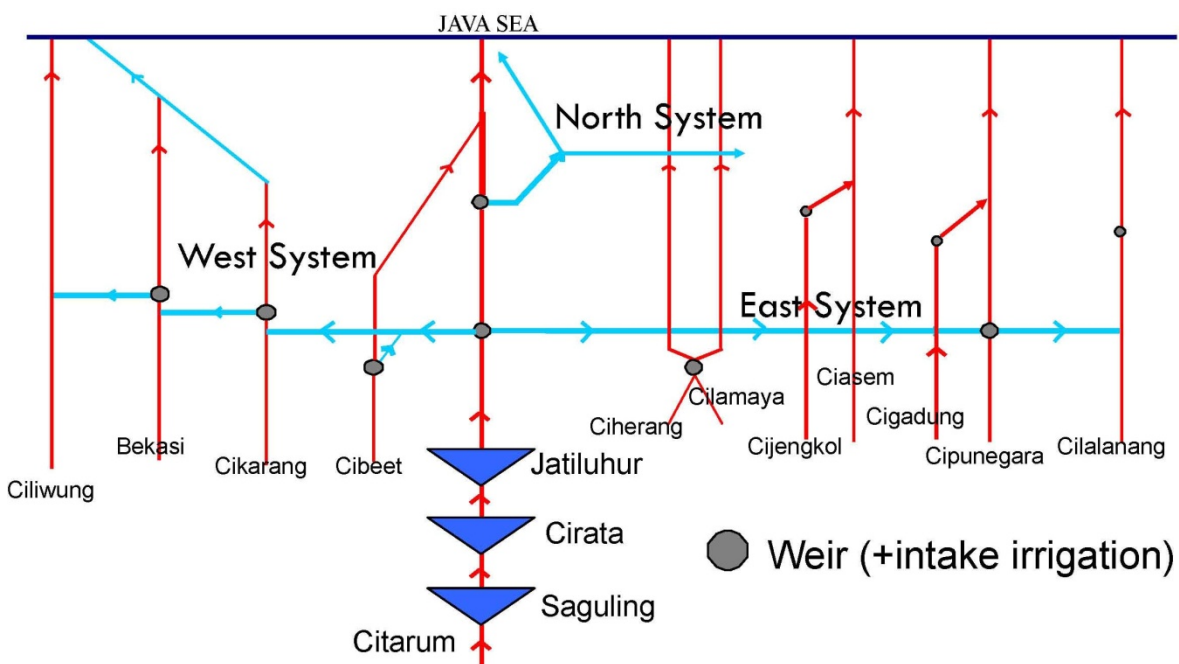


Fig. 2. Schematic of system configuration.

Torrential high intensity rainfall concentrates in the river channels of the Upper Citarum, Upper Bekasi, Upper Cibeet, Ciharang, Ciasem and Upper Cipunegara rivers. There are cases where the river channel in the flat plain cannot accommodate the peak flow and causes flooding. The elevated river water hampers the water from the alluvial plain to discharge into the river. The stagnated land side water causes inundation. The Lower Citarum, Lower Cipunegara, Ciharang and the Lower Ciasem have caused inundation frequently.

The regulated discharges from three dams help with maintaining the river channel in the middle

reaches of the Citarum River. However, the unregulated flow of the Cibeet River causes damage to the riverbanks in the downstream reaches. The sediment from the Cibeet River has developed sand dune and river mouth delta. Also, the flooding often occurs in the downstream areas because the incoming tides impede the stream flows.

The Cikeas and Cileungsi Rivers at the place where they join and become the Bekasi River in the southern part of Bekasi City, have almost the same drainage area of 200 km². Thus, the catchment area suddenly doubles at this point and simultaneous stormy rainfall on the two mountainous slopes has often caused flooding in Bekasi City. The sediment loads of the Bekasi and Cikarang Rivers are at similar to the Upper Citarum area. Other rivers also have similar issues. Recently, land use in the watershed areas has changed significantly and affected the flow regimes. While the flood peak discharge has increased, the low flow discharge has decreased.

The natural river channel of the Cipunegara River is rather stable. However, recent sand mining in the river has caused degradation of the channel. There are several hydraulic structures affected by the river channel change. Flooding often occurs in the downstream reaches, due to the effect of tides.

The most recent flood occurred during (cari data terbaru yang majalaya). The depth of submergence reached 2.0 m and 50,000 people were evacuated from the area. The flooding was accompanied by mudflow and it damaged roads, 51 ha of paddy fields and 13,600 private houses.

(3) Legal and Institutional Arrangement

The basic concepts and principles of the institutional arrangement on water-related disaster in Indonesia are enclosed in Law No. 24 year of 2007 on Disaster Mitigation and already followed by the local government regulation such as governors and as chief of district decrees. The Law No. 24 mentions the terminologies, principles on disaster rehabilitations, role-sharing on the responsibilities of disaster rehabilitation, institutions, rights and obligations of the citizens, implementations of the disaster rehabilitations, funding, etc.

Badan Nasional Penanggulangan Bencana (Banas PB) is the national coordinating body for disaster preparedness. In provincial and regional levels the coordinating body are called Badan Penanggulangan Bencana Daerah, with the tasks are similar to Banas PB.

The task forces are entitled to organize response teams with the officials. The mandates thereof are disaster response, remedy, rescue and restoration. Emergency food, first aid kits and blankets are stocked. But the actual main contributions are remedy and rescue such as the establishment of shelters for the refugee and the management of the shelters due to the budgetary and technical constraints.

PJT II is the standing operational body of water resources in the whole complex of river basins. Its responsibilities are management of infrastructures including the secondary irrigation canals and disaster management. It is a state owned company and is mandated to be financially independent. Since many institutions involved in disaster rehabilitation activities, consequently institutional framework should be arranged. Meanwhile, water-related disaster management is not only response, remedy, rescue and restoration to the disaster but also preparation, planning, and mitigation, therefore disaster preparedness that involved monitoring of climate and hydrology should be conducted.

There are several agencies which are responsible to observe climate and hydrology and publicise data. They are:

- BMG –Meteorology and Geophysic Agency
- Indonesia Power –The Dam Operator Agency for Saguling Reservoir
- PJB – Pembangkitan Jawa Bali, The Dam Operator for Cirata Reservoir
- PJTII – Perum Jasa Tirta II, The Dam Operator for Jatiluhur
- PSDA – Balai of Water Resources Management for Citarum River Basin.

The agencies are monitor and prepare reports on rainfall, water level in the river, groundwater and general climatologic states of the area. The disaster preparedness related to water resources in the basin is the responsibility of Ministry of Public Works, Provincial and District Disaster Coordination Team and PJT II.

The ministry provides the river improvement works to mitigate flood damages. The emergency response is the responsibility of the local government. PJT II is mandated to conduct the maintenance works of flood mitigation facility. It provides the information on flood to the central and local government. PJT II cooperates with the disaster coordination team of local government in the protection of flood mitigation facility and the restoration activities in the damaged area as a part of system services. The enhancements of data gathering and the mobility will improve the services remarkably.

The roles of PJT II are mainly disaster response in the CRB. It divides the project area into five divisions and establishes standing offices. Each office forms a disaster response team with its employee. The team employs temporary manpower if it is necessary to respond to the disaster. Their main responses are protection of river banks, flood mitigation facilities such as dykes and other infrastructures. The division offices store sandbags, piles, sealing sheets and fuels. PJT II mobilizes heavy equipment such as dump trucks, bulldozers, shovels and backhoe.

(4) Strategic Framework

Water related disaster includes floods, mud flows and drought. While drought is also been classified as a water related disaster, the strategic response to drought mitigation is treated differently through increasing water availability.

Activities related to disaster management under this definition include:

- Planning and construction of structural measures to control flood and mud flows, such as levees (dikes), flood control reservoirs and so on,
- Development and implementation of disaster preparedness plans.

Disaster mitigation is done through enhancement of disaster preparedness which is the activity on enhancement of the flood forecasting and warning system and decision support system for the flood response team, rescue and remedy teams. These can be categorized by:

- Institutional strengthening to implement the disaster mitigation system.
- System design for disaster forecasting and warning
- Hydrological equipments and materials

Meanwhile, to increase water availability as the strategic response to drought mitigations are:

- Project planning, including “master planning” (that is, planning that focuses on development of infrastructure, and distinct from broader basin planning)
- Construction of infrastructure for storing and delivering water (including reservoirs, canals and pipeline systems)
- Operation and maintenance of infrastructure
- Promoting efficient and effective utilization of water
- Drilling of wells for use of groundwater

The objectives of disaster management are:

- To have effective disaster preparedness plans in place for floods and mud flow events
- To have appropriate works in place to minimize the physical impacts of flood and mud flow events
- To have effective drought management plans in place where available water falls seasonally below design expectations

(5) Program and Activities

To enhance disaster preparedness, a flood forecasting and warning system is to be installed in the central office of PJT II and warning stations are to be established in each division office of PJT II. PJT II provides flood fighting teams with the most updated information and recommendation regarding the response activity relevant to the impending flood. The warning is to be disseminated to the residents as well.

Further, the urgent restoration of damaged infrastructure is the mandate of PJT II. PJT II dispatches flood response teams to the flooding sites. The activities are effective if the mobilization is in time. In this respect enhancement of the hydrological monitoring system is crucial. It proposes the installation of telemetered gauging stations in the upstream reach area of the Bekasi River, Cihorang, Cilamaya, Ciasem and Cipunegara rivers.

Institutional strengthening to define the role of a community in disaster fighting activities is necessary in case of urgency including the rules for actions. The rules for community participation to tasks force team will be prepared.

The outputs are the establishment of an information system for flood forecasting, warning dan flood fighting and the institutional procedures for disaster forecasting, dissemination of early warning and disaster fighting activities. The activity will enhance the hydrologic database dan involve community participation.

Based on road map for Integrated Citarum Water Resources Management as a set of strategies of Citarum River Basin to accomplish the vision for the year 2021 where the government and communities working together for clean, healthy and productive catchments and rivers, bringing sustainable benefits to all people of the Citarum River Basin, the integrated management of disasters consists of integrated water resources management, empowerment of stakeholders and water resources provision components.

The allocation of integrated management of disaster is planned in Tranche 2, 3 and 4 for Bandung lowland, Upper Bekasi, Lower Citarum, Lower Cibeet, Lower Ciharang, Lower Cilamaya and Lower Cipunegara with budget USD 40 million.

The interventions for disaster management particularly for flood and mud flow are in the following Table.

Table 1

Proposed Measures related to Disaster Management for Flood and Mud Flow

Intervention	Main Outputs / Activities	Time Frame
Integrated Management of Water-related Disaster (basin-wide)	<ul style="list-style-type: none"> • Review effectiveness of existing disaster management strategies and coordination managements and make recommendations for improvements, particularly in relation to introduction of basin water resources council and support units • Development and implementation of effective land use controls in disaster prone areas • Relocation of households in disaster prone areas • Development and implementation of effective controls on sand and gravel extraction • Public awareness campaigns on disaster preparedness • Institution strengthening (capacity building) for agencies responsible for: monitoring; emergency response; evacuation; and restoration • Establishment of a flood forecasting system • Develop contingency plans for industrial accidents affecting contamination of the river system 	2011-2016
Upper Citarum Basin Flood Management (Technical Assistance and Implementation)	<ul style="list-style-type: none"> • Development and implementation of mud flow and landslide forecasting and warning/evacuation measures • Relocation of dwellings from disaster-prone areas • Enhancement of public awareness regarding disaster preparedness 	2008-2010 and 2011-2015
Development of an online flow forecasting system	<ul style="list-style-type: none"> • Development and implementation of flow forecasting and warning/evacuation measures 	2019-2023

Table 2**Proposed Measures related to Disaster Management for Drought**

Intervention	Main Outputs / Activities	Time Frame
Upgrading Bandung Water Sources	<ul style="list-style-type: none"> • Investigation of bulk water supply options for Bandung urban area • Implementation of preferred bulk water supply alternatives for Bandung urban area • Construction of Cibutarua Weir • Construction of Santosa Reservoir on the Cilaki River • Construction of a 4.5 km diversion tunnel • Construction of a reservoir upstream of Tamiang Cangkir Weir 	2008-2016
Upgrading of Water Source for Irrigation (Upper Cipunegara)	<ul style="list-style-type: none"> • Construction of a dam and reservoir on the Cibeber River • Rehabilitation of the existing irrigation water distribution system • Construction of a diversion weir on the Cipunegara River and a diversion tunnel to convey water to appoint upstream of the reservoir to increase inflows to enable the irrigated area to be increased 	2015-2020
Bulk Water Supply Options for Bekasi and Karawang	<ul style="list-style-type: none"> • Investigation of bulk water supply options for Bekasi and Karawang • Detailed engineering design on selected option (s) 	2019-2023

(6) Conclusion

Water related disaster includes floods, mud flows and drought. Water-related disaster management is related to planning, preparation, response, remedy, rescue, mitigation, and restoration. In order to mitigate the impact of disaster, preparedness of disaster that involved monitoring of climate and hydrology should be conducted. While drought is also been classified as a water related disaster, the strategic response to drought mitigation is treated differently through increasing water availability.

The objectives of disaster management are: (1) to have effective disaster preparedness plans in place for floods and mud flow events, (2) to have appropriate works in place to minimize the physical impacts of flood and mud flow events and (3) to have effective drought management plans in place where available water falls seasonally below design expectations.

Institutional arrangement should be smoothly constructed to make an effective and optimal coordination. Financial mechanism helps the institutions to foster new restoration and rehabilitation. The newest technology proved to be helpful to mitigate such as telemetry system and early warning system. Community participation and empowerment are encouraged to help optimal disaster management results.

A-2 Philippines: presented by LLDA

(1) Background

The Philippines, composed of about 7,100 islands, is the world's second largest archipelago. The country is vulnerable to almost all types of natural hazards because of its geographical location. It is located in the within the Circum-Pacific belt of fires and along typhoon path and exposed to natural perils like earthquakes, volcanic eruptions, typhoons and their resultant effects like tsunami, landslides, floods and flashfloods.

The Laguna de Bay Region is in the Southern part of the Luzon Region of the Philippines. It is managed by the Laguna Lake Development Authority or LLDA which was created in 1966 by virtue of Republic Act 4850 as a government-owned corporation, with the mandate to essentially provide the leadership in the environmental management of the said Region. Quoting from RA 4850, LLDA's task is: "...to promote and accelerate the development and balanced growth of the Laguna de Bay area and the surrounding provinces, cities, and towns with due and adequate provisions for environmental management and control, preservation of the quality of human life and ecological systems, and the prevention of undue ecological disturbances, deterioration, and pollution."

The condition of Laguna de Bay (the lake itself and its tributaries) is a well-known issue in the discussion among policy makers who have been tasked to address water pollution problems in the Philippines. Both the citizens of the country as well as the national leaders are aware of the declining state of the quality of the water system, a situation that pushed the issue in the public limelight.

(2) Sources of Environmental Pressures or Risks

The risks that Laguna de Bay system faces is compounded each day as a result of economic growth and population increase, urbanization, industrialization, deforestation, and changes in land use that are the major contributors to environmental degradation in the watershed, hence, threaten the ecological viability of the Laguna de Bay and its tributaries. Left unaddressed, the water system is expected to gradually die; thus depriving society and the future generation the opportunity to use the lake for recreation and livelihood; and access to safe drinking water.

Organic Wastes.

A significant pressure on the water quality of the lake and the river systems is contributed by organic pollution which comes from the discharge of households of around 70% and industrial sources (20%) and from agriculture and forestry (10%), especially from the western part of the lake where industrial development is very evident.

Deforestation and Sedimentation

Between the periods 1996-2000, 25 percent of the commercial and non-commercial forests was reduced to 5 percent, while 67 percent of the total watershed devoted for agricultural use was reduced to 53 percent. The reductions are mainly attributed to industrialization, among others. These changes in land use and land cover indicate the occurrence of deforestation, which in turn lead to soil erosion and sedimentation in the water system. It is significant to note that net sediment loading of 4 million cubic meters has been recorded for the lake (Delft Hydraulics, 2003) which could result in flooding especially in the low-lying areas.

Deforestation and lake sedimentation also impact the community's health and income opportunities. Anecdotal data indicate that the declining water quality in the Laguna de Bay has resulted in an increased occurrence of waterborne diseases in the community; and reduced income from tourism due to a decline in the number of tourists visiting the lake. This also results in the dramatic increase in the water treatment cost for tourists and domestic use.

Weak Institutional Capacity

The importance of a strong legal institution to arrest the degradation of the water quality of the lake cannot be overemphasized. Empirical evidence demonstrates that pollution control efforts may be hampered by the limited government capacity to enforce current environmental laws, rules and regulations. Equally important is the lack of widespread application of market-based and other instruments that charge for environmental services, an economic tool that is also crucial to pollution management. Although LLDA has some experience in implementing user fee programs, it is still limited in the coverage of pollution sources and the pollutants generated by said sources. Likewise, there is a need for upgrading the capability of the LLDA in permitting, monitoring and enforcement.

(3) Disaster Risk Reduction Management

To arrest the rate of environmental deterioration and resolve the increasing land and water use conflicts LLDA will need to take a holistic and integrated approach that focuses on ecosystem management complemented with a disaster risk reduction management. The essence of this management approach is to relate human beings and their activities to the ecosystem that contains them.

In addition, inherent in an ecosystem management approach is sustainable land and water use. This requires balancing the environmental protection, economic vitality, and social well being.

(4) Participatory and Partnership Approach in the formulation of Disaster Risk Management Plan

A participatory disaster risk management planning and partnership with the stakeholders will be necessary. Effective disaster risk reduction management plan must consider the (rightful) interests of all these players. Each of these entities, groups, and individuals has a potential role in the stewardship of the ecosystem in the region. No single government or non-government agency or organization has the capacity to fully carry out this plan in the Lake and its basin and achieve sustainability unilaterally and single handedly. A new paradigm of governance that transcends beyond sectoral and single jurisdiction is needed. It is important to allow users and stakeholders in the basin to participate in management decisions and to develop solidarity on the vision and common goals and solutions to disasters.

(5) Developing and sharing knowledge

Creating awareness about the disaster risk reduction management of the ecosystem among the communities, governmental and non-governmental entities, and private sector requires development and sharing of knowledge. The spectrum of knowledge and information may cover technical, political, social and economic considerations.

(6) End note

If no disaster risk management plan is formulated/implemented coupled with interventions are done in the next 25 years, Class C water (for fishery) may deteriorate to a Class D (for irrigation). The source for domestic water supply and recreation will thus be jeopardized. Fish production will continue to decrease due to the decline in lake primary productivity. This decline in fish income has resulted in socio-economic dislocation of population in fishing communities and enormous losses in income from fishery.

A-3 Sri Lanka: presented by MASL

(1) Introduction

Sri Lanka is an Island with extent of about 65,610 square kilometers lies between 7° and 9° latitude and between 80° and 82° longitude. The island consists of a mountainous area in the south-central parts and a vast coastal plain, which surrounds it. Despite the relatively small size of the country, there is considerable variation in climate over time and space. The annual average rainfall varies from less than 1000mm over a small region in the arid zone of the north-western and south-eastern parts of the island to over 5000mm in a few places on the south-western slopes of the central hills. Climatically, there are 3 zones of the country namely: wet zone, intermediate zone and dry zone. There are 103 river basins cover the entire land area of the island enhancing the water resources. The *Mahaweli* basin is the largest basin which covers 10327sqkm of the island.

There is little seasonal variation of temperature. The mean annual temperature in the coastal areas below 150m in elevation ranges from 25.0°c to 28.0°c while in the hill country above 1500m; it ranges from 15.0° c to 19.0° c.

Sri Lanka's population which at the last census taken in 1981 was 14.8 million is projected to reach 19.0 million by the year 2001 and 23.1 million by the year 2031. The population is unevenly distributed across the country. The administrative structure is based on its republican constitution. The 9 provinces are divided into 25 districts, each headed by a Government Agent and districts are divided into 336 Divisional Secretariat divisions. DSD divided into smallest unit of *Grama Niladari* Division.



1) Disaster in Sri Lanka

Sri Lanka was not a disaster prone country until recently. However, When Tsunami badly hit on coastal belt of the country on 26th December 2004, taking more than 40000 lives, people of Sri Lanka were made to understand the serious impacts of natural disasters. Immediately after the recovery of the situation, GOSL established a separate Cabinet Ministry to handle this sector and enacted the Disaster Management Act No.13 of 2005 to address these challenges that can be arisen by natural disasters. This act facilitates to prevention, mitigation, preparedness and recovery from any kind of natural hazards in the country. However, this has still not been effectively implemented due to weaknesses of enforcement and inter-organizational co-ordination & information sharing.

2) Mahaweli Authority of Sri Lanka (MASL)

The Mahaweli Authority of Sri Lanka (MASL) was established under the Act No. 23 of 1979. The *Mahaweli Ganga* Development Programme, the largest multipurpose integrated rural development programmed ever undertaken in Sri Lanka was based on water resources planning & development of *Mahaweli* and adjacent river basins.

Broad objectives were to increase Agricultural production, Hydro-power generation, Create employment opportunities, Settlement of landless poor in newly developed areas, discourage rural-urban migration and flood control. Operation and maintenance of the major dams and reservoirs for regulation and control release of water to downstream irrigation settlement projects and for power generation is the key functions of the Authority. Water allocation for major water uses such as irrigation, hydropower and domestic water supply is coordinated at the national level in consultation with relevant stakeholder agencies through seasonal operational planning (SOP) process.

In the downstream major irrigation projects, emphasis is on water management, community driven development (CDD) with the long term strategy for poverty reduction and human resources development, livestock, agriculture development with special attention on crop diversification, intensification and promotion of enterprises for socio-economic development and employment generation. Watershed management is encouraged through educational and awareness programmes on soil and water conservation while monitoring of sedimentation and water pollution have become important role of the MASL.

Dam Safety and Operational efficiency Improvement, through carrying out remedial works of high risk dams and effective operation and maintenance programmes relating to upstream dams, reservoirs and diversion canals, maintenance of main and branch canals of major irrigation systems, transfer of responsibility of O & M of tertiary canals to Farmer Organizations in the downstream irrigation systems are also considered as priority programmes.

3) Disaster Management Center (DMC)

In July 2005, the Sri Lanka Disaster Management Act No.13 of 2005 was enacted which provides the legal basis for instituting a disaster risk management system in the country. The Act also provides for establishing the Disaster Management Centre (DMC) under the Council to be the apex body for the purpose of planning, coordinating and implementing of certain natural and other forms of disasters.

Objectives of the DMC were to enforce countrywide Ministries, Departments and Public Corporations, Provincial Councils and Local Authorities and District, Division and *Grama Niladhari* (GN) administration; to coordinate and monitor activities related to, prevention mitigation, preparedness, response and recovery such as Hazard Mapping and Risk Assessment, Long-term Disaster Mitigation, Forecasting, Early Warning and Information Dissemination, Preparedness to respond to disasters when they occur, Emergency Operations Management and Management of the Post-disaster Activities after a Disaster.

(2) Water Related Hazards in Sri Lanka

There are three frequent water related hazards in Sri Lanka namely; Floods, Landslides and Droughts. Other occasional water related hazards are Tsunami, Water Pollution, Sea Water Intrusion, Coastal Erosion and Dam Breach.

1) Flood

High-intensity rainfall will produce more frequent extreme events – Flash floods that will cause serious damages to the properties. It will also concentrate the river runoff to a shorter period. In Sri Lanka, flood mainly affected in Ratnapura, Kalutara, Colombo and Gampaha districts.

(i) Driving Force & Pressure on water system

With the ad-hoc type of development in the urban areas in the country even without having proper enforcement of prevailing regulations, majority of wetlands which were available to absorb rainwater during intensive rains occurs, have now been filled, for various developments. This ad-hoc development leads flash floods on roads and surrounding areas. Industrial waste discharge into natural water ways & drainage system and lack of proper maintenance will also leads block the water ways and cause sudden flood. Weak enforcement of law for protection of reservation also leads flash flood.



(ii) Quantity/Quality Change & Impacts

River peak discharges & reservoir storages will be changed with the flood situations, due to high surface runoff. Therefore, this may create environment to dam breach. It may cause loss of lives and private & public properties. Water quality also would be badly affected and deteriorated due to floods. Therefore, various health hazards may spread over the flood affected areas and increases secondary impacts. Due to floods huge loss to the food crops inevitable and finally badly affect on the national economy.

(iii) Response

Legal and institutional arrangement would have been established for flood mitigation. Ensuring food security of affected people and sufficient fund allocation for flood risk mitigation work would minimize the impacts. Preparedness plan would formulate for risk reduction. Government intervention through Dam Safety & Water Resources Planning Project funded by World Bank would address aging issue of 32 high risk large dams, would reduce the potential flood risk in future.

2) Landslides

Down slope transportation of soil and rock resulting from naturally occurring vibrations, changes in direct water content, removal of lateral support, loading with weight, and weathering, or human manipulation of water and slope composition will result in landslide. Hill country of Sri Lanka becomes a landslide prone area due to ad-hoc use of natural resources. After the Tsunami, in December 2004, it was noticed that very un-usual behaviors of the ground of hill country of Sri Lanka., witnessing above facts.



(i) Driving force & Pressure on Water system

Ad-hoc and un-authorized clearances of sloping lands for various crop cultivations and undertaking some construction of buildings, hotels etc without doing proper feasibility/stability study, non adopting proper mitigating measures will lead to landslides with seasonal rainfall.

(ii) Quality/Quantity Change & Impacts

Due to deforestation, soils directly expose to rain & soil particles wash away with rain water. These soil particles will deposit on reservoir beds. This will cause negative impacts to hydropower generation and, storage capacity will be reduced and finally it affects to national economy. Similarly this would affect to water quality and if there is huge spill over of water due to large quantity of earth coming to reservoirs huge loss happening to the lives and properties of the downstream areas cannot be avoided.

(iii) Response

Apply soil conservation measures to mitigate landslide in vulnerable areas. Formulate policies & regulations to mitigate adverse impact of landslide. Integrated Water Resource Management (IWRM) would be incorporated into watershed management plan. Encourage authorities to invest on reforestation and establishment of forest nursery would help to conservation of vulnerable areas.

3) Drought

Meteorological drought is the reduction in rainfall and hydrological drought is the reduction in water resources. Agricultural drought is the impact of drought on human activity influenced by various factors: the presence of irrigation systems, moisture retention capacity of the soil, the timing of the rainfall and adaptive behavior of the farmers. Drought generally affects in dry zone of Sri Lanka.



(i) Driving Force & Pressure on water system

Illegal forest clearings & large scale agriculture development leads decrease of soil moisture content and increase surface evaporation. This will lead to drought condition. Forest fire for *Chena* cultivation also badly affect on soil moisture. Reduction of forest cover tends to decline seasonal rainfall. Number of tube wells per unit area will be increased with increasing population density. This will result in depletion of ground water table.

(ii) Quality/Quantity Change & Impacts

Drought leads water scarcity in rivers, tanks and wells. Water quality also deteriorates due to accumulation of minerals such as fluoride. This on food may lead health problems such as dental diseases and kidney failure. Drought increase salinity in the lands and this would lead land degradation. Therefore, drought badly affects to food production and thereby national economy of the country will be seriously affected. Sea water intrusion also affects to flora and fauna at the drought condition.

(iii) Response

Prevailing legal & institutional arrangement for drought mitigation needs to be reviewed and improved. Impacts would be minimized by practicing climate change adaptation techniques such as Rain water harvesting, Crop diversification, adjusting cultivation plans to match with shifted rainfall patterns etc. Introduce drought resistance crops. Use environment management plans & land use

management with mitigatory measures. Forest covers would expansion by planting forest in suitable areas.

(3) Action plan

1) Expected out come

Expected out come is to minimize water related disasters & minimize the impacts of disasters. Similarly minimize the potential losses to the human lives and to the social and environment assets and finally to the economy of the country. (Water related disasters which are experienced up to now in Sri Lanka are namely; flood, drought, landslide, tsunami, water prolusion, costal erosion sea water intrusion.)

2) Strategic Goals

- (i) Integration of polices & guidelines for disaster risk reduction into water resources planning for sustainable development in the water sector in the country.
- (ii) Collaboration of inter- government agency & strengthening of institutional mechanisms and there capacities to build resilience to hazards.
- (iii) Development of community base programmes for emergency preparedness, response and recovery to minimize the disaster risk.

3) Priorities for Actions

(i) Political & Institutional Factors

Lack of enforcement of law & guidelines is a major contributory factor for prevention and mitigation of disasters in Sri Lanka. However, legal framework for DRM exists with explicit responsibility defines for all levels of government are in satisfactory level, because of Disaster Management Act No: 13 was enacted in 2005. Since DMC has established in recently, roles of the actors are not properly assigned. The prevailing political environment too is not matured enough to address consistent disaster risk management, is a barrier for implementing DRM plans.

The human & financial resources are inadequate below national level. However, adequate resources are available to implement DRM plans at national level. Currently, collaboration of inter-government agencies & recourses sharing is lacking at all level. It would be improved through organizing workshops and seminars with stakeholder agencies. Therefore, stakeholder agencies would be identified in specific hazards for effective risk management. Government fund allocation would not be sufficient for DRM at all administrative levels. Therefore, other local as well as foreign support organizations would assist by providing sufficient funds for disaster risk mitigation.

Institutional strengthening for DRM would not be satisfactory at all administrative levels. Therefore, awareness programmes & training on DRM would be arranged with the proper plan. Community base awareness progrmme on DRM should be organized to cover ground level. Community participation is very effective factor for disaster risks mitigation in the country,

(ii) Identify, Assess & Monitor DR & Enhance Early Worning

Risk assessment based hazard data and vulnerability information availability at all administrative

Levels are not adequate. Zonal mapping has been carrying out by DMC at GN level. Development of indicators on vulnerability for different hazards is essential for effective monitoring of disaster risk mitigation.

Data and statistical information system would be manage, monitor, maintain and disseminate data on key hazards. In this regard, the DMC has been installed web base information database called as “*disinventra*’ would be improved with collaboration of inter-government agencies.

Scientific & technological development also helps to identify, assess and monitor the disaster risks. The Dam Safety & Water Resource Planning Project (DSWRPP) will address this challenge by improving & modernizing Hydro- meteorological Information system (HMIS). Weather forecasting and climatic change forecasting would be an effective factor of disaster mitigation.

Enhance early warning reduce the impacts of hazards. Therefore, early warning system would enhance for keeping impact at minimum level. The DMC of Sri Lanka has planned to install 30 towers in selected places in the island and send SMS for the selected persons at community level. This would be one of the innovative and priority actions for early warning system to prepare for the disasters.

(iii) Reduce Potential Risk Factor

Water Resources Planning & Integrated Water Resource Management (IWRM) is an important tool for water related disaster risk mitigation in the country. The DSWRP Project has planed to prepare a National Water Use Master plan for sustainable management of water resources in Sri Lanka. This would be useful for mitigation of water related disasters in the country in future.

Introduce climate change adaptation techniques would useful for disaster mitigation. Rain water harvesting technique would practice in off-rainy seasons such as “*Pathaha*” construction, Ferro Ceramic tank for collection of drinking water, Pond construction for agricultural purpose. Drought and flood resistance crops would be introduce for keep the crop production at required level.

Land use planning and introduction of building codes at GN level would be useful for disaster mitigation. This is an on going activity of DMC of Sri Lanka. In addition to that DMC prepare inundation maps for commanding area of specific tanks to flood mitigation. These activities would be improved for prevention and mitigation of water related disasters in Sri Lanka.

Structural measures such as dams; sluice gates, training bunds, etc. would prevent the possible hazards. The DSWRP project carried out risk assessment for major dams of Sri Lanka and identified 32 dams has to be rehabilitated as a priority action. Rehabilitation & protection of structural measurers would be a priority activity of the Mahaweli Authority of Sri Lanka, since the hydropower generation of the Mahaweli reservoirs contributes 30% to the national power requirement. Diversion of Mahaweli waters in to downstream agricultural development too a major contributory factor to the national economy.

(iv) Strengthen Disaster Preparedness for effective Response at al level

The DMC of Sri Lanka has prepared Draft National Disaster Preparedness Plan for the strengthening of disaster preparedness. A coordinated disaster preparedness and response system is a prerequisite to any disaster preparedness plan. Each system design will depend upon the traditions and governmental structure of the country under review. However, without ensuring that there is “horizontal coordination” at central government levels among ministries and specialized government bodies and “vertical coordination” between National and local authorities, the

preparedness plan will rapidly disintegrate. This requires a structure for decision-making, inter-ministerial committees to coordinate the plan, focal points within each ministry to be responsible for the plan implementation and communication, as well as regional and community structures to implement the plan at the local level. The DMC is being preparing district level, provincial level response plan to improve disaster management capacities.

The preparedness plan must have an information system. For slow onset disasters this should consist of a formalized data collection process, early warning, and monitoring system to update the early warning information. For sudden onset disasters a similar system must be in place for prediction, warning, and evacuation communication. For this purpose, DMC is being preparing “*disinventra*” data base.

Financial reserves and contingency mechanism are in place to support effective response and recovery, is not satisfactory level. Emergence funds should be available for quick response of disaster mitigation. In this regards, Disaster Management Act facilitate to fund allocation for emergency situations. However, sufficient funds are not available to allocate for emergency conditions, according to the present economic situation of the country. Therefore, mutual-aid agreement would be developed with the foreign donors.

The level of Volunteer participation for disaster response in Sri Lanka is satisfactory. People are prepared to engage in mutual support schemes/sharing mechanism and organizing themselves to support for affecting peoples. Therefore, Sri Lanka has been recovered quickly form the impacts of tsunami, 2004 compared with other tsunami (26th December, 2004) affected counties. However, volunteer participation would be improved by continues awareness programme and developing volunteer participation committees at all administrative levels.

4) Cross Cutting Issues

(i) Multi Hazard Approach

Multi hazard approach plays and important role in disaster risk management in the country. With the finalization of the disaster preparedness plan in national and other levels will address this challenge adequately.

(ii) Gender Perspective & Cultural Diversity

Gender perspective & cultural diversity one of the key factor which influence any participatory effort in the development. Therefore, disaster risk management too cannot be exempted from this perspective.

(iii) Community & Volunteers Participation

In Sri Lanka, communities are very much proactive in volunteer participation in hazardous situations. This has proved very strongly at the time of first Tsunami in 26th December 2004. This trend needs to be improved with the establishment of DMC of Sri Lanka.

(iv) Capacity Building & Technology Transfer

Now there is a great financial and technical support to DMC for the capacity building of the related institutions and their staff on the direction of DRM. Similarly Dam Safety & Water Resources Planning Project also allocated substantial amount of funds to train staff on identification risk levels of Dams and awareness of water related distress in the country.

A-4 Thailand: presented by DWR

(1) Introduction

Thailand is administratively divided into 76 provinces which further divided into district, sub - district or Tambon and village consecutively. Province is the local administration unit headed by provincial governor. The provincial governor is appointed by the central government. The population of Thailand consists of over 30 ethnic groups of people making up approximately 63 millions. About 5.8 million people are registered in the capital city of Bangkok.

Topographically, Thailand is divided into four regions; the North, the Central or the Chao Phraya River Basin, the Northeast and the south or the Southern Peninsula. The northern region terrain is mountainous which render this region to be prone to water - related disasters such as flashflood, landslide and inundation. The northeastern region is an arid area and frequently suffers flashflood and inundation during rainy season, severe drought and cold spell during summer and cool season. The central region, the vast fertile land which is dubbed as the "Rice Bowl" of the country often encounters the repeated riverine flood and urban inundation during the rainy season. The southern region terrain is hilly on the west coast and the coastal plain on the east. This part of Thailand has occasionally frequented flashflood, mudslide, tropical storm and forest fire.

The climate, Thailand is a warm and rather humid tropical country with an average high temperature of 34.1 °C and the low of 22.6 °C. There are three overlapping seasons: the monsoon that lasts from July to October, from when it turns moderate to cool until February and warms up to sweltering heat until June.

About watershed management, Thailand is divided into 25 major river basins and 254 sub - basins, with total coverage areas of 512,000 sq.km. The total annual rainfall is 804,372 million cubic meters (MCM) while average rainfall is 1,573 mm./year. Average runoff is 213,423 MCM/year or equivalent to 3,425 mm/person/year.

(2) Water Related Disaster in Thailand

1) Flood

In Thailand, flooding results from tropical disturbances, typhoons, or a combination of the two. The heavy rainfall swells the rivers which bursts their banks or creates severe flooding conditions along the tributaries from backwater effects. Flooding in river basins in Thailand is often severe. Urban area along the mainstream is regularly flooded. The peak flood period lasts from early June in the North to early December in the South.

The hydro - meteorological causes of floods are prolonged heavy rains on saturated soils. This leads to an increase in surface runoff that can only slowly be discharged through the river systems. Flooding can occur due to river overflow or surface runoff. Heavy local rains throughout the region and typhoon - induced surges of water in the river system contribute to the overflow of riverbanks. In addition, a range of natural and man - made factors presently affect flooding.

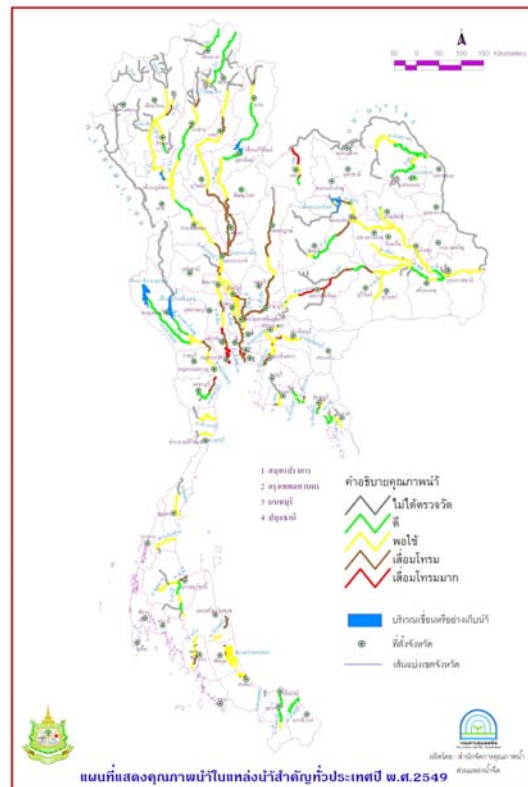
Climate change, particularly global warming effects, is believed to be a contributing factor to increased frequency and intensity of severe flooding. Increased rainfall amount and sea - level rises will result in greater risk of flooding in low - lying coastal and estuary areas. Warming of the water temperature in the sea would result in an increase in the number and intensity of typhoons causing sea surges that would also contribute to inundation of low - lying areas.

2) Droughts

Droughts during dry season in Thailand occur frequently every year. This is due to continuous increase of water demand caused by population and economic growth of the country while the natural and man - made storage have insufficient capacity for the whole year. Most of the areas suffering droughts are the areas which water consumption and uses rely on rainfall and natural stream

3) Water pollution

Thailand is considered that severe water pollution occurs in major streams. Waste water from community and economic activities cause pollution problems to many sources of surface water and may cause danger to people in the area. In general, water pollution is severe in dry season due to loss of water to dilute waste and dirt. Results from the water quality monitoring in 48 major rivers and 4 large ponds in 2002 shown that most of surface water sources are moderate, 39%, to low, 35%, quality. Only 17% of water sources are in good condition. Lower Chao Phraya, Ta Chin and Songkhla lake river basins are very low quality. For BOD load, total BOD load in Thailand is about 6.19 M kg BOD/day. The BOD load divided from three major sources. There are source from community load 2.6 M kg BOD/day (42 %), source from industrial load 2.7 M kg BOD/day (44 %), and source form agriculture 0.8 M kg BOD/day (14 %).



(3) Statistical Data of Disaster and Damage in Thailand

Generally, disaster can be categorized into two types: natural disaster and man - made disaster. All the same, whenever the disaster occurred, it will main and kill people, destroy property, adverse impact on the economy and people's way of life, cause of impede national sustainable development. Thailand is considered as non - disaster prone country. There are no catastrophic natural disaster such as volcanic eruption, and earthquake. Notwithstanding, Thailand has occasionally frequented large - scale natural disasters particularly water related disasters such as riverine flood, urban inundation, tropical storm and drought. For example, in 2000, the flashflood and inundation in Hat Yai metropolis of Songkhla province, southern region and a year later in 2001, the flashflood and sedimentary slide in Prae and Petchaboon provinces, north and northeastern, and in 2006, big flood event all region especially in north and central region. Thailand had resulted in detrimental consequences on people's lives, property, natural environment and economy. Besides, in the past two decades, Thailand has also encountered numerous man - made disasters such as chemical spills and chemical related plant explosion also wastewater, etc.

The tables below show about level of disaster intensity, vulnerability, managing competency and risk levels of Thailand, and show disaster risk priority also damage cost.

Table 3 - 1 Prioritization and The Level of Disaster Intensity, Vulnerability, Managing Competency and Risk Levels of Thailand

Type of Disaster Intensity Level Vulnerability	Level	Managing	Competency Level	Risk Level
1. Flood	High	Moderate	Moderate	High
2. Tropical Cyclone	High	High	Moderate	Moderate
3. Drought	High	Moderate	Moderate	Moderate
4. Land slide	Moderate	Low	Poor	Moderate

Source: Civil Defense Plan 2005, Department of Disaster Prevention, Ministry of Interior, Thailand

**Table 3 - 2 Statistic Data of Disaster and Damage in Thailand during 2003 - 2007
Drought Damage Assessment**

Descriptions		2007	2006	2005	2004	2003
Areas	Provinces	61	61	71	64	63
	Districts	543	479	682	446	373
	Villages	25,128	30,354	44,519	19,027	12,904
Human	People	5,241,227	11,045,506	11,147,627	8,388,728	5,939,282
	Households	1,372,427	2,741,202	2,768,919	1,970,516	1,399,936
Assets	Agriculture field (rai)	554,890	1,254,447	13,736,660	1,480,209	484,189
Cost Mill Baht		-	166.78	7,565.86	190.67	174.32

Source: Department of Disaster Prevention and Mitigation

**Table 3 - 2 (continue) Statistic Data of Disaster and Damage in Thailand during 2003 - 2007
Flood Damage Assessment**

Descriptions		2007	2006	2005	2004	2003
Areas	Provinces	46	47	63	59	66
	Districts	486	482	541	337	349
	Villages	20,499	20625	10326	9,964	5,281
Human	People	3,640,978	5,198,814	2,874,673	2,324,441	1,882,017
	Households	940,663	1,430,085	763,847	619,797	485,436
	Evacuees	3,455	-	21,260	33,985	12,328
	Casualties	62	340	88	31	54
Assets	House	7,369	49,611	6,040	5,947	10,329
	Factories	NA	NA	46	17	2
	Hotels/ Condominiums	NA	NA	15	11	NA
	Fish ponds	34,767	125,683	13,664	12,884	22,339
	Live stock	38,079	142,211	696,123	71,889	301,343
	Agriculture field (rai)	2,645,982	5,605,559	1,701,450	3,298,733	1,595,557
	Vehicles & others	NA	NA	880	148	NA

Infra- structures	Roads	8,330	10,391	5,697	4,173	5,071
	Bridges	309	671	667	173	393
	Hydraulic structures	591	778	22,527	716	179
	Institute Bldgs.	271	1,425	2,123	827	174
	Drains	163	1,085	1,482	594	282
Cost Mill Baht		1,697	7,077	5,982	850	2,050

Remark: Flood damage include with tropical cyclone and flashflood-landslide.

(4) Flood Risk Map and Drought Risk Map in Thailand

In 2006 since May to October, the rainfall in Thailand was irregularly high coupled with the influence of the southeast monsoon and low trough passing through Thailand which became the depression in August and in October caused severe flash flood in flat areas and nearby water course areas. The flood damaged vast areas of economic zone in urban and cultivated land in rural at approximately 6 million rai all over the country. There were about 340 casualties, damages covered 47 provinces. The budget approved by the Government for recovering the flood situation included 22,468 million Baht.

The Department of Water Resources as the Secretary of the National Water Resources Committee has proposed the framework for flood mitigation master plan both for mid - term and long term to the Cabinet on 7th November 2006 and the Cabinet approved the framework and assigned the involved agencies to implement. From this framework, Thailand reviews the risk maps in combination with the use of geographic information system, hydrological data, and satellite images 13 years (1993 - 2005),etc.

Flood Risk Map Show in figures 5 - 1. The picture shows land slide areas and flood areas. Thailand has flood risk areas about 4.4 million hectare. Number of villages in land slide and flash flood high risk areas are in 2,370 villages, in Fig 5 - 2. Flood risk areas can rank in urban area by using many factors such as frequency of event, lost of economic, etc. Then it can divide into 32 urban areas in Fig 5 - 3.

Drought Risk Map: Drought in Thailand can be classified into 2 levels, the first level is the area where consumptive water is shortage and the second level is the area where agricultural water is shortage. In 2005, Thailand had survey number of villages suffering droughts in consumptive water. There are 7,479 villages in Fig.5 - 4

(5) Risk Management against with extreme event

From big flood event occurred in year 2006, the cabinet of Thailand has approved the framework to against with extreme calamity and assigned to other related agencies to implicate the framework. For the framework it comprise of six strategies or measures to management about flood, land slide and flash flood disasters, four strategies or measures to release drought disaster and three strategies or measures to solve with wastewater problem. Nevertheless, in each disaster issue it cannot solve by only one dimension of each issue. In each issue of framework, it has some cross cutting issues should do together. Hence, strategies and measures of management vies is important. There are eight strategies and measures to enhance with disaster management. To implicate the strategy or measure of the framework, it is depend on the area topography, social condition, ethic problem, economic condition and related with cultural and traditional condition, etc.

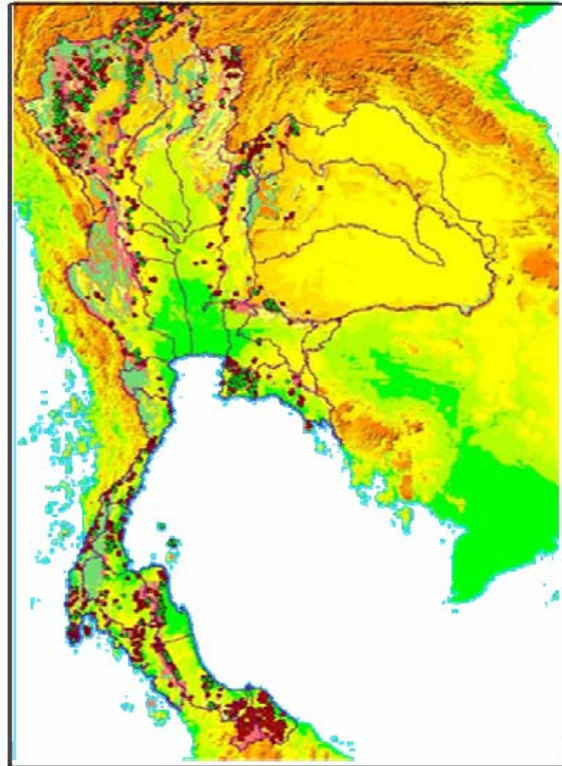
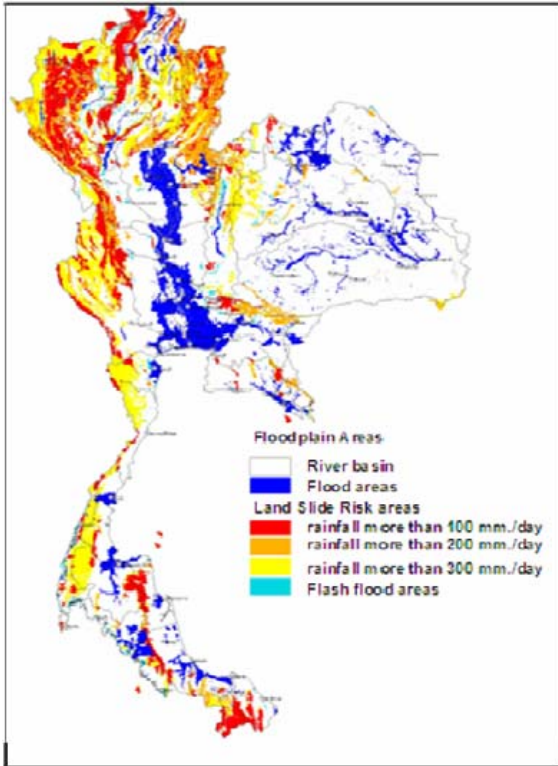


Figure 5 - 1 Flood and Landslide Risk Areas

Figure 5 - 2 Flash flood and Landslide Risk Areas

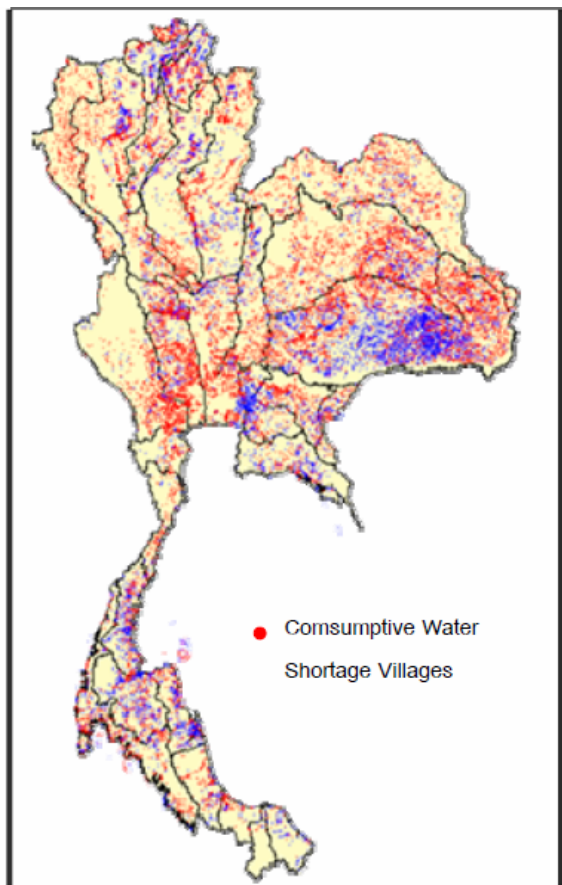
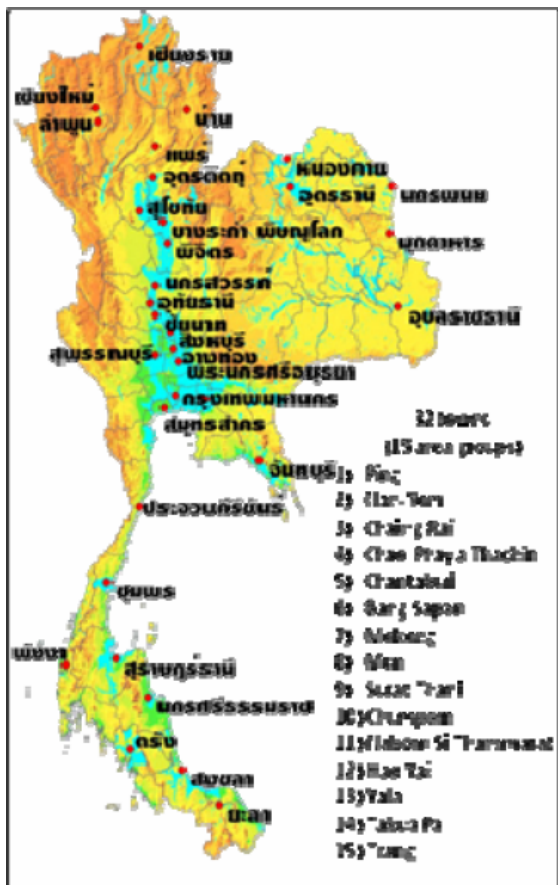


Figure 5 - 3 Urban/Economic Zone in Flood prone areas

Figure 5 - 4 Consumptive Water Shortage Villages

1) Flood/Land slide/Flash flood Disaster Issue: 6 strategies

(i) Watershed protection and rehabilitation

To protection & Rehabilitation of Upstream Forest for Healthy Ecology, the first priority of these measures to solve with problem; there are

- 1) Upstream Rehabilitation
- 2) Upstream Weir Construction
- 3) Reed Cultivation
- 4) Soil & Water Conservation

(ii) Rehabilitation of water sources, waterway and wetlands. There are 5 measures:

- 1) Survey & Make Inventory of Wetland, Water Resources, & Natural Stream
- 2) Define Guidelines on Sustainable Use of Wetland
- 3) Improve/Rehabilitate Stream, Water Resources, Wetland in Pilot Area
- 4) Dredge the Stream for Drain& Boundary Marking
- 5) Retaining Wall for Bank Protection

(iii) Development and improvement of water sources, drainage and diversion system.

There are 4 measures show in here,

- 1) Reservoirs
- 2) Develop/Improve Diversion System
- 3) Develop/Improve Water Resources & Drainage System
- 4) Groundwater Management

(iv) Land use management and flood protection in economic area

To manage land use in order to protection from flood in economic areas, there are;

- 1) Plan, Layout, Define the Land Use Measure
- 2) Improve the Structures Obstructing water way along Communication Routes
- 3) Study & Construct the Flood Protection System in Community & Economic Areas

(v) Improvement of agricultural patterns

To improve agricultural pattern and use agricultural area as retarding pond concept for reduce the magnitude of flood, there are 2 measures.

- 1) Pilot Project on Use of Agricultural Area as Retarding Pond
- 2) Develop Rice Cultivation in Flood Risk Area

(vi) Flood Mitigation Management

- 1) Enhance the Participation of Local Administration Organization & People
- 2) Develop Tools & Mechanism for Management e.g. National Water Center, Decision support System. Etc.
- 3) Research on Flood Prevention & Mitigation
- 4) Oversee & Monitor the Project Implementation

2) Drought Disaster Issue: 4 strategies

(i) Increase water supply

To increase water supply by increased water provision, It has 7 implementations.

- 1) Artificial Rain Project
- 2) Construct Upstream Weir
- 3) Water Resources Rehabilitation
- 4) Water Resources Development

- 5) Water Quality Improvement for Shallow Well
- 6) Construction of Water Supply System & Groundwater Well
- 7) Promotion and increasing Farm Pond

(ii) Water Spreading

To spread of water, It can implement by these measures;

- 1) Increasing Water Conveyance System
- 2) Field Water Supply System
- 3) Pump & Truck
- 4) Mobile Unit of Groundwater Quality Improvement
- 5) Water Distribution Point Improvement/Con

(iii) Increase an efficiency of water supply system

- 1) Village Water Supply System Maintenance
- 2) Groundwater Well Washing

(iv) Management

- 1) Increase Water Use Efficiency
- 2) Improve Dry Season Crop
- 3) Training on Water Supply Maintenance
- 4) Reservoir Control
- 5) Investigation on Status of Water Resources
- 6) Orient & Monitor the Water Quality
- 7) Research & Study for Drought Mitigation
- 8) Public Relation & Campaign for Water Saving
- 9) Knowledge transfer on Farm Pond
- 10) Drought Management Organization

3) Wastewater Problem Issue:

(i) Rehabilitate water quality in critical basin and urgent by

- 1) Management on wastewater from community
- 2) Management on wastewater from agriculture
- 3) Management on wastewater from industry
- 4) Salinity intrusion Control

(ii) Oversee & control the waste and wastewater disposal by

- 1) Law enforcement via participation

(iii) Enhance the participation of local authority and people by

- 1) Campaign and disseminate for having knowledge and understanding in management of wastewater from community, agriculture & industry

4) Strategy of Management: there are comprise of many measures;

- 1) Promulgation of water act
- 2) Water organization reform
- 3) Promulgation of sub provisions
- 4) Enhance & strengthen RBC
- 5) Establishment of management organization
- 6) National water resources information center

7) Water resources fund

8) Water resources sustainable management research project

(6) Water-related disaster Implementation Project

1) Early Warning System Project

According to flood disaster strategies and measures, the Department of Water Resources was assigned to develop the early warning system for the flood and landslide prone area in the upland and mountainous slope areas by setting up the priority taking into account the level of risk.

Early warning Systems (EWS) in Thailand has been developed for effective flash floods and landslide control since fiscal year 2005. The systems consist of main station and work stations at any risky area, The main station is at present operating and controlling by servers, while the work stations are designated as monitoring and warning systems which consists of rain and water level gauges, and communication equipment. Early warning systems are working on real time and depending on rainfall intensity and routing time deriving from relationship of upstream and downstream water levels.

The automatic early warning systems are installed at different rainfall measure stations. In case there is heavy storm that cause higher rainfall at a level that tends to cause flood and landslide, the system will automatically send out the warning signal to the warning stations the distribute the information to all communities immediately so as to carry out disaster relief measures as already rehearsal. In Thailand, total of 2,370 flood risk villages have been identify. In the 2005 - 2007 periods, a total of early warning systems had been installed covering 548 villages. In the year 2007 the early warning systems in 19 stations had send alarming signal 33 times.

In addition, under this project, the networks of people participation have been established in order to encourage the communities to cooperate with the warning system and preparing to evacuate themselves to safety places in case of having critical situation. At present, 88 work stations for Risky Areas of Northern Thailand have been installed and ready to transmit the signal in different 3 stages, i.e., green for normal, yellow for warning and red for evacuate situations. Those who are interested in information about the project and transmitted data can be access to web

<http://202.129.59.76/website/security/login.php>

The methodology of the project, to meet the main aim, the following procedures have been applied.

1. collected data for selecting the pilot areas where flash flood and landslide frequency occurred.
2. designs the system prototype for data transmitting and computer modeling in flash flood and landslides.
3. designs the system that can transmit and received the data between the main station and the work stations.
4. develop the early warning network linking the main station and users at the local areas.
5. establish and strengthen the networks of people participation to learn and cooperate in operating warning systems.

The main operation system comprise of Automatic Data Receiving - Sending System and the key factor to succeed is Community Alert Supporting Systems.

Community Alert Supporting Systems and User interface:

- 1) The participation in the alert system for flood and landslide: for instance, the representatives of villagers or community leaders have been and will be trained to gain the knowledge and

understanding about the instruments, procedures, alert methods, announcement and post - disaster management conducted with other working units.

- 2) People have been and will participate in the system management, training, transfer of technology and knowledge related to disaster, water - out, situational monitoring or the maintenance of system and tools.

The stages of warning signal

The stages of warning signal, the system will transmit the signal in different 3 stages of alert light and siren as follow:

1. First stage of Alert means that the watch - out should be provided.
2. Second stage of Alert means that the alert should be given.
3. Third stage of Alert means that people should be moved to the safe areas.

For each stage level, it has been study and analysis data such as soil moisture index, rainfall intensity to set each stage level criteria in each areas of the project.



Figure 6.1 - 1. Automatic Early Warning System

2) Upper Ping Flood Forecasting System

The Department of Water Resources has implemented the pilot project of monitoring and inspection of data related to meteorology, hydrology, and others , which is relatively precise and timely . The data obtained could be used as the database for situation analysis, surveillance, early warning and solving water crisis arisen in Chiang Mai province (Northern part of Thailand). The database is also provided to Hydrological Regional Center 13 (Chiang Mai) which is benefit for efficient flood warning at a certain level in Chiang Mai City area. The accomplishment under this project comprise:

- 1) Establishment of networking for data measurement total to 3 stations at the Upper Ping River Basin.
- 2) Establishment of Central Data Service Center (Hydrological Regional Center 13) for the Upper Ping Basin located at Chiang Mai Province . The central station centers will collect all data received from the basins to facilitate the monitoring and application.

Advantages of the Project

- 1) The data obtained from these stations will be used for water crisis management especially for flood. Other environmental data are also obtained as real time data collection.

- 2) The stations will be linked to other telemeter system or automatic remote sensing operated by other agencies to manage water resources in an efficient and compatible manner which could help solving water crisis problem timely.
- 3) It is the decision making support system for solving natural calamities specially water - related disaster effectively and is able to reduce damages and mitigate people troubles in the river basins.
- 4) It contributes to the development of personnel and technology to achieve modernization and effectiveness for water - related disaster management and other relevant natural resources management in the overall river basin context system.

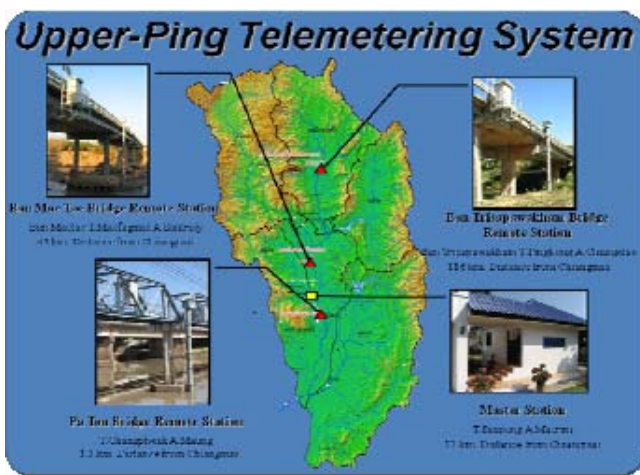


Figure 6 - 1 Telemetering Station in Upper - Ping



Figure 6 - 2 Concept Flood Forecast System Upper - Ping

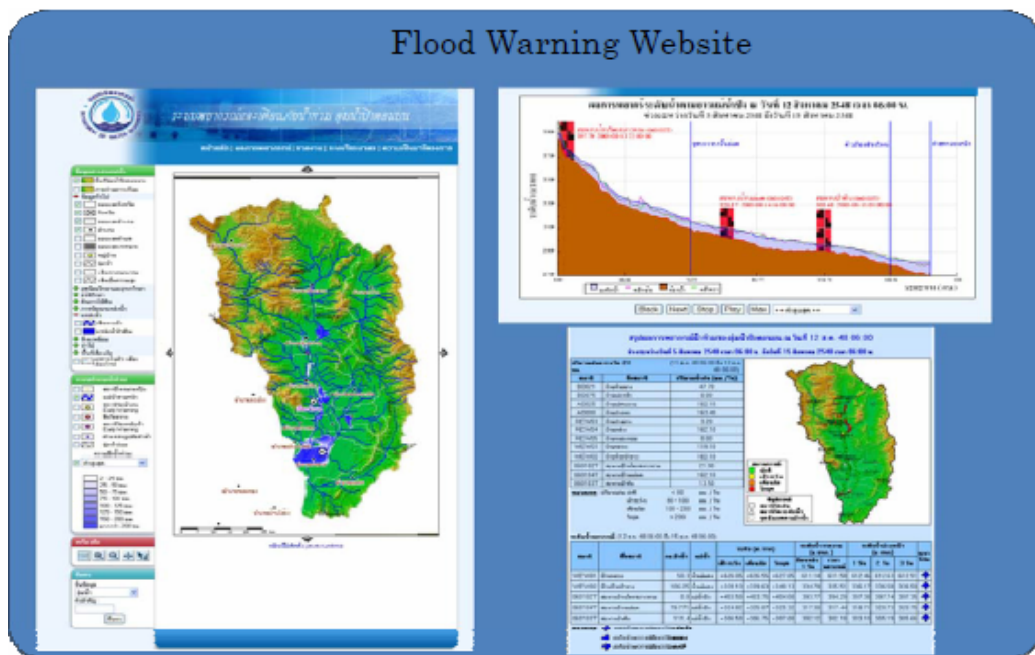


Figure 6 - 3 Sample of the station

A-5 Viet Nam: presented by DWR

(1) Natural Disaster in Viet Nam

1) General context

In recent decades, natural disasters have happened at an increasingly serious level over the world. The disasters have caused severe consequences to human life, especially the poor. Disasters are natural phenomena; their magnitude and consequences have increased due to human activities in the socio-economic growth, technological development, urbanization, population boom, natural resources and environmental degradation. In the past 2 decades, more than 200 million people on average directly suffered from the consequences of natural disasters every year.

Vietnam is located in the tropical monsoon area, one of the five storm-prone areas of the Asia Pacific region. Therefore the country often faces natural disasters of various types. In recent years, disasters have continually occurred all over the country, causing vast losses in human life, property, socio-economic and cultural infrastructure as well as environmental degradation. In the recent decade (1997-2006), Natural disasters such as typhoons, floods and drought have caused significant losses, including 7500 missing and dead people, asset damage equivalent to 1.5% of GDP. Natural disasters in Vietnam have been increasing in terms of magnitude, frequency and volatility.

2) Major types of natural disasters in Vietnam

1. Typhoons: In more than 50 years (1954-2008), there were totally 390 typhoons and tropical depressions in Vietnam, of which 31% hitting the North, 36% in the North and Middle Central Coast and 33% in the South Central Coast. Typhoon's landfalls usually accompany with high tide and heavy rain, thus resulting in and floods. It is estimated that up to 80-90% of the Vietnam's population are affected by typhoons.

2. Floods

- **Floods in Northern river systems:** Flood season in the Red river system and Thai Binh river system normally occurs from May to September, earlier than that in other regions. On average, there are about 3 to 5 floods within the region annually.

- **Floods on rivers in the Central:** The flood season on the rivers from Thanh Hoa to Ha Tinh is in the period June to October every year. Floods on these rivers generally occur on main streams because of dyke systems preventing the overflow. Flood amplitude is above 7m on the Ma river system and above 9m on the Ca river system. On the rivers from Quang Binh to Binh Thuan, the flood season is from September to December.

- **Floods on rivers in the Central Highlands:** This region does not have a major river system with a relatively low annual rainfall precipitation. The influenced area of floods in this region is narrow and characterized by mountainous and flash floods.

- **Floods in the South East:** Since rainfall is not very high plus thick and diverse vegetation cover forest, floods in the Dong Nai River are not considerably strong but long lasting. Nevertheless, history has seen some unusual and extremely strong floods, such as in October 1952, the highest flow at the flood crest in Bien Hoa is 12,500 m³/s.

- **Floods in the Mekong delta:** Floods are usually caused by the Mekong river upstream floods. The progress of floods in the Mekong river delta is slow and floods last for a long period of 4 to 5 months annually, causing inundation in most areas of the Mekong river delta.

3. Flash floods and mud floods: Flash and mud floods are often found in mountainous and hilly areas where characterized by steep slopes, heavy rains and disadvantaged drainage conditions. Flash floods also occur due to breakages of small reservoirs or landslides blocking up flows, etc. Flash floods have occurred and threatened in the Northern Mountains, the Central, the Central Highlands and the South East. Due to climate changes in recent years, flash floods have become much more popular in Vietnam.

4. Inundation: Inundation in Vietnam is usually caused by heavy rains and it is long lasting in some areas.

5. Droughts and desertification: Drought is a common type of disasters in Vietnam, which causes the 3rd greatest losses, following typhoons and floods. In recent years, droughts have continually happened throughout the country. In some particular year, droughts reduced 20-30% of the food productivity, thus severely threatening people's livelihoods. Drought control is difficult due to water source shortage and depleted reservoirs. Prolonged droughts result in desertification in several regions, especially the South Central, sandy coastal areas and steep land in the highlands and mountains.

6. Salinity intrusion: The coastline of Vietnam is 3,260 km long with many river estuaries, therefore salinity intrusion is found along the entire coastline at different rates. Three zones at higher risk of salinity intrusion are the South West coastal provinces, Central coastal provinces and the downstream part of the Dong Nai River. The South West coastal region is the most severely affected by salinity intrusion with 1.77 million ha of salinized land, accounting for 45% of the total area. Salinity intrusion prevention and water freshening in this area are usually very costly.

7. Squalls and cyclone: Cyclones, due to stronger winds, high velocity and frequent directional changes, often cause violent damage. Squalls and cyclones are common phenomena in Vietnam, and their frequency has increased in recent years.

8. Landslides: Landslide is a common type of disasters in Vietnam, consisting of river bank erosion, coastline erosion, and landslides on mountain slopes, land fissuring, etc. Landslides are usually caused by external factors (water), internal factors (geological changes) and human activities (uncontrolled mineral exploitation or construction), etc.

9. Earthquakes and tsunami

Earthquakes: have happened in Vietnam though in a limited strength.

Tsunami: Tsunami has not yet happened in Vietnam, many coastal areas of Vietnam may be at risk of tsunami effects due to earthquake potentials in some neighboring countries.

(2) Consequences of natural disasters to socio-economic development

1) Socio-economic consequences:

Natural disasters in Vietnam are the impediment to the economic development, sustainable development, and poverty reduction. Therefore, they have become major constraints to the accomplishment of the Millennium Development Goals. Vietnam has more than 80% of its population living at risk of direct impacts of natural disasters.

Natural disasters have taken away many achievements of the national socio-economic development.

Natural disasters intensify the rich-poor gap and impede the hunger eradication and poverty alleviation, especially in disaster-prone areas. On average, millions of people are in need of assistance due to natural disasters every year. Many of them, who have just escaped from poverty,

are re-impooverished due to the disasters.

Natural disasters affect educational development such as destroying educational infrastructure and interrupting school time, especially in mountainous areas and the Mekong river delta.

Natural disasters also have negative impacts on vulnerable groups such as the old, the disabled, women, and children.

2) Environmental consequences:

Natural disasters cause environmental destruction and pollution and harmful influence on production and people's life.

3) Consequences of natural disasters to national defence and public security:

- Destroy defence and security constructions.
- Reduce the national reserve.
- Cause social instability.
- Cause problems in public security and order.

(3) Achievements and limitations

1) Remarkable achievements

- **Step by step improving legal documents**, creating a legal corridor for natural disaster prevention, response and mitigation. In recent years, Vietnam has developed and issued relevant legal documents, such as Dyke Management Law, Water Resources Law, Law on forest protection and development, Law on Environmental Protection, Land Law, Law on Natural Resources and Minerals, Law on Fisheries, etc., Ordinance on dyke management, Ordinance on flood and storm control, Ordinance on exploitation and protection of water resources structures, Ordinance on the protection of hydro-meteorological surveying structures, etc. Decrees to guide the implementation of laws and ordinances have been promulgated.

- **Strengthening and refining the organizational structure, enhancing the capacities, equipments and facilities** for the direction of natural disaster prevention, response and mitigation activities from the central to local levels.

- **Developing and implementing relevant socio-economic development programs**, such as the plantation of watershed forests, protective forests, mangrove forests, reservoir construction for flood and drought reduction, "Living With Floods" Program, Safety for Fishing Boats and Ships Program, Dyke Reinforcement and Renovation Program, etc.

- **Conducting research, applying technologies to flood and storm control as well as natural disaster prevention, response and mitigation**

+ Research on river bank and coastline erosion prevention and control.

+ Research on extreme flood prevention for the Red river delta.

+ Research on 12 types of natural disasters.

+ Research on the establishment of self-help funds.

+ Models of disaster-safe houses.

+ Methodology for damage and relief need assessment.

+ Flood mapping in central provinces.

+ Research on flash flood prevention planning.

+ Applying new technologies to disaster forecast, warning and management.

+ Using new materials and technologies in building disaster prevention and mitigation structures.

- International cooperation:

+ Integrate in international organizations for natural disaster mitigation, for example Asian Disaster Reduction Center (ADRC), Asian Disaster Preparedness Center (ADPC), **ASEAN** Committee on Disaster Management (ACDM), World Meteorological Organization (WMO), Typhoon Committee (TC), Natural Disaster Mitigation Partnership (NDM-P), International Strategy for Disaster Reduction (ISDR), etc.

+ Cooperate with international organizations such as UNDP, UNESCAP, WB, ADB, etc., foreign agencies and NGOs in disaster mitigation.

- **Search and Rescue:** Establishing the National Committee for Search and Rescue, strengthen organization structure from central to local levels; enhancing facilities and equipments for search and rescue activities; developing an overall plan for search and rescue until 2015.

- **Relief and recovery activities:** The government annually allocates a certain proportion of budget and essential commodities for emergency relief and prompt damage recovery. When disasters happen, political and social organizations such as the Fatherland Front, Trade Union, Youth and Women Associations... have actively organized donation activities for victims in affected areas. Relief and recovery efforts also come from on-site sources, taking advantage of the people's mutual support tradition.

- **Training and advocacy activities:** thanks to the mass media, training and advocacy on activities to raise public awareness have been improved. Training and exercises have been provided at grassroot level as well as for responsible officers in ministries, sectors and localities. As a result, the awareness of government officers and the people have increased. Poor families in coastal areas are supplied with equipments to obtain information and prevent natural disasters proactively.

- Resources for natural disaster prevention, response and mitigation

+ The government gives preference and annually increases funding for natural disaster prevention, response and mitigation. The investment is given priority to specific programs and projects which aims at these objectives such as the forest plantation program, dyke upgrade program, reservoir program, landslide program, "living with floods" program, safety for boats and ships program.

+ Provinces mobilize local resources, the contributions of the people, social and political organizations, and international organizations in natural disaster prevention and damage recovery.

+ Supplementarily allocate Official Development Assistance (ODA).

2) Limitations

In recent years, considerable efforts have been made for natural disaster prevention; infrastructure, facilities and technical capacity have been improved; the leadership and coordination in response to natural disasters at central and local levels have had substantial progress. However, with regard to the consequences of natural disasters and the socio-economic development goals, the following shortcomings and limitations need to be addressed in the near future:

1. Disaster prevention, response and mitigation activities are reactive and mainly focus on problem response.
2. The response to disasters is slow due to objective and subjective reasons.
3. Unstable production system, inappropriate production structure.
4. Poor infrastructure results in vulnerability to disaster risks.
5. Forecasting and warning systems do not meet standard requirements, particularly with regard

to such disasters as flash floods, landslides, whirlwinds, etc.

6. Emergency relief, damage recovery and reconstruction are insufficient, lack of direction and coordination.
7. Search and rescue operations are unprofessional and limited due to lack of equipments and facilities, thus they cannot take advantage of the combined strengths of all forces and people.

3) Reasons

1. *Awareness*

- Inadequate public awareness of natural disasters and sustainable development, especially living in harmony with the nature.
- Dependent and reactive attitude, disregard and inexperience in facing natural disasters.
- Dissemination activities to raise community awareness of disaster prevention, response and mitigation are infrequent and disorganized. The knowledge on disaster prevention is mostly spread throughout the mass media and has not been included in school curriculum.

2. *Planning*

- Lack of integrated planning and coordination among ministries, sectors and localities. Lack of due attention to the integration of natural disaster prevention, response and mitigation into local and sector's socio-economic development programs.
- In construction planning, lack of due attention to flood and storm avoidance and safety, particularly in industrial zones, tourism areas, urban areas, coastal and mountainous areas, residential areas and roads.
- The encroachment on sea and rivers for construction or setting structured projects in areas highly prone to floods, flash floods, storms, sea water rising and landslides make them more vulnerable. Therefore, it is costly for protection and maintenance.
- Development planning has not been integrated with environment and landscape preservation. For example, natural sand dunes on the sea shore, watershed protective forests and mangrove forests have been destroyed for aquaculture.

3. *Policy and mechanism*

- Lack of penalties for failure to obey laws, regulations, and the orders of relevant authorities.
- Overlaps of functions and duties amongst different agencies, and lack of clear responsibilities.
- Lack of measures to encourage disaster-related insurance purchases.
- Lack of encouragement and incentives for individuals and organizations volunteering and participating in search, rescue and response activities in natural disasters.
- Lack of rules and regulations for organizations on the appeal, collection, receipt and distribution of disaster relief.
- Lack of improved policies on the mobilization of resources for disaster prevention and mitigation.

4. *Investment*

- Investment in natural disaster prevention, response and mitigation is scattered and has not satisfied the requirements of disaster mitigation.
- Investment in the maintenance, management and utilization of existing structures is not corresponding to that in new construction.
- Disbursement for some critical, approved projects such as reservoirs, parking place for boats and ships, dyke protection, etc. is slow and does not meet current requirements.

5. *Direction and management*

- The directions and orders in response to natural disasters have not yet been seriously executed. The implementation is slow and dependent way of thinking still exists.
- The direction and implementation of four “on-the-spot” principles are not serious.
- There have been inappropriate directions where economic development was separated from natural disaster prevention, response and mitigation. For instance, coastal protective forests were destroyed for aquaculture while watershed protective forests were cleared for crop production.
- Ineffective management and protection of watershed forests, coastal and riverside protective forests led to the degradation of forest coverage in some areas. As a result, the effectiveness of flood, storm and drought prevention and control was limited. Consequently, this resulted in unexpected dangers.
- The poor management of sand exploitation and other activities on river banks have led to harmful impacts on flood discharge and caused erosion.
- The shortcomings of vehicle management on rivers and at sea, particularly pelagic fishing boats resulted in unexpected damage when disasters occur.
- The effectiveness of quality control in some particular construction project was limited. Therefore, they were damaged by disaster though at low intensity. Some structures even prevent flood discharge or make flood worse.
- Slow project progress and disbursement, especially ODA.
- The management and utilization of disaster recovery resources are limited, lack of transparency or for inappropriate purposes.

(4) National Strategy

1) Strategic goal:

1. Mobilize all resources to effectively implement disaster prevention, response and mitigation from now up to 2020 in order to minimize the losses of human life and properties, the damage of natural resources and cultural heritages, and the degradation of environment, contributing significantly to ensure the country sustainable development, national defense and security.
2. Enhance the capacities of forecasting flood, storm, drought, seawater intrusion, of informing earthquake, of warning tsunami and hydro-meteorology phenomena, of which the focus is given to increase the early warning of storm and tropical depression to 72 hours in advance.
3. Ensure that the development planning and building codes of socio-economic structures and residential areas in places frequently affected by disaster suit.
4. Complete the relocation, arrangement and stabilization of the life for people in disaster prone areas according to the planning approved by authorized government agencies. Up to 2010, manage to relocate all population from flash flood and land slide high-risk areas and dangerous areas to safety places.
5. Ensure 100% of local staffs who directly work in the field of disaster prevention, response and mitigation at all levels to be trained and strengthened of capacities for disaster prevention, response and mitigation; ensure more than 70% of population living in disaster prone areas to be disseminated of knowledge on disaster mitigation.

2) Activities for natural disaster prevention and control

1. Complete the system of legal documents.

- a) Natural Disaster Prevention, Response and Mitigation Law.
- b) Review, amend and supplement relevant legal documents.
- c) Promulgate policies on disaster relief and recovery after the disaster.
- d) Promulgate assistance policies for disaster prone areas.

2. Strengthen organizational mechanism.

- a) Strengthen the steering mechanism for natural disaster prevention, response and mitigation at all levels.
- b) Provide training courses to improve the capacity of staff in charge of natural disaster prevention, response and mitigation.
- c) Establish organizations supporting natural disaster management.

3. Non – structural measures.

- a) Program of establishing and reviewing plans.
- b) Program of enhancing forecast and warning capacity.
- c) Program of improving the community awareness.
- d) Program of planting and preserving protective forest.
- e) Program of enhancing disaster management and science and technology application capacity.

4. Structural measures.

- a) The program to review, upgrade and build structures for natural disaster prevention, response and mitigation in line with designed standards and natural disaster characteristics of each region, each local.
- b) The program to build erosion prevention structures.
- c) The program to strengthen and upgrade sea dyke systems.
- d) The program to establish systems of structures prevent salt but preserve fresh water.
- e) The program to build systems of storm shelters for boats, ships.
- f) The program to upgrade dyke systems of Red river and Thai Binh river.
- g) The program expand flood discharge openings of bridges and sluices along road and railroad systems.

Natural disaster prevention, response and mitigation will be implemented through programs and projects managed by Ministries, sectors and localities in order to meet above strategic goals.